City Contract No: 20180234
V# 6824

Contract Date: 9/1/2017
RFQ No. 16-190

AGREEMENT FOR PROFESSIONAL DESIGNER/CONSULTING SERVICES
WATERSHOPS POND HYDROPOWER DESIGN

This CONTRACT AGREEMENT ("Agreement") is made effective September 1, 2017 and after execution by all required parties, by and between the **CITY OF SPRINGFIELD,** a Massachusetts municipal corporation with a principal office at 36 Court Street, Springfield, Massachusetts 01103, acting by and through its Department of Capital Asset Construction and its Department Disaster Recovery & Compliance, with the approval of its Mayor (hereinafter called the "CITY" or "OWNER"), and **GZA ENVIRONMENTAL**, a corporation with a business mailing address at 1350 Main Street, Suite 1400, Springfield, MA 01103 (hereinafter called the "DESIGNER").

WHEREAS, the City requires the services of a qualified and experienced Designer to provide engineering designs, consulting, permitting assistance, specifications, and construction administration services to implement certain portions of the City's successful NDRC grant application, as well as a feasibility study for the Watershops Pond Hydro Power Design; and

WHEREAS, the DESIGNER represents and warrants that the DESIGNER, its personnel, subsidiaries, and subcontractors, and assembled Design Team possess the necessary knowledge and experience to perform the Work and services herein described; and

WHEREAS, the DESIGNER represents, with full knowledge that the City is relying on such representation, that it has the necessary skills, qualifications, expertise, experience, and equipment to perform the work and services; and

WHEREAS, the OWNER desires to retain the services of the Designer on the terms and conditions set forth in this Agreement and the DESIGNER has agreed to accept such retainer after being selected as the top ranked proposer from the City's Request for Proposals Qualifications performed pursuant to MGL Ch. 7C § 38-44, (An excerpt of the City of Springfield RFP No. 16-190 is attached to this Agreement as **Exhibit A**, and is incorporated by reference herein the original document is housed at the City due to its size. A copy of the selected Designer's Response to RFP 16-190 is attached as **Exhibit B** to this Agreement and is also incorporated by reference);

NOW, THEREFORE, in consideration of the mutual covenants and agreements hereinafter contained, the parties hereto do hereby agree as follows:

ARTICLE 1: SCOPE OF SERVICES

A. The Designer agrees to furnish the following Design services to the OWNER for the purpose of studying and developing plans and performing a feasibility study for the Watershop's Pond Hydro Power Plant for the City of Springfield. The Designer will work with City officials to conceive and implement a design that will address the future programmatic needs and services of the residents of the City of Springfield. Services are described in detail in the DESIGNER'S proposal dated October 5, 2016, which is attached hereto as **Exhibit B** and incorporated herein by reference.

B. The following scope of work is based on the RFP No. 17-048, and includes services based on an initial master plan effort including public engagement and then the construction documents and bidding of a Phase One program with an established project budget of One Hundred Ninety Six Thousand Dollars and 00/100 ($196,000.00). The services may be summarized as follows:

I. **Task 1**- Incorporate Recent Dam Investigation Reports.

a. Identify Impacts from FERC Criteria- part of the federal permitting and licensing process, Watershops Pond Dam will fall under FER C jurisdiction and may be subject to additional dam safety criteria under the FER C Dam Safety Program. Under this task, GZA will review FERC dam safety criteria and identify additional modifications or procedures that may impact the operation and maintenance of the dam.

b. Preliminary Geotechnical Assessment and Development of Existing Conditions- GZA will review existing geotechnical information, including the historic U.S. ACE 1956 reconstruction drawings, notes from our visual observations performed during the Phase I Inspection (GZA, 2016),and historical photos of the dam with the water level partially drawn down to confirm the geometry of the dam to the plans.

c. Stability Analysis- GZA will perform a stability analysis in accordance with FERC requirements with the understanding that the dam will be required to comply with FERC regulations if the dam becomes licensed as a hydro power facility.

d. Identify and Detail Costs Associated with Dam Updates/Repairs- GZA will consider the improvements that may be needed under the separate tasks and incorporate the findings within a new repair plan developed as part of this task. GZA will summarize the required dam repair/updates and detail the costs associates with implementing these updates within a table.

e. Head and Potential Head for Dam- In conjunction with Task 5, GZA will perform a hydraulic analysis at the dam to develop a headwater/tail water stage-discharge curve that will be used to determine the available gross head curve at the dam for a variety of flows.

II. **Task 2**- Develop Preliminary Site Plans and Layout Drawings

a. Site Survey and Layout Drawings- Using the topographic and boundary information as a base, GZA will develop preliminary Site Plans and Layout Drawings which will include Existing Conditions ;Erosion Control, Site Access and Staging; 25% Proposed Conditions, Plan and Section; General Arrangement drawing(s); and Details.

b. Develop Bathymetry Plan, Cross Sections, and Perform Sediment Investigations- GZA will prepare a bathymetric plan of the surveyed portions of Watershops Pond, with top of sediment and bottom of sediment contour maps using the collected survey data plotted on the base plan information prepared in Task2a.GZA will compute the volume of sediments in the vicinity of the dam and upstream areas that may need to be dredged for the proposed alterations to the dam and appurtenant structures.

III. **Task 3-** Develop Preliminary Electrical One Line. In consultation with our sub-consultant, GZA will contact Eversource, the City's public electric utility provider, to discuss inter connection requirements. Subsequently, GZA will develop an electrical one-line diagram.

IV. **Task 4**- Develop Preliminary List of Mechanical and Electrical Equipment. GZA will work with turbine suppliers and the City to review the options and make a final selection of the turbine type based on the known variables and considerations for lead time and operational aspects.

V. **Task 5**- Perform Updated Hydrologic Analysis

a. Update Probable Maximum Flood Study- As part of this task, GZA will assess the Watershops Pond Dam's watershed runoff response under various design storms up to and including the P M F.

b. Perform Incremental Damage Assessment / Assess Inflow Design Flood- GZA will evaluate the possibility of reducing the magnitude of the SDF using the In-flow Design Flood(IDF)methodology outlined in Chapter2:Selecting and Accommodating In-flow Design Floods for Dams, of the FERC Engineering Guidelines of the Evaluation of Hydropower Projects.

c. Perform Stream Gage Analysis and Evaluate Climate Change Potential- GZA will also review flow trends from US GS Gage01178000 Mill River (gage records from 1938-1951) and compare to US GS Gage01184490 Broad Brook (gage records from 1961-P resent).GZA will evaluate the suitability of the stream gage data and potential identified low trends(if any)toextrapolatethegagedataapproximately40 years to account for climate change. GZA will develop flow-duration curves for each decade (i.e.,1960s,1970s, 1980s,etc.) to identify any flow trends at the gage for use in extrapolating future decreases/increases in streamflow at Watershops Pond Dam.

d. Verify Bypass Flow Exemption- GZA will verify the potential Watershop Pond Dam Hydropower Project exemption from bypass flow (i.e. maintaining a conservation flow over the dam separate from flow discharged from the turbine),and provide an updated calculation if the Project is determined to be not exempt.

VI. **Task 6**- Revise Projected Power and Energy Output- GZA will revise the projected power and energy output detailed in Section 3.5of the 2015 Resource Assessment. The projected power and energy estimate is dependent on head and turbine efficiency.

VII. **Task 7**- Perform Interconnection Analysis

GZA will work with its electrical sub-consultant to:

a. Provide information on how the system would operate when the grid is down;

b. SOW /explain how the hydropower facility can connect to the Brookings School with or without electrical upgrades at the school;

c. Develop a preliminary transmission route from the hydropower facility to Brookings School;

d. Perform a preliminary investigation of interconnection requirements, including any potential risks; and

e. Review and determine whether the Project qualifies or is appropriate for Ever source's Blackstart Program, and if the Project qualifies, explain how the facility qualifies for the program and what benefits the City may realize from the program participation. Describe what different and/or additional equipment would be needed at the hydro power facility to provide this capability.

VIII. **Task 8**- Perform Potential Risk Assessment. GZA will perform a potential risk assessment that identifies potential permitting, environmental, engineering, and financial issues that will need to be considered as part of the development of the hydropower project. GZA will outline the potential permitting implications of hydropower development at the Watershops Pond Dam Site, including anticipated wetlands and water quality permitting and licensing under the Federal Energy Regulatory Commission.

IX. **Task 9**- Preliminary Discussions with Regulatory Agencies- GZA will establish contact w th the various regulatory agencies that will have input and regulatory jurisdiction over the Project, which will include, but may not be limited to the following:

a. City of Springfield Conservation Commission;
b. Springfield Historical Commission;
c. Massachusetts Historical Commission and Board of Underwater Archeological Resources;
d. Massachusetts Division of Fisheries and Wildlife;
e. MA Natural Heritage and Endangered Species Program;
f. U.S National Park Service; and
g. U.S. Fish and Wildlife Service.

X. **Task 10**- Perform Limitations and Alternatives Assessment. Review of the Site constraints For the layout and construction will be described and discussed.

XI. **Task 11**- Develop Cost Estimates. GZA will develop a detailed cost estimate of project components including: permitting, engineering, labor, equipment, and construction costs. The cost estimate will identify potential costs through completion of construction to provide a budgetary estimate to aid in the City's future planning.

XII. **Task 12**- Develop Feasibility Study Based on Current Information. GZA will develop a comprehensive Feasibility Study that summarizes the evaluation and analysis performed throughout Tasks1 through 11, in addition to information previously presented in the Preliminary Hydropower Resource Assessment (GZA, 2015).

XIII. **Task 13**- Develop a Project Schedule. GZA will develop a high-level schedule for all phases of the hydro power development Project including permitting, design, construction, and startup/commissioning. The sequence and schedule will include the scope of work necessary to license and construct the proposed project and will incorporate the findings of the Feasibility Study.

XIV. **Task 14**- Stewardship of the Watershops Pond Federal Lands to Parks (FLP) Conveyance. GZA will prepare the FLP Stewardship Report, following our review of existing field conditions and current and historical information provided by the City.

XV. **Task 15**- Continued Progress Reports under the City's Preliminary Permit (FERC). Under this Task 15, GZA will file the next two required progress reports. Article 4 of the Terms and Conditions of the Preliminary Permit requires that a progress report be filed at the close of each six-month period from the effective date of the permit. To date, the City has filed two progress reports, both prepared and submitted by GZA on behalf of the City.

For a complete and detailed listing of the Scope of services to be provided, please see the Vendor's Scope of Service, attached hereto as **Exhibit C** and incorporated by reference.

C. The DESIGNER'S Project documents and submissions shall be submitted to:

City of Springfield
Department of Capital Asset Construction
Attn: Peter Garvey
36 Court Street
Springfield MA, 01103

AND

City of Springfield
Tina-Marie Quagliato Sullivan
Director of Disaster Recovery & Compliance
36 Court Street, Room 405
Springfield, MA 01103

ARTICLE 2: TERM AND SCHEDULE FOR SERVICES

A. This Agreement shall be effective as of September 1, 2017, 2016, and shall be completed by August 31, 2020 for a total term of Three (3) Years. The City reserves the right to amend the term of the contract through mutual agreement via written amendment if needed.

B. Consultant/Designer will schedule the described work immediately upon Contract Execution.

C. GZA will maintain regular communication with the City and its NDRC Grant implementation team so that issues and concerns are addressed on a timely basis.

D. At the present time, GZA anticipates providing a draft of the Feasibility Study within 150 calendar days following execution of the Contract Agreement with the exception of the following tasks that will require additional time:

i. Review and discussions with Eversource relative to interconnection
ii. Responses from regulatory agencies and other stakeholders, and
iii. Legal issues involving determination of property boundaries and rights of way.

H. For a complete breakdown of task schedule please see **Exhibit C**.

ARTICLE 3: Design Team and Consultants of DESIGNER

A. Designer/Consultant

GZA Environmental, Inc.
1350 Main Street, Suite 1400
Springfield, MA 01103

B. For a complete Breakdown of Designer project Staff, please see **Exhibit C**.

C. No other consultants or subcontractors will be assigned by the DESIGNER to perform services unless otherwise expressly approved by the City in writing.

ARTICLE 4: COMPENSATION

A. All financial obligations of the OWNER are subject to the existence of a sufficient appropriation to meet said obligations.

B. The OWNER is not obligated for any compensation or any expenses of any kind unless the OWNER has appropriated sufficient funds therefore.

C. Compensation by the OWNER to the DESIGNER will be as follows:

1. A fixed lump-sum "not to exceed" payment which will include all expenses, as described in

this Agreement and **Exhibit B**.

2. DESIGNER'S compensation under this Agreement and the OWNER'S maximum liability hereunder, shall be **One Hundred Ninety Six Thousand Dollars and 00/100 ($196,000.00),** broken down as follows:

Task# /Description	Cost
1 Incorporate Recent Dam Investigation Reports	**$35,700**
2 Develop Preliminary Site Plans and Layout Drawings	**$45,000**
3 Develop Preliminary Electrical One Line	**$10,100**
4 Develop Preliminary List of Mechanical/Electrical Equipment	**$ 7,600**
5 Perform Updated Hydrologic Analysis	**$21,800**
6 Revise Projected Power Output	**$ 3,800**
7 Perform Interconnection Analysis	**$ 7,800**
8 Perform Potential Risk Assessment	**$ 8,000**
9 Preliminary Discussions with Regulatory Agencies	**$ 9,500**
10 Perform Limitations and Alternatives Assessment	**$ 8,700**
11 Develop Cost Estimates	**$ 5,800**
12 Develop Feasibility Study Based on Current Information	**$17,300**
13 Develop a Project Schedule	**$ 4,100**
14 Stewardship of the Watershops Pond FLP Conveyance	**$ 9,300**
15 Continued Progress Reports under the FERC	**$ 1,500**

Total: $ 196,000.00

See **Exhibit C** for complete price breakdown sheet.

3. The DESIGNER will make reasonable efforts to complete the work on assigned projects within the project budget and will keep the OWNER informed of progress toward that end so that the budget or work effort can be adjusted if found necessary.

4. The DESIGNER is not obligated to incur costs beyond the indicated budgets, as may be adjusted, nor is the OWNER obligated to pay the DESIGNER beyond these limits.

5. When any budget has been increased, the DESIGNER'S excess costs expended prior to such increase will be allowable to the same extent as if such costs had been incurred after the approved increase.

ARTICLE 5: PAYMENTS

A. It is anticipated that progress payments for each Project Order shall be made to the DESIGNER monthly on a percentage of completion basis, as determined by the OWNER.

B. The OWNER need not process a request by the DESIGNER for payment unless the DESIGNER submits invoices meeting the following conditions:

1. Proper Invoice: In addition to any other requirement set forth in this contract with respect to what constitutes a proper invoice or for the DESIGNER to be entitled to receive payment, the DESIGNER's invoice, in triplicate, must set forth the following:

a. A description, with specificity, of the goods delivered, work performed, services rendered, or other event initiating entitlement to payment pursuant to the terms hereof.

2. That portion of the contract price related to such payment less any deductions, such as

retainage, required pursuant to the terms hereof.

3. The contract number: Should the invoice not be calculated correctly, such as not taking into account retainage as a deduction, the OWNER may either reject the invoice or treat the invoice as proper only to the extent of the correct calculation.

4. Supporting Documentation: In addition to any other requirement set forth in this contract with respect to what supporting documentation must accompany an invoice, the following documents must be attached to any invoice submitted by the DESIGNER:

a. A complete itemized listing/breakdown of tasks completed or milestones reached by the Designer, accompanied by any relevant milestone of performance, certificate, or other equivalent document, if applicable, indicating that the milestone has been achieved during period invoiced.

b. Out-of Pocket Expenses: A summary showing all charges that are actual and are in conformity with the contract and have not previously been charged. In addition, copies of paid invoices are required.

c. Such other supporting documentation as the sub-consultant's payment forms and support, or similar.

d. Any other documentation reasonably requested by the OWNER.

ARTICLE 6: OBLIGATIONS OF THE DESIGNER/CONSULTANT

A. DESIGNER'S PERSONNEL AT SITE:

1. The presence or duties of the DESIGNER'S personnel at a construction site, whether as onsite representatives or otherwise, do not make the DESIGNER or its personnel in any way responsible for those duties that belong to the OWNER and/or the construction contractors or other entities, and do not relieve the construction contractors or any other entity of their obligations, duties and responsibilities, including, but not limited to, all construction methods, means, techniques, sequences and procedures necessary for coordination and completing all portions of the construction work in accordance with the Contract Documents and any health or safety precautions required by such construction work.

2. The DESIGNER and its personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions and have no duty for inspecting, noting, observing, correcting or reporting on health or safety deficiencies of the construction contractor or other entity or any other persons at the site except DESIGNER'S own personnel.

B. OPINIONS OF COST, FINANCIAL CONSIDERATIONS, AND SCHEDULES:

In providing opinions of cost, financial analyses, economic feasibility projections, and schedules for the PROJECT, the DESIGNER has no control over cost or price of labor and materials; unknown or latent conditions of existing equipment or structures that may affect operation or maintenance costs; competitive bidding procedures and market conditions; time or quality of performance by third parties; quality, type, management, or direction of operating personnel; and other economic and operational factors that may materially affect the ultimate PROJECT cost or schedule. Therefore, the DESIGNER makes no warranty that the OWNER'S actual PROJECT costs, financial aspects, economic feasibility or schedules will not vary from the DESIGNER'S opinions, analyses, projections or estimates.

C. CONSTRUCTION PROGRESS PAYMENTS:

Recommendations by the DESIGNER to the OWNER for periodic construction progress payments to the construction contractor will be based on the DESIGNER'S knowledge, information, and belief from selective sampling that the work has progressed to the point indicated. Such recommendations do not represent that continuous or detailed examinations have been made by the DESIGNER to ascertain that the construction contractor has completed the work in exact accordance with the contract documents; that the final work will be acceptable in all respects, that the DESIGNER has made an examination to ascertain how or for what purpose the construction contractor has used the monies paid; that title to any of the work, materials, or equipment has passed to OWNER free and clear of liens, claims, security interests, or encumbrances; or that there are not other matters at issue between OWNER and the construction contractor that affect the amount that should be paid.

D. RECORD DRAWINGS:

Record drawings, if required, will be prepared, in part, on the basis of information compiled and furnished by others, and may not always represent the exact locations, type of various components, or exact manner in which the PROJECT was finally constructed. The DESIGNER is not responsible for any errors or omissions in the information from others that are incorporated into the record drawings as long as the DESIGNER reasonably believes such information to be correct.

E. ACCESS TO DESIGNER'S ACCOUNTING RECORDS:

Right to Audit: The Designer shall maintain books, records, and accounts of all costs in accordance with generally accepted accounting principles and practices. The OWNER or its authorized representative shall have the right to audit the books, records, and accounts of the DESIGNER under any of the following conditions:

1. If the Contract is terminated for any reason in accordance with the provisions of these Contract Documents in order to arrive at equitable determination of costs;

2. In the event of a disagreement between the DESIGNER and the OWNER on the amount due the DESIGNER under the terms of this Contract;

3. To check or substantiate any amounts invoiced or paid which are required to reflect the costs of the DESIGNER, or the DESIGNER's efficiency or effectiveness under this Contract or in connection with extras, changes, additions, back charges, or other, as may be provided for in this Contract;

4. If it becomes necessary to determine the OWNER'S rights and the DESIGNER'S obligations under the Contract or to ascertain facts relative to any claim against the DESIGNER which may result in a charge against the OWNER.

5. To provide any required information to a funding source of the OWNER.

6. Under these stated conditions, The OWNER shall have unlimited access during normal working hours to the DESIGNER'S books and records for an audit; and the DESIGNER shall cooperate with the performance of the audit including but not limited to providing copies of requested documents.

F. DESIGNER'S INSURANCE:

The DESIGNER will maintain at a minimum throughout this AGREEMENT the following

insurance:

1. Worker's compensation and employer's liability insurance as required by the state or province where the work is performed.

2. Comprehensive automobile and vehicle liability insurance covering claims for injuries to members of the public and/or damages to property of others arising from use of motor vehicles, including onsite and offsite operations, and owned, non-owned, or hired vehicles, with $1,000,000 combined single limits.

3. Commercial general liability insurance covering claims for injuries to members of the public or damage to property of others arising out of any covered act or omission of the DESIGNER or of any of its employees, agents, or subcontractors, with $1,000,000 combined single limits.

4. Professional liability insurance of $2,000,000.

5. OWNER will be named as an additional insured with respect to liabilities hereunder in insurance coverages identified in items "2" and "3", and DESIGNER waives subrogation against OWNER as to said policies.

G. If the DESIGNER claims that the DESIGNER or any of its subsidiaries or sub-contractors is delayed or cannot perform the work because of a failure on the part of the OWNER, then the DESIGNER must timely (within ten calendar days of the knowledge of this failure) and in writing, inform the OWNER of this fact or the claim is considered waived.

H. LITIGATION ASSISTANCE:

Upon the OWNER's request, the DESIGNER agrees to cooperate with and provide assistance to the OWNER in any litigation or claim undertaken or defended by the OWNER. For services required or requested of the DESIGNER pursuant to this paragraph, except for suits or claims between the parties to this AGREEMENT, the OWNER and the DESIGNER will mutually agree on compensation to the DESIGNER, by a written amendment to this Agreement, signed by all parties hereto, and such additional compensation is subject to appropriation of sufficient funds by the City.

ARTICLE 7: OBLIGATIONS OF THE OWNER:

A. OWNER-FURNISHED DATA:

The OWNER may provide to the DESIGNER all technical data in the OWNER'S possession, including, but not limited to, previous reports, maps, surveys, borings, and all other information relating to the DESIGNER'S services on the PROJECT. The DESIGNER may, where reasonable, rely upon the accuracy, timeliness, and completeness of the information provided by the OWNER.

B. ACCESS TO FACILITIES AND PROPERTY:

The OWNER will make its facilities accessible to the DESIGNER as required for the DESIGNER'S performance of its services and will provide labor and safety equipment as required by the DESIGNER for such access. The OWNER will perform, at no cost to DESIGNER, such tests of equipment, machinery, pipelines, and other components of the OWNER'S facilities as may be required in connection with DESIGNER'S services, unless otherwise agreed to.

C. ADVERTISEMENTS, PERMITS, AND ACCESS:

Unless otherwise agreed in the Scope of Services, the OWNER will obtain, arrange, and pay for all

advertisements for bids, permits and licenses required by local, state, or federal authorities; and land, easements, right-of-way, and access necessary for the DESIGNER'S services or PROJECT construction.

D. TIMELY REVIEW:

The OWNER may examine the DESIGNER'S studies, reports, sketches, drawings, specifications, proposals, and other documents; and may obtain advice of an attorney, insurance counselor, accountant, auditor, and other consultants as the OWNER deems appropriate; and render in writing decisions required of OWNER in a timely manner. Such review or examination shall not diminish the DESIGNER'S responsibilities under this Agreement.

E. PROMPT NOTICE:

The OWNER will give prompt written notice to DESIGNER whenever the OWNER observes or becomes aware of any development that affects the scope of timing of DESIGNER'S services, or any defect in the work of the DESIGNER or construction contractors. The giving or failure to give such notice shall not diminish the DESIGNER'S responsibilities under this Agreement.

F. ASBESTOS OR HAZARDOUS SUBSTANCES:

1. If asbestos or unanticipated hazardous substances in any form are encountered or suspected, the DESIGNER shall immediately notify the OWNER and may stop its own work in the affected portions of the PROJECT to permit testing and evaluation of the problem. If asbestos is suspected, the DESIGNER will, if requested, assist the OWNER in contacting regulatory agencies and in identifying asbestos testing laboratories and demolition/removal contractors or consultants. If asbestos is confirmed, the OWNER may engage a specialty consultant or contractor to study the affected portions of the work and perform all remedial measures. If unanticipated hazardous substances other than asbestos are suspected, the DESIGNER may conduct tests as directed by the OWNER to determine the extent of the problem and may perform the necessary studies and recommend the necessary remedial measures at an additional fee to be negotiated.

2. Asbestos Abatement cost estimates and asbestos abatement monitoring services will be prepared by a supplemental vendor through a separate agreement.

ARTICLE 8: GENERAL LEGAL PROVISIONS

A. AUTHORIZATION TO PROCEED:

Execution of this AGREEMENT by the OWNER will be authorization for DESIGNER to proceed with the work when ordered by the OWNER, unless otherwise provided for under this AGREEMENT.

B. REUSE OF PROJECT DOCUMENTS:

All designs, drawings, specifications, documents, and other Work Products of the DESIGNER are instruments of service for the PROJECT whether the PROJECT is completed or not and they become the property of the OWNER.

C. FORCE MAJEURE:

The DESIGNER shall not be held responsible for damages or delay in performance caused by acts of God, strikes, lockouts, accidents, or other events that are within the exclusive control of the OWNER.

D. TERMINATION:

1. Termination of Contract by the OWNER for Cause:

a. If, through any cause, the DESIGNER shall fail to fulfill to the OWNER'S satisfaction in a timely and proper manner the DESIGNER'S obligations under this contract, or if the DESIGNER shall violate any of the covenants, agreements, or stipulations of this contract, the OWNER shall thereupon have the right to terminate this contract, by specifying the reasons therefore, in writing, at least fourteen (14) days before the effective date of such termination. Unless the DESIGNER cures the default to the OWNER's satisfaction within the 14-day day period, the contract shall automatically terminate. The DESIGNER shall be entitled to receive payment for all work satisfactorily completed up to the effective date of termination.

2. Termination of Contract by the OWNER for Convenience:

Notwithstanding the foregoing, this Agreement may be terminated with or without cause and for convenience by the OWNER by giving the DESIGNER thirty (30) calendar days written notice of termination signed by the Mayor or his designee, however, the DESIGNER shall be entitled to receive payment for all work satisfactorily completed up to the effective date of termination.

3. Remedies of the OWNER:

a. In addition to the right to terminate the contract, the OWNER shall also have the right to secure substitute services at the expense of the DESIGNER, require the DESIGNER to perform the promised services, withhold further payment from the DESIGNER until the services are performed.

b. In the event of such termination, all originals of finished or unfinished documents, data, studies, surveys, drawings, maps, models, and reports prepared by the DESIGNER under this contract shall, at the option of the OWNER, immediately become the property of the OWNER and shall immediately be delivered by the DESIGNER to the OWNER, and the DESIGNER shall be entitled to receive compensation for satisfactory work completed as of the termination date.

E. SUSPENSION, DELAY OR INTERRUPTION OF WORK:

The OWNER may suspend, delay or interrupt the services of the DESIGNER for the convenience of the OWNER. In the event of force majeure, or such suspension, delay, or interruption, in excess of 30 calendar days, an equitable adjustment in the PROJECT'S schedule, commitment and cost of DESIGNER's personnel and subcontractors, and DESIGNER's compensation will be made to reflect the actual costs of such delay. Any increase in the DESIGNER's compensation pursuant to this paragraph must be contained in a written amendment to this Agreement, signed by all parties hereto, and is subject to appropriation by the City.

F. NO THIRD PARTY BENEFICIARIES:

This AGREEMENT gives no rights or benefits to anyone other than the OWNER and DESIGNER and has no third party beneficiaries.

G. INDEMNIFICATION:

The DESIGNER shall indemnify, defend, and hold the OWNER harmless from and against

claims, liabilities, suits, loss, cost, expense, and damages to the extent arising from any act or omission of the DESIGNER, his employees, officers, agent, subcontractors and affiliates, in performance of the work and services pursuant to this contract. Such indemnification shall include, but not be limited to, claims of breach of contract or warranty, fault, tort, including negligence, strict liability, statutory or regulatory violations.

H. ASSIGNMENT:

Neither party shall have the authority to assign all or any part of this AGREEMENT without the prior written consent of the other party.

I. JURISDICTION:

This is a Massachusetts Contract. The law of the Commonwealth of Massachusetts shall govern the validity of the Agreement, its interpretation and performance, and other claims related to it. Any actions resulting from the interpretation or performance of or related in any way to this Agreement shall be brought in the Superior Court of Hampden County, Massachusetts sitting in Springfield, (except for claims by the City of a value less than $25,000.00 which shall be brought in the District Court sitting in Springfield, Massachusetts), or the United States District Court for the District of Massachusetts, sitting in Springfield, Massachusetts.

J. SEVERABILITY AND SURVIVAL:

If any of the provisions contained in this AGREEMENT are held for any reason to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality or unenforceability will not affect any other provision, and this AGREEMENT shall be construed as if such invalid, illegal or unenforceable provision had never been contained herein.

K. ARTICLES 6, 7 and 8 shall survive the termination of this AGREEMENT for any reason.

ARTICLE 9: ADDITIONAL TERMS AND CONDITIONS:

The following terms and conditions are included as part of this AGREEMENT:

A. The DESIGNER shall maintain an Affirmative Action Program regarding the recruitment of minorities and of women that is consistent with the objectives and goals of the Massachusetts State Office of Minority and Women Business Assistance.

B. Subletting of Contract or Contract Funds: The DESIGNER shall not assign, transfer, convey, sublet or otherwise dispose of this contract or of his right, title or interest therein, or of the power to execute such contract to any other person, firm or corporation, without the prior written consent of the OWNER. In no case shall such consent relieve the DESIGNER from the DESIGNER'S obligations or change the terms of this contract.

C. Safeguarding of Information: Any materials given to or prepared by the DESIGNER under this contract shall not be sold or otherwise made available to any individual or organization without prior approval of the OWNER.

D. Nondiscrimination: During the performance of this contract, the DESIGNER agrees as follows:

1. The DESIGNER will not discriminate against any employee or applicant for employment because of race, color, religion, gender, sexual orientation, disability, family status or

national origin, or any other unlawful discrimination, except where the DESIGNER can prove that religion, gender, or national origin is a bona fide occupational qualification reasonably necessary to the normal operation of the DESIGNER. The DESIGNER agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

2. The DESIGNER, in all solicitations or advertisements for employees placed by or on behalf of the DESIGNER, will state that such DESIGNER is an equal opportunity employer.

3. Notices, advertisements, and solicitations placed in accordance with federal and Massachusetts law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this provision.

4. The DESIGNER will include the provisions of paragraphs (1), (2) and (3) above in every subcontract or purchase order so that the provisions will be binding upon every subcontractor or vendor.

E. Conflict of Interest:

Upon the request of the Director of the appropriate City department or any authorized agent of the OWNER, as a prerequisite for any payment requested by the DESIGNER pursuant to the terms of this contract, there shall be furnished to the OWNER a statement, under oath, that no officer or employee of the City of Springfield or any member or employee of a Commission, Board, or Corporation controlled or appointed by the City of Springfield and no member of such person's immediate family, including spouse, parent or children, or any other such family member, has received or has been promised, directly or indirectly, any financial benefit, by way of fee, commission, finder's fee, or in any other manner, remuneration arising from or directly or indirectly related to this contract.

F. Prohibition against Contingent Fees:

The DESIGNER by entering into this Agreement hereby certifies that the DESIGNER has not employed any company or person other than a bona fide employee working for the DESIGNER to secure this agreement and the DESIGNER has not paid or agreed to pay any person, company or corporation, individual or firm other than a bona fide employee working solely for the DESIGNER any favor, commission, percentage, gift, or any other consideration contingent upon or resulting from the award of making this or any other agreement. It is the DESIGNER'S understanding that in the event of a breach or violation of the provision, the OWNER shall have the right to terminate this or any other agreement with the DESIGNER immediately and without liability and at the OWNER'S discretion, to deduct from the contract price or otherwise recover, the full amount of such fee, commission, percentage, gift or consideration.

G. The Director of the appropriate City department shall decide on all matters of contract dispute as raised by the DESIGNER.

H. Decreases and Work Not Performed: If deemed expedient, the OWNER or DESIGNER may decrease the scope of work without affecting enforcement of this contract. If the work is not performed, the DESIGNER and the OWNER shall mutually agree upon the credit due to OWNER based on the reasonable value of the work deleted.

I. Attorney's Fees and Other Expenses: The DESIGNER will not litigate or otherwise pursue any frivolous or unsubstantiated claims against the OWNER. If an DESIGNER'S claim is without substantial justification, the DESIGNER will reimburse the OWNER for all costs and expenses and attorney's fees associated with defending such claim.

J. The DESIGNER shall comply and all design work shall conform to all applicable and current editions or revisions of Massachusetts Statewide Building Code, at the time of the design work.

K. DESIGNER'S Representations:

By entering into this Contract with the OWNER, the DESIGNER represents and warrants the following, together with all other representations and warranties in the Contract Documents:

1. That the DESIGNER is experienced in and competent to perform the type of work required;

2. That the DESIGNER is financially solvent, able to pay the DESIGNER'S debts as they mature, and possesses sufficient working capital to initiate and complete the work required under the Contract;

3. That the DESIGNER is familiar with all Federal, State, County, Municipal and departmental laws, ordinances, permits, regulations and resolutions applicable to its work which may in any way affect the work of those employed therein, including but not limited to any special acts relating to the work or any part thereof;

4. That such temporary and permanent work required by the Contract which is to be done by the DESIGNER will be satisfactorily performed in accordance with paragraph 6 below;

5. That the DESIGNER will fully comply with all requirements of the Contract Documents;

6. That the DESIGNER will perform the work consistent with sound Architectural practice, good workmanship, and sound business practices, and in the most expeditious and economical manner consistent with high industry standards and in the OWNER'S interest;

7. That the DESIGNER will furnish efficient business administration and experienced management and an adequate supply of employees at all times; and

8. That the DESIGNER will complete the work within the Project/Task Time, milestones, and price, unless adjusted by mutual agreement of the parties hereto.

L. Any notices to be given to the OWNER under this Agreement shall be given to the Director of the applicable Department of the City. Any notices to be given to the DESIGNER shall be given to *GZA Environmental, 1350 Main Street, Suite 1400, Springfield, MA 01103, Attn: Thomas Jenkins.*

ARTICLE 10: ENTIRE AGREEMENT

This AGREEMENT including its Exhibits, constitutes the entire AGREEMENT, and supersedes all prior written or oral understandings, and may only be changed by a written amendment executed by the authorized representatives of both parties listed on the signature page of this Agreement, or their lawful successors in office or title.

Section 3 Clause included in Contract No.

Section 3 Clause

A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.

C. The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

D. The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

E. The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.

F. Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

G. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

IN WITNESS WHEREOF, the City of Springfield (OWNER) and the DESIGNER have each hereunto set their hand and seal, effective as of the date of the last signatory.

THE DESIGNER:

GZA Environmental
By TOM JENKINS
Title V. P.
Date Signed 12.13.17

THE OWNER:

Approved:

Director, Disaster Recovery & Compliance
Date Signed 12/27/17

Approved:

Executive Director, DCAC
Date Signed 12-19-17

Approved:

Office of Procurement
Date Signed 12-14-17

Approved as to appropriation:

Comptroller
Date Signed 12/26/17

ACCT# 26451811 - 530105 - 64516

$196,000.00

Approved as to Form

City Solicitor
Date Signed 12-20-17

Approved:

CAFO, Acting
Date Signed 12/27/17

Approved:

DOMENIC J. SARNO, Mayor
Date Signed 12/28/17

CORPORATE CERTIFICATE

*THIS MUST BE THE NAME OF THE PERSON AUTHORIZED IN YOUR BY-LAWS TO SIGN CONTRACTS *

**SINCE AN OFFICER CANNOT CERTIFY TO HIMSELF, SOMEONE MUST SIGN THIS OTHER THAN THE PERSON SIGNING THE CONTRACT *

I, ** Kenneth R. Johnston A Resident of Salem in

The State of New Hampshire DO HEREBY CERTIFY: that I am the Clerk/

Secretary of GZA GeoEnvironmental, Inc.

A Corporation duly Organized and existing under and by virtue of the laws of the

State of Massachusetts

And that I have custody of the records of such Corporation: and that as of the date herein below recited

* Thomas E. Jenkins Associate Principal, Vice President
(Officer, person who is signing the Contract) (Title)

Authorized to execute and deliver in the name and on behalf of the CORPORATION the following:

GZA GeoEnvironmental

CONTRACT NO.20180234

DESIGNER/CONSULTING SERVICES FOR WATERSHOP'S POND HYDROPOWER DESIGN

WITNESS WHEREOF, I have hereunto set my hand and affixed the Corporate Seal

Of such corporation this 13th day of December 2017

** Kenneth R. Johnston

Exhibit A

CITY OF SPRINGFIELD, MASSACHUSETTS
OFFICE OF PROCUREMENT
36 COURT STREET, ROOM 307, SPRINGFIELD, MA 01103

REQUEST FOR QUALIFICATIONS

RFQ Number 16-190; Professional Design Services for the Implementation of the HUD NDRC Grant

Will be received at the Office of Procurement until 2:00 P.M. June 29, 2016 and will be logged in at that time. Proposals received after the due date and time will be returned unopened.

All packages must be marked with Proposer's business name, the above RFQ number and the due date.

By: **Lauren Stabilo, Chief Procurement Officer**

This Request for Proposal is for: **Professional Design Services for the Implementation of the HUD NDRC Grant** (Per the attached specifications)

As requested by: **Springfield Department of Capital Asset Construction and the Department of Parks, Buildings, and Recreation Management**

THIS FORM MUST BE COMPLETED, SIGNED, AND RETURNED WITH BID.

This Proposal is submitted by: _____
(Company Name)

_____
(Company Address)

I acknowledge receipt of addenda numbered: _____, _____, _____, _____, _____.

signed by: _____
(Printed or Typed Name and Title)

_____/_____/_____
(Signature and Date)

Telephone Number: _____

Fax: _____

Email Address: _____

ADVERTISEMENT
CITY OF SPRINGFIELD, MASSACHUSETTS
OFFICE OF PROCUREMENT

Sealed Qualifications Packages & Bids for: Professional Design Services for the Implementation of the HUD NDRC Grant per RFQ No. 16-190

will be received until 2:00 PM: **June 29, 2016** by:

The Office of Procurement
Lauren Stabilo, Chief Procurement Officer
36 Court Street, Room 307, Springfield MA 01103
Phone (413) 787-6284 FAX 787-6295

At which time the proposals will be privately opened, logged, and read. Request for Qualifications documents and specifications will be available for in person pickup during normal business hours at the Office of Procurement beginning on June 1, 2016, or through the City's website: www.springfieldcityhall.com for no charge.

Through the National Disaster Resilience Competition (NDRC), the U.S. Department of Housing and Urban Development (HUD) will provide funding for resilient housing and infrastructure projects to states and communities that were impacted by major disasters between 2011 and 2013. The City of Springfield has been awarded an NDRC grant amount of $17,056,880. The City, through its Department of Parks, Buildings, and Recreation Management (DPBRM) and its Department of Capital Asset Construction (DCAC), is seeking to engage one or more qualified multi-disciplined engineering firms to provide engineering designs, consulting, permitting assistance, specifications, and construction administration services to implement certain portions of the City's successful NDRC grant application.

The anticipated services will include the development of preliminary and final designs, permit applications, environmental impact studies and analyses, regulatory permit applications and supporting documentation, drawings, specifications, and administrative support services to assist the City in its creation of an Urban Watershed Resilience Zone made up of economically-distressed neighborhoods within which the City will carry out a portfolio of projects presented in the City's Phase II NDRC Application (October 27, 2015). This procurement will cover the general ecological and engineering consulting needs of the DPBRM, DCAC, and other various City departments for NDRC-related projects that will be under the care and control of the DPBRM and DCAC.

The City retains the right to procure similar engineering services outside of any contract entered into as a result of this advertisement / contract. The resultant term of the awarded contract will be for one year, with two additional one-year renewable options at the sole discretion of the City of Springfield.

The Chief Procurement Officer reserves the right to reject any or all proposals. The City of Springfield will hold a pre-submission conference on June 16, 2016, at 2:00P.M. at the Conference Center at 200 Trafton Road in Forest Park, Springfield, MA 01108. Proposers are highly recommended to attend.

All questions regarding this Request for Proposals or its specifications must be received by the Office of Procurement no later than June 22, 2016, by 4:30 P.M.

City of Springfield
Professional Services for the Implementation of the HUD NDRC Grant
Department of Capital Asset Construction
Department of Parks, Buildings, and Recreation Management
RFQ No. 16- 190
RFQ Due Date: June 29, 2016, 2:00 P.M. EST

I. INTRODUCTION

A. General

1. The City of Springfield, MA (City) is inviting proposals from consultants to provide Professional Engineering and Consulting Services through its Department of Capital Asset Construction (DCAC) and its Department of Parks, Buildings, and Recreation Management (DPBRM).

2. The City of Springfield ("City") is seeking the services of a qualified "Designer" as defined in M.G.L. Chapter 7C, §§ 44-57, to provide professional design services design and construction administration services for the project entitled; "Professional Services for the Implementation of the HUD NDRC Grant. As referenced by Chapter 7C, Designer services for the overall project may be done as a distinct two-step process, including the ranking of proposals followed by interviewing of the finalists by the City of Springfield Designer Selection Panel.

B. Project Cost

1. The total estimated construction cost for this potential Project is $3.5 Million, depending upon the project scope and solution that is agreed upon by the Owner and that are ultimately approved by the Department of Capital Asset Construction, Department of Parks, Buildings, and Recreation Management, and the City Council. The Fee for Designer Services is not to exceed Ten Percent (11.5%) of the total ECC cost and represents a ***set fee*** for the services covered under this RFQ.

C. Pre-Submission Conference

The City of Springfield will hold a pre-submission conference on June 16, 2016, at 2:00 P.M. in the Conference Center at 200 Trafton Road in Forest Park, Springfield, MA 01108. Firms wishing to submit a response to this RFQ/P are encouraged to attend the conference. Agents who are not full time employees of a submitting firm are not eligible to attend the pre-submission conference.

D. Contract Award

1. In general, contract(s) resulting from this solicitation will be awarded to the qualified Proposers, whose proposals, costs, and/ or presentation / interview will be the most advantageous

to the City of Springfield to provide the required services. No contract will be effective until the City and selected Proposer sign a contract and the City issues a Notice of Award.

2. The City has not made a determination as to the number of firms to be selected for this contract; however, it is anticipated that only one firm will be selected.

E. Contract Term

The proposed contract to be awarded by the City will be for the term of One (1) year, and the City will retain Two (2) one-year in length renewal options, to be exercised at the City's sole discretions. The City of Springfield Office of Procurement will submit a renewal in writing upon approximately Sixty (60) days' notice.

F. Sample Contract, Terms and Conditions

1. Please see attached sample contract for Designer/Architect Services (Attachment A). This contract has been attached for reference purposes only. This RFQ and the selected Designer's proposal will be appended to and become part of the Contract for Designer Service. Any Designer selected as a result of this RFQ will be required to execute a Contract for Designer Services with the City that is similar to the document attached hereto.

2. The successful Proposer will be required to provide a certificate of liability insurance, at the time of contract execution, indicating minimum coverage of 10% of the total cost of the project or $1 Million Dollars, whichever is less.

3. The successful firm/individual must comply with all applicable federal, state, and local laws and regulations, particularly MHC regulations and administrative procedures, including the City's review of DCAM and Designer Selection forms, and the ability to acquire the necessary insurance.

G. Pertinent Dates

RFQ/P Advertisement Date	June 1, 2016
Pre-Submission Conference	June 16, 2016, 2:00 P.M. Forest Park Conference Center.
Final Date for RFQ Questions	June 22, 2016, 4:30 P.M.
RFQ Submission Date	June 29, 2016
Consultant Interviews (if necessary)	No Later than July 2016
Contract Award Date	No Later than August, 2016

II. SUBMISSION PROCEDURES AND INFORMATION

A. Questions

1. Bidders may submit written questions via e-mail by June 22, 2016. All inquiries related to the requirements should prominently refer to **"RFQ No. 16-190, Professional Services for the**

Implementation of the HUD NDRC Grant", list the opening date, and be emailed to Theo Theocles at ttheocles@springfieldcityhall.com, or faxed to the following address:

Theo G. Theocles, Esq. Deputy Procurement Officer
36 Court Street, Room 307, Springfield, MA 01103
Phone: 413-784-4898
Email: ttheocles@springfieldcityhall.com
Fax: 413-787-6295

2. The resultant contract will be administered by:

Peter J. Garvey
Director, Department of Capital Asset Construction (DCAC)

3. Any inquiries related to this RFQ must be made in writing, submitted to the Office of Procurement by the date identified in this RFQ. Inquiries submitted after the time and date specified will not be addressed. Oral questions will not be accepted at the pre-submission conference and, if necessary, addenda will be issued. Oral or written questions or inquiries will not be accepted from any third party agents or brokers.

4. The City will issue responses to inquiries and any other corrections, amendments and additional information which it deems necessary in written addenda issued prior to the closing date. Addenda will be emailed to all vendors whom requested specifications from the office of procurement. Each proposer must indicate that they have read and reviewed any and all addenda and their proposal addresses any and all modifications contained in said addenda.

B. General Instructions

1. The City considers any information, which may have been released either in writing or orally prior to the issuance of the official RFQ to be preliminary in nature and the City shall not be bound by any such information.

2. All proposers shall furnish all information required in this RFQ. Failure to submit all required material will result in the Submission being rejected by the City. The person signing the proposal must initial any erasures or changes that appear in the response for the response to be valid.

3. Brokers are not allowed to submit proposals on behalf of any firm and submissions will only be accepted from firms licensed to do work in the State of Massachusetts. Persons signing the proposal must have the authority to bind the submitting firm to the City of Springfield for any and all tasks if the firm is selected by the City.

4. Where potential Professional Engineering services are set forth in the RFQ, the City will / may consider proposals / disciplines for services other than those listed in this RFQ.

5. Proposers may not submit alternate proposals.

C. Restrictions on Contact with City Employees

Perspective proposers are advised that, from the date of advertisement of this RFP until the award of any resultant contract, they are not permitted to contact any City employee about any matter related to this RFQ, unless they have received the permission from the Office of Procurement. The restriction also extends to any broker / agent representing any firm. Any violations of the restriction clause committed by a firm, or broker / agent of a firm, are grounds for rejection of their bid.

D. General Submission Requirements

1. Submit One (1) original and Six (6) copies of the entire submission package. Please mark original clearly.

2. Submissions must be received to the Office of Procurement before 2:00 pm on June 29, 2016 at 2:00 P.M. EST.

3. Proposers are recommended to include their firm name and complete address on the outer envelope and/or package enclosing the submission. Proposals shall be addressed to:

Ms. Lauren Stabilo, Chief Procurement Officer
36 Court Street, Room 307, Springfield, MA 01103
Phone: 413-787-6284
Fax: 413-787-6295

4. Proposal must be clearly identified by marking the package or envelope with the following:

"Professional Services for the Implementation of the HUD NDRC Grant",
City of Springfield RFQ No. 16-190
Closing Date: June 29, 2016, 2:00 P.M. EST

5. Proposals are due by 2:00 pm on the closing date listed above. No proposals will be accepted after the closing time. Proposals may be delivered to the Office of Procurement at the address listed above between the hours of 8:30 am and 4:00 pm Monday through Friday, excluding holidays observed by the City, except date due submission. Proposers are responsible for informing any commercial delivery services of all delivery requirements, and for assuring that all necessary information appears on the outer wrapper of the package as directed. The City will not accept electronic or telegraphic proposals.

E. General

1. Withdrawal. Applicants may withdraw an application as long as the written request to withdraw is received by the City of Springfield Chief Procurement Officer prior to the time and date of the proposal opening.

2. Public Record. All responses and information submitted in response to this RFQ are subject to the Massachusetts Public Records Law, M.G.L. chapter 66, sections 10, and chapter 4, section 7(26). Any statements in submitted responses that are inconsistent with the provisions of these statutes shall be disregarded.

3. Waiver/Cure of Minor Informalities, Errors and Omissions. The City reserves the right to waive or permit cure of minor informalities, errors or omissions prior to the selection of a Respondent, and to conduct discussions with any qualified Respondents and to take any other measures with respect to this RFQ in any manner necessary to serve the best interest of the City and its beneficiaries.

4. Rejection of Responses, Modification of RFQ. The City reserves the right to reject any and all responses if the City determines, within its own discretion, that it is in the City's best interests to do so. This RFQ does not commit the City to select any Respondent, award any contract, pay any costs in preparing a response, or procure a contract for any services. The City also reserves the right to cancel or modify this RFQ in part or in its entirety, or to change the RFQ guidelines. A Respondent may not alter the RFQ or its components.

5. All words, signatures, and figures submitted on the proposal shall be typed or written in ink. Proposals that are conditional obscure, or which contain additions not called for in the specifications, erasures, alterations or irregularities will be rejected.

6. The City of Springfield reserves the right to reject proposals, to waive technicalities, to advertise for new proposals, or to make awards that may be deemed to be in the best interests of the City.

7. All proposals, discs, plans, CAD drawings, data collected, and reports become the property of the City.

8. All documents prepared for the project shall remain the property of the City of Springfield.

F. Incurring Cost

The City shall not be held liable for any proposal preparation or, if awarded a contract, for any pre-contract activity or costs incurred by any proposer in the preparation of their proposal, preparation or presentation at an interview, during any negotiations regarding the contract, or in execution of the contract.

G. Oral Presentations / Interviews

The City may require proposers to give oral presentations / interviews regarding their proposal and / or to demonstrate the firm's capabilities to provide the City of Springfield with the necessary services required under the contract. Agents and / or brokers of any proposer will not be allowed at any presentation or interview. If shortlisted for an interview, the proposer will be notified of the exact requirements to be addressed at the interview.

H. Examination of Specifications

The proposer shall carefully examine the RFQ and all other documents and data associated with this contract, and become familiar therewith. The Proposers shall not at any time after executing a contract, make any claims whatsoever alleging insufficient data or incorrectly assumed conditions, nor shall he claim any misunderstandings with regard to the nature, conditions, or character of the work to be completed under this contract, and shall assume all risks resulting from any changes in the conditions which may occur during the progress of the work.

III. FORMAT OF RFQ RESPONSES

A. Submission Format

1. The submission package should be in the sequence and format listed as follows. Submission should have divider pages and be titled as stated.

i. Cover Letter
ii. Executive Summary
iii. Tab 1 – Team Organization
iv. Tab 2 – Designer Application Form
v. Tab 3 – Background of Firm
vi. Tab 4 – Professional Personnel
vii. Tab 5 – Hourly Rates
viii. Tab 6 – Quality Assurance Plan
ix. Tab 7 – Affirmative Action Plan
x. Tab 8 – Section 3 Compliance Plan

B. Cover Letter

1. At a minimum, the Cover Letter must:

i. Provide a summary of similar experience
ii. Identify the Project Manager
iii. State that the submitting firm has an office in the State of Massachusetts
iv. State that the Project Manager is a Registered Professional Engineer in the State of Massachusetts and has been with the current firm for a minimum of 3 years.
v. Includes a statement that the proposer accepts all terms and conditions contained in the RFQ
vi. Provide a statement that addenda have been received, reviewed, and accepted as part of the response to the RFQ

C. Executive Summary

1. This section should include a brief overview of materials included in the following sections and include all requested statements or exceptions noted by the proposer.

2. This section should also include all of the required forms fully executed including:

i. RFQ/P Cover Page

ii. Affirmative Action Plan

iii. Tax Certification Affidavit for Contractors

iv. Collusion or Fraud Statement

D. Tabs

Each Section must be tabbed and titled as requested below:

1. Tab 1 – Team Organization

The proposer must provide a listing of required services that the firm will be providing, along with which services will be provided by any sub-consultants. The proposer must also submit an organizational chart that clearly identifies the Project Manager, the services that will be provided, the individuals who will be providing those services, and which firm they are associated with, if they are with a sub-consultant.

2. Tab 2 – Designer Application Form

The proposer must submit a completed "Standard Designer Application Form for Municipalities and Public Agencies not within DSB Jurisdiction (Updated May 2014)". A copy of the form can be downloaded in Word format or PDF format from www.mass.gov website. The primary firm is responsible for completing all sections of the form, and a completed section 8B must be submitted for each sub-consultant.

3. Tab 3 – Background of Firm – Project Experience

Please include the following information in this section:

- Firm Name
- Parent Company (if any) and year acquired
- Year Established
- Any former name that firm has been known by
- Business address of Parent Company (if any)
- Business address of office to be in primary charge of the work
- Name of Project Manager
- Name of Person to Contact with any questions about proposal

- Name of Firm Principals, where registered and current professional standing
- Type of Services that primary firm is qualified to provide.
- Listing of Primary Firm and Sub-consultant Qualifications

This section should also include a narrative section on relevant experience of the primary firm and all included sub-consultants. Individual project pages are acceptable; however, all experience listed should only be from the last 10 years to be considered relevant. Project information should include references. If you are subcontracting any work you may not use cost plus a percentage of cost (markup) to their billing.

4. Tab 4 – Professional Personnel - Resumes

This section should include resumes of all individuals from the primary firm and sub-consultants to be involved in this assignment with the City of Springfield. The resumes shall be limited to two pages in length, include the number of years an individual has been with the current firm and identify which specific area of expertise the individual will provide under headings such as:

- Civil Engineer
- Structural Engineer
- Landscape Architect
- Electrical Engineer
- Geotechnical Engineer
- Hydraulics Engineer
- Land Surveyor
- Environmental Engineer
- Licensed Site Professional
- Construction Administrator / Inspector / Management
- Architect

The resume of the Project Manager cannot be more than 2 pages in length. The Project Manager must have:

- A minimum of 10 years' experience
- Bachelor's Degree in Engineering
- Must have been with the current firm for a minimum of 5 years
- Must be a registered Professional Engineer in Massachusetts
- Must have acted as Project Manager on similarly-sized Contracts in the recent past with the current company.

5. Tab 5 – Fee Schedule - Hourly Rates

The proposer shall include in this section a complete list of hourly rates for the primary firm and for all sub consultants. The rates should be in a combined format rather than separate sheets for each firm, if appropriate. Contractor must also identify how project expenses will be addressed and charged. If you are subcontracting any work you may not use cost plus a percentage of cost (markup) in their billing.

Proposers must state in the Executive Summary portion of their submittal if they will renew the contract for the second and third years at the hourly rates included in the original submission or if new hourly rates will be submitted.

6. Tab 6 – Quality Assurance Plan

The proposer must include a copy of the firm's Quality Assurance Plan in this section. The selected consultants shall perform all work to the highest standards of professional care. The consultant shall establish and maintain a Quality Assurance Plan, subject to the City's approval, setting forth the Consultant's policy for Quality assurance and procedures for implementing that policy. Such plan must apply to all employees engaged in work under this assignment, include regular and written procedures for performance of all project activities, and provide sufficient information to senior managers to enable effective supervision of project. The submitted Quality Assurance Plan must provide details of your internal control system, which controls the following areas at a minimum:

i. Design Review and Quality Assurance
ii. Project Scheduling
iii. Personnel Assignments and Scheduling
iv. Financial Control

7. Tab 7 – Affirmative Action Plan

The proposer must submit a copy the prime firm's Affirmative Action Plan. Please provide in this section your firm's policies and goals in regards to the recruitment of minority men and women. See **Attachment D** for other required information and forms to be submitted.

8. Tab 8 – Section 3 Compliance Plan

The proposer must submit a copy the prime firm's HUD Section 3 compliance plan and must agree to abide by the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3). Section 3 is a provision of the HUD Act of 1968 that helps foster local economic development, neighborhood economic improvement, and individual self-sufficiency. The Section 3 program requires that recipients of certain HUD financial assistance, to the greatest extent feasible, provide job training, employment, and contracting opportunities for low- or very-low income residents in connection with projects and

activities in their neighborhoods. Please provide in this section the prime firm's policies and goals in regards to compliance with Section 3 as it applies to this project.

IV. EVALUATION PROCEDURE AND CRITERIA

A. Submission Requirements

Any proposer who does not meet all of the outlined submission requirements, including submission of all necessary forms and documents, will be rejected, deemed non responsive, and will not be considered for the contract.

B. Selection Committee

The City will be assembling a selection committee for this project. At this time the members have not been identified.

C. Selection Process

The City will be using a two-step selection process -

1. STEP 1 - Upon receipt of all submissions deemed to meet all of the outlined submission requirements; the selection committee will review independently all of the proposals using the Consultant Ranking Form located in **Attachment C** for each Proposer. Proposers will then be ranked from highest to lowest based upon scores achieved.

2. STEP 2 - If deemed necessary by the City, oral presentations / interviews will be held by the City. Specific selection criteria used in the interview process will be distributed to the firms selected for interviews.

3. A determination has not been made as to the number of firms to be selected for this contract; however, there may be more than one firm selected.

D. General Selection Criteria

1. The following general criteria shall be used to evaluate the firms submitting proposals:

i. Proposer / team provides all necessary services required by the City

ii. Proposer has provided similar services to similarly sized communities in Massachusetts

iii. Project Manager possesses significant diversified engineering experience applicable to the City of Springfield's project

iv. Understanding of the work requirements

v. Qualifications of Personnel

vi. Necessary resources to complete assigned tasks

vii. Compliance with Affirmative Action Requirements

viii. Quality of Oral Presentation / Interview, if required

E. Minimum Evaluation Criteria

1. Proposers must meet the following minimum requirements:

i. Ten (10) years' experience of providing similar on-call engineering experience

ii. Project Manager must have a minimum of 3 continuous years' service with current firm

iii. Must meet all Affirmative Action requirements

iv. Must meet all HUD Section 3 requirements

v. Firm must have an office in the State of Massachusetts

vi. Be a qualified Designer with the Meaning of M.G.L. Chapter 7C, section 44, employing a Massachusetts registered architect responsible for and being in control of the services to be provided pursuant to the Contract.

2. All of the above minimum evaluation criteria must be addressed in the Cover Letter submitted to the City of Springfield.

V. SCOPE OF WORK

A. General

1. Through the National Disaster Resilience Competition (NDRC), the U.S. Department of Housing and Urban Development (HUD) will provide funding for resilient housing and infrastructure projects to states and communities that were impacted by major disasters between 2011 and 2013. The City of Springfield has been awarded an NDRC grant amount of $17,056,880.

2. The City, acting through its Department of Capital Asset Construction (DCAC) and its Department of Parks, Buildings, and Recreation Management (DPBRM), is seeking to engage one or more qualified multi-disciplinary engineering firms to provide engineering designs, consulting, permitting assistance, specifications, and construction administration services to implement certain portions of the City's successful NDRC grant application.

B. Anticipated Services

1. The anticipated services will include the development of preliminary and final designs, permit applications, environmental impact studies and analyses, regulatory permit applications and supporting documentation, drawings, specifications, and administrative support services to assist the City in its creation of an Urban Watershed Resilience Zone made up of economically-distressed neighborhoods within which the City will carry out a portfolio of projects presented in the City's Phase II NDRC Application (October 27, 2015). This procurement will cover the general ecological and engineering consulting needs to the DPBRM and the DCAC other various City departments for NDRC-related projects that will be under the care and control of the DPBRM and DCAC.

2. Some of the services may include:

i. Consultation and Advice

ii. Feasibility Studies

iii. Field Investigation and Data Collection

iv. Schematic, design development, and construction documents, drawings, specifications and publically-procured construction bidding documents

v. Environmental Assessments

vi. Engineering Reports

vii. Municipal Park Design

viii. Low Impact Development and Sustainable Design

ix. Lake and Pond Evaluation, Assessment, and Management

x. Land Surveying

xi. Construction Cost Estimating

xii. Design Services, whole or in part

xiii. Value Engineering

xiv. Small Scale, Low Impact Hydropower Assessment, Implementation, and Permitting

xv. Construction Management and Inspection

xvi. Materials Testing – Design

xvii. Materials Testing - Construction

xviii. Expert Testimony

xix. Assistance to the City's Office of Procurement in securing construction bids and awarding contracts

xx. Administering and observing construction activities

xxi. Assistance in start-up, assessment of capacity, and operation of facilities

xxii. Dam studies and designs

xxiii. Preparation of O&M Manuals

3. The Consultant may be required to accomplish projects which require special expertise and/or are too large for execution by City staff. Typical areas of expertise to be needed under this agreement may include but are not limited to:

i. Hazardous Materials / Environmental Site Assessments

ii. Building Inspections and Assessments

iii. Geographic Information Systems

iv. Land Surveying

v. Geotechnical Engineering

vi. Architectural Services

vii. Landscape Architecture

viii. Applied Hydraulic Engineering

ix. Small-Scale Hydropower Engineering and Permitting

x. Mechanical Engineering

xi. Electrical Engineering

xii. Environmental Permitting

xiii. Environmental Sciences and Engineering

xiv. Construction Inspection & Administration

4. The selected engineering firm(s) will provide a wide range of design and specialized consulting services through the medium of appropriately staffed divisions, sub-consultants or subsidiary organizations. To be properly qualified to render specialized engineering services, the division, sub-consultant or subsidiary organization must be directed by a professional engineer with training and experience in the specialized field.

5. The Consultants will have prime responsibility for all aspects of the projects as assigned. It is understood that the Consultant selected may not have on-staff all of the fields of expertise, and engaging sub-consultants may be necessary on some projects.

6. With regard to sub-consultants, if firms identify specific outside firms to prove certain services, the required information identified in **Section II** of this document. Depending upon the services identified, it may be necessary to have the sub-consultant attend the oral presentation / interview, if invited.

7. This procurement and scope of services will be limited to the extent that statutory procedures govern the selection of engineers for certain types of projects.

ATTACHMENTS

Attachment A: Draft Contract for Designer Services with City of Springfield (Example contract form for reference only). The Attachment includes pertinent Federal Procurement Statutory Language.

Attachment B: Designer Application Form – DSB 2014

Attachment C: Comparative Criteria to be used by Evaluation Committee

Attachment D: Forms and Certifications to be completed and submitted with proposal:

1. Request for Qualifications Cover Sheet, Signed (This is the RFQ Cover Sheet and is not actually included in Attachment D, but is still required for submission)
2. Tax Certification Affidavit
3. Collusion/Fraud Statement
4. Affirmative Action Forms and Corresponding Affirmative Action Plan
5. Debarment Certificate

End of Request for Qualifications for Designer Services

Exhibit B

GZA

Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

1350 Main Street
Suite 1400
Springfield, MA 01103
T: 413.726.2100
F: 413.732.1249
www.gza.com

June 29, 2016
15.P000031.17

City of Springfield
Office of Procurement
36 Court Street – Room 307
Springfield, Massachusetts 01103

Attention: Lauren Stabilo, Chief Procurement Officer

RE: Bid Number SPG-16-190
Professional Design Services for the Implementation of
the HUD NDRC Grant

Dear Ms. Stabilo:

GZA GeoEnvironmental, Inc. (GZA) is pleased to submit to the City of Springfield our Statement of Qualifications to provide Professional Design Services as outlined in your Request for Qualifications (RFQ, received June 10, 2016). GZA has been providing professional services to the hydropower industry for decades. The hydropower industry is a multi-disciplinary sector, and GZA is a multi-disciplinary firm. Owners of hydroelectric dams have long counted on GZA's extensive experience in the fields of civil, hydrologic, and dam engineering to assist them in constructing, repairing, and maintaining their structures. GZA now provides a wider range services, including licensing, permitting, environmental studies, and design of new or rehabilitated small hydroelectric facilities. GZA understands that licensing and permitting can often be the biggest challenge to successfully bringing a hydroelectric project on-line. GZA can guide a client through the Federal Energy Regulatory Commission (FERC) licensing process by providing technical, environmental, and filing preparation services all the way from the Preliminary Permit application through the License or Exemption process. State and local permits are important, too, and GZA's experience in dealing with multi-agency permitting situations is invaluable for such projects.

GZA has over 550 employees in 27 offices throughout the Northeast and Midwest and is headquartered in Norwood, Massachusetts. We also have Massachusetts offices in Newburyport, Hingham, Boston, and **Springfield**, which is GZA's proposed "prime work location" if selected for this assignment. Located at 1350 Main Street in the MassLive building, **GZA's prime work location is immediately next door to Springfield's City Hall** and includes 25 employees, one of which is **GZA's proposed Project Manager and Principal-in-Charge: Tom Jenkins, P.E.**

Mr. Jenkins has practiced civil engineering in western Massachusetts for twenty-seven years and has worked directly and continuously with various City of Springfield departments for over twenty-three years. Mr. Jenkins joined GZA in 2007, after fourteen years with Baystate Environmental Consultants in East Longmeadow. His knowledge of City practices, organization, and infrastructure is vast and diverse. City departments and staff have come to rely on his experience and understanding of the City's technical affairs as almost an extension of themselves. Springfield's unique and impressive history is one of Mr. Jenkins' personal interests,

and his involvement in the maintenance and betterment of City facilities and amenities is a great source of personal pride.

We understand that the City of Springfield desires a consultant with an intimate understanding of their issues and concerns. GZA has a proven history of providing this level of service to City departments. Designer services for the HUD NDRC Grant implementation will require rapid project understanding and immediate action in order to meet the Grant's schedule demands. GZA is structured to provide the required level of service—our Springfield location allows us to be with City staff or on the jobsite immediately, and our knowledge and understanding of City issues and the content of the City's NDRC Grant application will result in our professionals being productive without delay. To assist GZA with this assignment, we have put together an impressive team which is described in detail in our Statement of Qualifications.

We anticipate that the City may receive a number of proposals from other firms. Respecting your review timetable and to summarize what distinguishes GZA from other firms, we highlight our:

- Pro-active and highly experienced staff who understand both the technical and regulatory issues relative to the built and natural environment in Springfield;
- GZA's multi-disciplinary services and experience;
- GZA's Springfield presence, which is cost effective and responsive; and
- Prior successful history and understanding of providing consulting services to the City of Springfield, especially as related to the City's successful Phase II NDRC Grant application submitted October, 2015.

Lastly, GZA has reviewed the City's website on multiple occasions for any addenda to the City's RFQ. Finding none, GZA accepts all terms and conditions in the original RFQ as received.

The enclosed sections of this proposal follow the format and sequence specified in the RFQ. We have attempted to be as concise as practical to provide an accurate yet thorough understanding of GZA. We would welcome the opportunity to discuss this proposal with the Selection Committee. Should you have any questions, please contact Tom Jenkins at (413) 726-2121. Thank you for this opportunity to express our interest.

Very truly yours,
GZA GEOENVIRONMENTAL, INC.

Thomas E. Jenkins, P.E.
Project Manager / Principal-in-Charge

Chad W. Cox, P.E.
Civil Engineer / Principal

Paul G. Davis, Ph.D., PWS, CPSSc
Associate Principal / Senior Environmental Scientist

enclosures

"Proactive By Design"

The City of Springfield and the Department of Capital Asset Construction may ask after reviewing several proposals and qualifications for Designer Services for the Implementation of the HUD NDRC Grant,

"What do GZA's employees, clients, and other cities and towns say makes GZA unique and different than other firms with similar technical capabilities, services, and experience?"

Answer: GZA is ***Proactive by Design.***

GZA has a proactive company culture. This is our unique way of doing business and how we strive for excellence and perform our work for you.

We are proactive in:

Communicating - We reach out to you to avoid any surprises. We strive to return calls, emails, and incoming communications on your required schedule. We meet face to face, actively listen to you and learn your needs, objectives, schedule and other project constraints.

Identifying Core Issues and Risk Alternatives – We operate in uncertain environments so we assess hazards, possible exposures, and risks. We involve independent quality control specialists on the team. We assess proven solutions and technologies and are open to new approaches.

Taking Ownership – Your needs and bottom line are our bottom line. We ask ownership questions, engage stakeholders, put ourselves in your position, and take full responsibility for our work.

GZA is a multi-disciplinary consulting firm which distinguishes itself by focusing on responsiveness and communications with our clients, perhaps best exemplified by the services that our local office has provided to the City of Springfield for so many years. Coupled with GZA's in-depth knowledge of the City's practices, organization, and infrastructure, our technical strengths will provide cost effective and responsive services to fulfill the City's needs.

GZA's Statement of Qualifications package demonstrates our approach to fulfill the City's need for professional designer and consulting services for the implementation of the HUD NDRC Grant. GZA was intimately involved in the preparation of the City's Phase II NDRC Grant application package, culminating in submission of the application to HUD in October, 2015. We provided timely technical advice, expertise, and perspective in helping shape the City's concepts and develop the final proposal and estimates of cost for resiliency improvements throughout the Urban Watershed Resiliency Zone. We worked intimately with representatives from the City's NDRC consultant, GCR Incorporated, Project Partners, and the following City departments and agencies:

Administration and Finance;
Capital Asset Construction;
Disaster Recovery & Compliance;
Forestry;
Information Technology;
Office of Housing;
Office of the Mayor;
Parks, Buildings, and Recreation Management;
Planning and Economic Development; and
Public Works

To provide the City of Springfield with the most comprehensive services, GZA has assembled an impressive team of professionals offering comprehensive expertise combining specialized hydropower expertise and industry leadership with a full range of engineering, environmental, and consulting services. The following sections of GZA's Statement of Qualifications package introduces GZA's capabilities and background, and introduces the City of Springfield to our selected subcontractors, including:

- Alden Research Laboratory, Inc. – Fisheries Support
- HDR, Inc. - Regulatory Support
- Heritage Surveys, Inc. – Topographic and Boundary Surveys
- Hydropower Consulting Specialists – Small-scale Hydropower Operations (WBE)

EXECUTIVE SUMMARY

Section 1 of GZA's Statement of Qualifications package includes a description of GZA and our proposed subcontractor team, including GZA's Project Manager / Principal-in-Charge, the other professionals that will be involved in the project, and an organizational chart identifying GZA's team and organization.

Section 2 provides completed Designer Application Forms as requested.

Section 3 includes specific qualifications of GZA and our proposed subcontractors. We have also included a brief description of GZA's understanding of the hydropower aspects of the proposed project, and Section 4 provides resumes of the key professionals from GZA and each of our subcontractors.

Section 5 provides hourly rates for GZA personnel and each of our proposed subcontractors. GZA will honor the enclosed rates throughout the first year of our contract, and will limit any adjustments in the second or third years to any increases in the Consumer Price Index City Average – All Urban Consumers.

Section 6 provides the City of Springfield with GZA's Quality Assurance Plan. Also included are two related documents, namely the Corporate Quality Control Plan and the corporate guidelines for Review of Personnel Work Products. Both offer insight into how GZA approaches QA/QC and the importance of these policies to the successful development of projects for our clients, including the City of Springfield.

GZA's corporate Affirmative Action Policy, February 16, 2015, is included in Section 7 of our Statement of Qualifications package. GZA prohibits discrimination in employment on the basis of race, color, religion, creed, citizenship status, marital status, national origin, sex, sexual orientation, Vietnam Era Veteran status, age, and disability.

Lastly, Section 8 addresses GZA's compliance with Section 3. In short, GZA agrees to abide by the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended. We have completed many recent assignments with the City of Springfield subject to Section 3 requirements.

Immediately following this Executive Summary are the required fully executed forms listed below:

RFQ Cover Page
Affirmative Action Form
Tax Certification Affidavit for Contractors
Collusion or Fraud Statement
Debarment Certificate

The enclosed subsequent Sections of GZA's proposal follow the format and sequence specified in the RFQ. We have attempted to be as concise as practical to provide an accurate yet thorough understanding of GZA and our proposed subcontractors. We would welcome the opportunity to discuss GZA's Statement of Qualifications with the Selection Committee.

Should you have any questions, please contact Tom Jenkins at (413) 726-2121.

CITY OF SPRINGFIELD, MASSACHUSETTS
OFFICE OF PROCUREMENT
36 COURT STREET, ROOM 307, SPRINGFIELD, MA 01103

REQUEST FOR QUALIFICATIONS

RFQ Number 16-190; Professional Design Services for the Implementation of the HUD NDRC Grant

Will be received at the Office of Procurement until 2:00 P.M. June 29, 2016 and will be logged in at that time. Proposals received after the due date and time will be returned unopened.

All packages must be marked with Proposer's business name, the above RFQ number and the due date.

By: **Lauren Stabilo, Chief Procurement Officer**

This Request for Proposal is for: **Professional Design Services for the Implementation of the HUD NDRC Grant** (Per the attached specifications)

As requested by: **Springfield Department of Capital Asset Construction and the Department of Parks, Buildings, and Recreation Management**

THIS FORM MUST BE COMPLETED, SIGNED, AND RETURNED WITH BID.

This Proposal is submitted by: GZA GeoEnvironmental, Inc.
(Company Name)

1350 Main Street, Suite 1400 - Springfield, MA 01103
(Company Address)

I acknowledge receipt of addenda numbered: _____, _____, _____, _____, _____.

signed by: Thomas Jenkins - Vice President
(Printed or Typed Name and Title)

6/29/16
(Signature and Date)

Telephone Number: 413-726-2100

Fax: 413-732-1249

Email Address: thomas.jenkins@gza.com

DESIGNER'S SERVICE
Affirmative Action Form

The undersigned bidder/proposer hereby certifies he/she will comply with the minority/women workforce percentage ratio and specific affirmative action goals contained in this contract and will make good faith best efforts to comply with the Minority/Women Business Enterprise goals under these contract provisions, as well as all other requirements deemed necessary by the Contract Compliance Officer for this type of contract.

NAME OF PROJECT Professional Design Services for the Implementaionof the HUD NDRC Grant BID NO. 16-190

Is your company at least 51% owned and controlled by one of the following group's members? Please check the appropriate categories.

MALE x	Black	Asian
	Hispanic	Caucasian x
	Alaskan Native	Cape Verdean
FEMALE	American Indian	

Signature of Bidder/Proposer (authorized representative)

Human Resources Coordinator
Title

GZA GeoEnvironmental, Inc.
Name of Firm

June 29, 2016
Date

THE AWARDING AUTHORITY SHALL REJECT ANY BID/PROPOSAL NOT ACCOMPANIED BY THIS CERTIFICATION. THIS FORM MUST BE SUBMITTED BY THE BIDDER WITH THE BID/PROPOSAL, AND SIGNED BY THE BIDDING COMPANY IF THE REQUIRED INFORMATION IS PROVIDED OR NOT.

TO BE INCLUDED IN ALL SPECIFICATIONS

COMPLIANCE WITH FEDERAL, COMMONWEALTH OF MASSACHUSETTS, AND CITY OF SPRINGFIELD TAX LAWS.

A. COMPLIANCE WITH TAX LAWS

The contractor must be in compliance **at the time it submits its bid and afterwards if selected as the contractor**, with all Federal, Commonwealth of Massachusetts and City of Springfield tax laws, the contractor will be disqualified from the bidding procedure.

B. TAX CERTIFICATION AFFIDAVIT.

The contractor **must** complete and return the Tax Certification Affidavit with the contractor's bid/proposal. Failure to complete and return the Tax Certification Affidavit will disqualify the contractor from the bidding procedure.

C. VERIFICATION OF COMPLIANCE WITH FEDERAL AND MASSACHUSETTS TAX LAWS.

If the City of Springfield discovers that the contractor is not in compliance with Federal or Massachusetts tax laws, the contractor shall be excluded from the bidding procedure.

D. COMPLIANCE WITH THE CITY OF SPRINGFIELD TAXES.

If the City of Springfield discovers that the contractor owes the City of Springfield any assessments, excise, property or other taxes, including any penalties and interest thereon, the contractor shall be excluded from the bidding procedure.

The contractor at all times during the term of an awarded contract shall observe and abide by all Federal, Commonwealth of Massachusetts and City of Springfield tax laws and remain in compliance with such laws, all as amended.

TAX CERTIFICATION AFFIDAVIT FOR CONTRACTS

Individual Social Security Number | State Identification Number | 04-2393851 Federal Identification Number

Company: GZA GeoEnvironmental, Inc.

P.O. Box (if any): Street Address Only: 1350 Main St - Suite 1400

City/State/Zip Code: Springfield, MA 01103

Telephone Number: 413-726-2100 Fax Number: 413-732-1249 Email: thomas.jenkins@gza.com

List address(es) of all other property owned by company in Springfield:

Please Identify if the bidder/proposer is a:

Corporation X

Individual ____ Name of Individual: ____

Partnership ____ Names of all Partners: ____

Limited Liability Company ____ Names of all Managers: ____

Limited Liability Partnership ____ Names of Partners: ____

Limited Partnership ____ Names of all General Partners: ____

You must complete the following certifications and have the signature(s) notarized on the lines below. Any certification that does not apply to you, write N/A in the blanks provided.

FEDERAL TAX CERTIFICATION

I, Daniel Breuer (authorized agent) certify under the pains and penalties of perjury that GZA (Bidder/Proposer), to my best knowledge and belief, has/have complied with all **United States Federal taxes** required by law.

GZA (Bidder/Proposer/Contracting Entity) Daniel Breuer (Authorized Person's Signature) Date: 6/22/16

CITY OF SPRINGFIELD TAX CERTIFICATION

I, Daniel Breuer (authorized agent) certify under the pains and penalties of perjury that GZA (Bidder/Proposer), to my best knowledge and belief, has/have complied with all **City of Springfield taxes** required by law(has/have entered into a Payment Agreement with the City).

GZA (Bidder/Proposer/Contracting Entity) Daniel Breuer (Authorized Person's Signature) Date: 6/22/16

COMMONWEALTH OF MASSACHUSETTS TAX CERTIFICATION

Pursuant to M.G.L. c. 62C §49A, I, Daniel Breuer (authorized agent) certify under the pains and penalties of perjury that GZA (Bidder/Proposer), to my best knowledge and belief, has/have complied with all laws of the Commonwealth relating to taxes, reporting of employees and contractors, and withholding and remitting child support.

GZA (Bidder/Proposer/Contracting Entity) Daniel Breuer (Authorized Person's Signature) Date: 6/22/16

Notary Public

STATE OF Massachusetts

County of Norfolk ,ss. June 22, 2016

Then personally appeared before me [name] Daniel Breuer, [title] CFO of [company name] GZA, being duly sworn, and made oath that he/she has read the foregoing document, and knows the contents thereof; and that the facts stated therein are true of his/her own knowledge, and stated the foregoing to be his/her free act and deed and the free act and deed of [company name] GZA.

Kristinn M. Gerra
Notary Public

My commission expires: April 6, 2018

KRISTINN M. GERRA
Notary Public
Commonwealth of Massachusetts
My Commission Expires April 6, 2018

YOU MUST FILL THIS FORM OUT COMPLETELY AND, SIGNATURES MUST BE NOTARIZED ON THIS FORM AND YOU MUST FILE THIS FORM WITH YOUR BID/CONTRACT. TAX AFFIDAVITS THAT ARE NOT SIGNED AND NOTARIZED MAY BE REJECTED.

COLLUSION OR FRAUD STATEMENT

THE UNDERSIGNED CERTIFIES UNDER PENALTIES OF PERJURY THAT THIS BID IS IN ALL RESPECTS BONA FIDE, FAIR AND MADE WITHOUT COLLUSION OR FRAUD WITH ANY OTHER PERSON. AS USED IN THIS SECTION THE WORD "PERSON" SHALL MEAN ANY NATURAL PERSON, JOINT VENTURE, PARTNERSHIP, CORPORATION OR OTHER BUSINESS OR LEGAL ENTITY.

Thomas Jenkins

(NAME OF PERSON SIGNING BID)

(SIGNATURE)

GZA GeoEnvironmental, Inc.

(COMPANY)

THIS FORM MUST BE SIGNED & RETURNED WITH YOUR BID OFFER. FAILURE TO SUBMIT THIS FORM MAY BE CAUSE FOR IMMEDITATE REJECTION

GZA

Proactive by Design

249 Vanderbilt Avenue
Norwood, MA 02062
T: 781 278 4700
F: 781 278 5701
F: 781 278 5702
www.gza.com

DEBARMENT CERTIFICATE

In accordance with 24 CFR 24.100 through 24.714, the borrower, hereby certifies that neither he, nor any of its principal employees has been disbarred, suspended or voluntarily excluded by any Governmental agency from receiving Federal financial assistance and non-financial assistance benefits.

By signing this Certificate, the organization expressly understands and acknowledges that any person or entity that has been debarred or suspended is not eligible to receive Federal financial and non-financial assistance and benefits under Federal programs and activities.

Date: June 21, 2016

Kenneth R. Johnston
(signature of authorized agent)

Kenneth R. Johnston
(printed name of agent)

First Assistant Secretary, CAO - 62.
(title of agent)

GZA

Proactive by Design

Section 1.

Team Organization

TEAM ORGANIZATION

As a full-service geotechnical and environmental engineering firm, GZA has all of the project management, administrative and field-level controls in place to provide geotechnical, environmental, and civil engineering services for the City of Springfield. Specifically:

- GZA has over 45 of years' experience working within New England and has had a Hartford-Springfield area office presence since 1979. With our experience in Springfield and the region, we have gained valuable understanding and knowledge of regulatory perspective and local and regional geology. GZA has been able to effectively integrate this knowledge into our projects.
- As a business based in the Northeast, GZA has some of the broadest site investigation, environmental and geotechnical engineering and project management capabilities of any firm in the region. We have completed over 24,000 projects within the Northeast.
- GZA is a financially stable organization with annual revenues of approximately $100 million, ensuring the delivery of the management and technical infrastructure required to manage all aspects of this contract.
- Our growth continues due to the successful integration of technical expertise, client service, and expansion of capabilities that complement our traditional core services. In May, 2007, GZA acquired Baystate Environmental Consultants, Inc. (BEC), a civil engineering and environmental sciences consulting firm located in East Longmeadow. BEC was incorporated in 1972 and had a long, continual history of assisting the City of Springfield in a wide variety of consulting services.
- **GZA's proposed Project Manager/Principal-in-Charge, Tom Jenkins, P.E.**, has practiced civil engineering in western Massachusetts for over twenty-seven years. In 1993, Mr. Jenkins joined with BEC and began his relationship with the City of Springfield and has worked directly and continuously with various City of Springfield departments since that time, as a BEC employee for fourteen years and, after a seamless transition, as a GZA employee and Associate Principal for the last 9+ years. His knowledge of City practices, organization, and infrastructure is vast and diverse, and City departments and staff have come to rely on his experience and understanding of the City's technical affairs, almost as an extension of themselves.

As a GZA Associate Principal and technical practice lead in GZA's Springfield office, Mr. Jenkins regularly interfaces with all of the service areas that GZA offers. In recent years, Mr. Jenkins has been instrumental in bringing many of GZA's services to the existing on-call contracts that GZA has with the City of Springfield. In short, Mr. Jenkins is a key player in GZA's continuing responsiveness to client needs, matching company personnel and practice areas to the tasks at hand and marshalling response teams to address client requirements.

To provide the City of Springfield with the most comprehensive services, GZA has assembled an impressive team of professionals offering comprehensive expertise combining specialized hydropower expertise and industry leaderships with a full range of engineering, environmental, and consulting services. The following sections of GZA's Statement of Qualifications package introduce GZA's capabilities and background, and introduce the City of Springfield to our selected subcontractors, including:

- Alden Research Laboratory, Inc. – Fisheries Support
- HDR, Inc. - Regulatory Support
- Heritage Surveys, Inc. – Topographic and Boundary Surveys
- Hydropower Consulting Specialists – Small-scale Hydropower Operations (WBE)

Project Team
Organization Chart

City of Springfield
Professional Design Services for the Implementation of the HUD NDRC Grant
RFQ No. 16-190

ALDEN
Solving flow problems since 1924

Fisheries Support:
Gregory Allen, P.E.
Stephen Amaral
William Fay

HDR

Regulatory Support:
Raymond Wingert, P.E.
Rob Mitchell
Cate Russell

GZA

Hydropower Consulting Specialists
4145 Church Street
Thorndike, MA 01079
Small-scale Hydropower Operations:
Celeste Fay, Bill Fay
100% Woman-Owned Business

HERITAGE SURVEYS, INC.
Topographic and Boundary Survey:
Bruce Coombs, RLS
Peter Watson

GZA Project Manager / Principal-in-Charge
Tom Jenkins, P.E.

GZA Consultant / Reviewer
Chad W. Cox, P.E.
William H. Hover, P.E.

GZA Technical Project Manager
Kristina D. Ekholm, P.E.

GZA Lead Environmental Scientist
Paul G. Davis, Ph.D.

GZA Staff Engineer
Bryan Carignan

GZA Lead Engineer
Christine H. Stonier, P.E.

GZA GIS Technicians
Daniel Boudreau

GZA

Proactive by Design

Section 2.

Designer Application Form

Proposal for Professional Services
Professional Design Services for the HUD NDRC Grant
City of Springfield
RFQ # 16-190

Commonwealth of Massachusetts

Standard Designer Application Form for Municipalities and Public Agencies not within DSB Jurisdiction (Updated July 2011)

1. Project Name/Location For Which Firm Is Filing:

Designer Services for the Implementation of the HUD NDRC Grant, RFQ 16-190

2. Project #

SPG-16-190

This space for use by Awarding Authority only.

3a. Firm (Or Joint-Venture) - Name and Address Of Primary Office To Perform The Work:

GZA GeoEnvironmental, Inc.
1350 Main Street, Suite 1400
Springfield, MA 01103

3b. Date Present and Predecessor Firms Were Established:

1964

3c. Federal ID #:

04-2393851

3d. Name and Title Of Principal-In-Charge Of The Project (MA Registration Required):

Thomas Jenkins, P.E., Principal in Charge

Email Address: thomas.jenkins@gza.com
Telephone No: 413-726-2100 Fax No.: 413-732-1249

3e. Name Of Proposed Project Manager:

For Study: (if applicable)
For Design: (if applicable)

3f. Name and Address Of Other Participating Offices Of The Prime Applicant, If Different From Item 3a Above:

3g. Name and Address Of Parent Company, If Any:

GZA GeoEnvironmental, Inc.
249 Vanderbilt Ave
Norwood, MA 02062

3h. Check Below If Your Firm Is Either:
(1) SDO Certified Minority Business Enterprise (MBE)
(2) SDO Certified Woman Business Enterprise (WBE)
(3) SDO Certified Minority Woman Business Enterprise (M/WBE)

4. **Personnel From Prime Firm Included In Question #3a Above** By Discipline (List Each Person Only Once, By Primary Function -- Average Number Employed Throughout The Preceding 6 Month Period. Indicate Both The Total Number In Each Discipline And, Within Brackets, The Total Number Holding Massachusetts Registrations):

Admin. Personnel	73	( )	Ecologists	6	(2)	Licensed Site Profs.	14	(14)	Other	55	( )
Architects		( )	Technician/Analysts	14	( )	Mechanical Engrs.	2	( )	Biologists	9	( )
Marine/Waterfront Eng/	13	(6)	Environmental Engrs.	84	(4)	Planners: Urban./Reg.	1	( )	CADD/Comp	26	( )
Civil Engrs.	61	(13)	Fire Protection Engrs.		( )	Safety/Occ. Health	7	(4)	Chem.Eng.	8	(2)
Code Specialists		( )	Geotech. Engrs.	72	(26)	Structural Engrs.	9	(6)	Chemist	5	( )
Construction Inspectors	3	( )	Industrial Hygienists	1	(1)	Soils Engineers	3	(1)	Hydrologists	6	(1)
Water Resources Eng.	11	(5)	Laboratory Experts	4	( )	Geologists	55	(2)	Project Mgr.	14	( )
Toxicologists	5	( )	Landscape Architects	1	(1)	Hydrogeologists	14	( )	Total	575	(88)

5. Has this Joint-Venture previously worked together? Yes No

6 List **ONLY** Those Prime And Sub-Consultant Personnel Specifically Requested In The Advertisement. This Information Should Be Presented Below In The Form Of An Organizational Chart. Include Name Of Firm And Name Of The One Person In Charge Of The Discipline, With Mass. Registration Number, As Well As MBE/WBE Status, If Applicable:

Project Team Organization Chart

City of Springfield
Professional Design Services for the Implementation of the HUD NDRC Grant
RFQ No. 16-190

Hydropower Consulting Specialists
4145 Church Street
Thorndike, MA 01079
Small-scale Hydropower Operations:
Celeste Fay, Bill Fay
100% Woman-Owned Business

ALDEN
Fisheries Support:
Gregory Allen, P.E.
Stephen Amaral
William Fay

HERITAGE SURVEYS, INC.
Topographic and Boundary Survey:
Bruce Coombs, RLS
Peter Watson

HDR
Regulatory Support:
Raymond Wingert, P.E.
Rob Mitchell
Cate Russell

GZA Project Manager / Principal-in-Charge
Tom Jenkins, P.E.

GZA Consultant / Reviewer
Chad W. Cox, P.E.
William H. Hover, P.E.

GZA Technical Project Manager
Kristina D. Ekholm, P.E.

GZA Lead Environmental Scientist
Paul G. Davis, Ph.D.

GZA Staff Engineer
Bryan Carignan

GZA Lead Engineer
Christine H. Stonier, P.E.

GZA GIS Technicians
Daniel Boudreau

7.	Brief Resume Of **ONLY** Those Prime Applicant and Sub-Consultant Personnel Requested In The Advertisement. Confine Responses To The Space Provided On The Form and Limit Resumes To **ONE** Person Per Discipline Requested In The Advertisement. Resumes Should Be Consistent With The Persons Listed On The Organizational Chart In Question # 6. Additional Sheets Should Be Provided Only As Required For The Number Of Key Personnel Requested In The Advertisement And They Must Be In The Format Provided. By Including A Firm As A Sub-Consultant, The Prime Applicant Certifies That The Listed Firm Has Agreed To Work On This Project, Should The Team Be Selected.	
a	Name and Title Within Firm: **PLEASE SEE ATTACHED RESUMES**	a. Name and Title Within Firm:
b	Project Assignment:	b Project Assignment:
c.	Name and Address Of Office In Which Individual Identified In 7a Resides: MBE WBE	c. Name and Address Of Office In Which Individual Identified In 7a Resides: MBE WBE
d.	Years Experience: With This Firm: With Other Firms:	d. Years Experience: With This Firm: With Other Firms:
e	Education: Degree(s) /Year/Specialization	e Education: Degree(s) /Year/Specialization
f	Active Registration: Year First Registered/Discipline/Mass Registration Number	f Active Registration: Year First Registered/Discipline/Mass Registration Number
g.	Current Work Assignments and Availability For This Project:	g. Current Work Assignments and Availability For This Project:
h.	Other Experience and Qualifications Relevant To The Proposed Project: (Identify Firm By Which Employed, If Not Current Firm):	h. Other Experience and Qualifications Relevant To The Proposed Project: (Identify Firm By Which Employed, If Not Current Firm):

8a Current and Relevant Work By Prime Applicant Or Joint-Venture Members. Include **ONLY** Work Which Best Illustrates Current Qualifications In The Areas Listed In The Advertisement (List Up To But Not More Than 5 Projects).					
a Project Name And Location Principal-In-Charge	b. Brief Description Of Project And Services (Include Reference To Relevant Experience)	C. Client's Name, Address And Phone Number (Include Name Of Contact Person)	d. Completion Date (Actual Or Estimated)	e. Project Cost (In Thousands)	
				Construction Costs (Actual, Or Estimated If Not Completed)	Fee for Work for Which Firm Was Responsible
(1) **PLEASE SEE ATTACHED LISTING**					
(2)					
(3)					
(4)					
(5)					

8b. List Current and Relevant Work By Sub-Consultants Which Best Illustrates Current Qualifications In The Areas Listed In The Advertisement (Up To But Not More Than 5 Projects For Each Sub-Consultant). Use Additional Sheets Only As Required For The Number Of Sub-Consultants Requested In The Advertisement.

Sub-Consultant Name:

a Project Name and Location Principal-In-Charge	b. Brief Description Of Project and Services (Include Reference To Relevant Experience	c. Client's Name, Address And Phone Number. Include Name Of Contact Person	d. Completion Date (Actual Or Estimated)	e. Project Cost (In Thousands)	
				Construction Costs (Actual, Or Estimated If Not Completed)	Fee For Work For Which Firm Was/Is Responsible
(1) **PLEASE SEE ATTACHED LISTING**					
(2)					
(3)					
(4)					
(5)					

9 List All Projects Within The Past 5 Years For Which Prime Applicant Has Performed, Or Has Entered Into A Contract To Perform, Any Design Services For All Public Agencies Within The Commonwealth.

# of Total Projects:	**# of Active Projects:**	**Total Construction Cost (In Thousands) of Active Projects (excluding studies):**

Role P, C, JV	Phases St., Sch., D.D., C.D.,A.C.*	Project Name, Location and Principal-In-Charge	Awarding Authority (Include Contact Name and Phone Number)	Construction Costs (In Thousands) (Actual, Or	Completion Date (Actual or Estimated) (R)Renovation or (N)New
		1 **PLEASE SEE ATTACHED LISTING**			
		2			
		3			
		4			
		5			
		6			
		7			
		8			
		9			
		10			
		11			
		12			

* P = Principal; C = Consultant; JV = Joint Venture; St. = Study; Sch. = Schematic; D.D. = Design Development; C.D. = Construction Documents; A.C. = Administration of Contract

10. Use This Space To Provide Any Additional Information Or Description Of Resources Supporting The Qualifications Of Your Firm And That Of Your Sub-Consultants For The Proposed Project. If Needed, Up To Three, Double-Sided 8 1/2" X 11" Supplementary Sheets Will Be Accepted. **APPLICANTS ARE REQUIRED TO RESPOND SPECIFICALLY IN THIS SECTION TO THE AREAS OF EXPERIENCE REQUESTED IN THE ADVERTISEMENT.**

Refer to the enclosed proposal for supplemental information regarding GZA GeoEnvironmental, Inc.

11. Professional Liability Insurance:

Name of Company	Aggregate Amount	Policy Number	Expiration Date
Lexington Insurance Company	$1,000,000	031711017	2/28/17

12. Have monies been paid by you, or on your behalf, as a result of Professional Liability Claims (in any jurisdiction) occurring within the last 5 years and in excess of $50,000 per incident? Answer **YES** or **NO**. If YES, please include the name(s) of the Project(s) and Client(s), and an explanation (attach separate sheet if necessary).

NO

13. Name Of Sole Proprietor Or Names Of All Firm Partners and Officers:

William E. Hadge	President
Daniel D. Breuer	Treasurer
Thomas F. Stark	Secretary
Enda P. Fahey	First Assistant Treasurer

14. If Corporation, Provide Names Of All Members Of The Board Of Directors:

Terese M. Kwiatkowski	Senior Principal	P.E.	41031	Patrick F. Sheehan	Senior Principal	P.E.	39156
John C. Osborne	Senior Principal	n/a	n/a	Mary B. Hall	Senior Principal	P.E.	35083
Thomas F. Stark	Senior Principal	n/a	n/a	Chad Cox	Principal	P.E.	45856
Russell J. Morgan	Senior Principal	P.E.	43000	Brad Roberts	Senior Principal	P.E.	39856

15. Names Of All Owners (Stocks Or Other Ownership):

David R. Carchedi	Senior Principal	n/a	n/a	4.09%
Robert J. Palermo	Senior Principal	P.E.	32053	4.09%
William Hadge	President/CEO	P.E.	35081	3.70%
William H. Hover	Director of Risk Management/Senior Principal	n/a	n/a	3.46%
Matthew J. Barvenik	Senior Principal	LSP	1631	2.46%
James V. Errico	Chief of Technical Practice/Senior Principal	P.E.	32871	2.41%

*GZA is entirely employee owned with 143 current stockholders. Listed above are the top 6 owners.

16. I hereby certify that the undersigned is an Authorized Signatory of Firm and is a Principal or Officer of Firm. I further certify that this firm is a "Designer", as that term is defined in Chapter 7, Section 38A1/2 of the General Laws, or that the services required are limited to construction management or the preparation of master plans, studies, surveys, soil tests, cost estimates or programs. The information contained in this application is true, accurate and sworn to by the undersigned under the pains and penalties of perjury.

Submitted by (Signature) _____ Printed Name and Title Thomas Jenkins, P.E. Date June 29, 2016

10. Use This Space To Provide Any Additional Information Or Description Of Resources Supporting The Qualifications Of Your Firm And That Of Your Sub-Consultants For The Proposed Project. If Needed, Up To Three, Double-Sided 8 1/2" X 11" Supplementary Sheets Will Be Accepted. APPLICANTS ARE REQUIRED TO RESPOND SPECIFICALLY IN THIS SECTION TO THE AREAS OF EXPERIENCE REQUESTED IN THE ADVERTISEMENT.

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Thomas F. Stark	Senior Principal	n/a	n/a	Chad Cox	Principal	P.E.	45856
Russell J. Morgan	Senior Principal	P.E.	43000	Brad Roberts	Senior Principal	P.E.	39856

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Submitted by (Signature) _____ Printed Name and Title Thomas Jenkins, P.E. Date June 29, 2016

GZA

Proactive by Design

Section 3.

Background of Firm

BACKGROUND OF FIRM

FIRM NAME:

GZA GeoEnvironmental, Inc.

YEAR ESTABLISHED:

1964

FORMER FIRM NAME:

In May, 2007, GZA acquired Baystate Environmental Consultants, Inc. (BEC), a civil engineering and environmental sciences consulting firm located in East Longmeadow. BEC was incorporated in 1972 and had a long, continual history of assisting the City of Springfield in a wide variety of consulting services.

CORPORATE ADDRESS:

249 Vanderbilt Avenue
Norwood, MA 02062

ADDRESS OF OFFICE IN PRIMARY CHARGE OF THE WORK:

1350 Main Street, Suite 1400
Springfield, MA 01103

PROJECT MANAGER AND CONTACT:

Thomas E. Jenkins, P.E.
413-726-2121
thomas.jenkins@gza.com

SERVICES:

- Geotechnical Engineering Services;
- Hazardous Waste Assessment, Management, and Remediation;
- Construction-Phase Related Services;
- Flood Control Systems Evaluation, Maintenance, Improvement;
- Civil Engineering;
- Landscape Architecture;
- Dam and Hydropower Services;
- Solid Waste Management;
- Building Condition Assessments;
- Water Resources and Environmental Engineering;
- Wetland and Natural Resources Environmental Sciences and Permitting.

Project Understanding and Approach

The feasibility of a project to re-power the Watershops Pond Dam was preliminarily demonstrated in a 2015 report by GZA titled, "Watershops Pond Dam - Preliminary Hydropower Resource Assessment." As a part of this study, GZA worked with the City to conceptualize a new configuration for the project. The original hydropower generation scheme involved withdrawal of water from the pond through an intake works on the right abutment to provide flow to one or more powerhouse chambers under the mill buildings adjacent to the dam. Water was then returned to the river via a tailrace downstream of the mill complex. This configuration was problematic to the City's desire to redevelop hydropower at the site because adjacent mill buildings are not owned by the City, which would significantly complicate project property rights issues. To avoid this problem, GZA worked with the City to conceptualize a new layout for the proposed project involving a new free-standing powerhouse immediately downstream of the dam and using the existing outlets to supply the turbine. This configuration will result in a project which is constructed on City property and is estimated to be capable of generating approximately 145 kW of power and 700 MWh of electricity annually.

Even though this project is relatively small, the process of advancing it to completion and commissioning is somewhat complex due to the nature of hydropower licensing under Federal law and regulations. Virtually all hydropower projects fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC) due to the inherent public interest of the utilization of a natural waterway for the generation of power which will be input into an interstate electrical grid. Therefore, hydropower projects of any size must complete an extensive process of studies and consultations to obtain Federal authorization prior to construction. A project must also receive approval to interconnect with the local electrical distribution system. These steps are in addition to all of the typical tasks necessary to design, permit, contract, and construct a public works project at a dam.

A preliminary sequence and schedule for Scope of Work necessary to license and construct the proposed project is presented below. This schedule has been developed with the intent of commissioning the project by November 2021.

Schedule of Studies and Investigations	
Proposed Events	*Time for Completion*
FERC issuance of Preliminary Permit	May 4, 2016
Design and Licensing Contract to Engineer	July 2016
Survey, Property Research, Preliminary Stakeholder Outreach, Hydrology / Energy Study, Economics Assessment, Preliminary Design	July 2016 – Sept. 2016
Interconnection/Impact Study	July 2016 – Oct. 2016
Preliminary Permit Updates	Nov. 2016; May 2017; Nov. 2017; May 2018, Nov. 2018
Preliminary Permit Expires	April 30, 2019

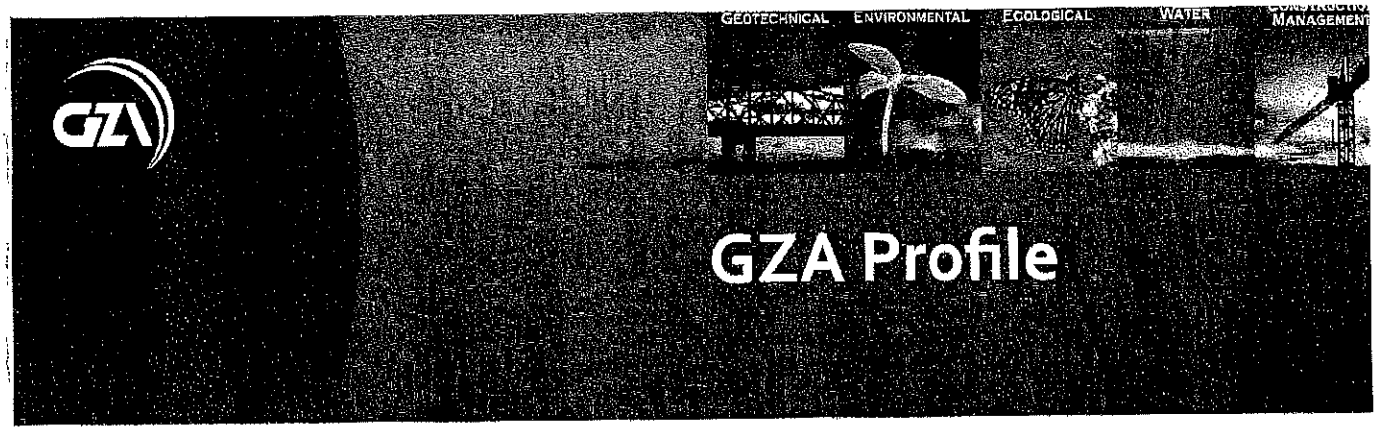
The Preliminary Permit which was issued by FERC to the City secures the City's rights to study development of the project, but does not allow the City to construct the project. Prior to construction, the FERC must issue a License or an Exemption to the City. For a small project, an Exemption is generally preferable, but requires that certain conditions be met for eligibility. Property right investigations will be among the first tasks of the project to establish if the City can apply for an Exemption.

The Pre-Application Document (PAD) and Notice of Intent (NOI) filing are the start of the process to obtain a License or Exemption. The PAD is intended to present existing engineering, economic, and environmental information relevant to licensing the project that is reasonably available, or can reasonably be obtained with due diligence, when the NOI is filed. The PAD serves as the foundation for issue identification, study plan development, and the Commission's environmental analysis. Hydropower licensing required consultation with numerous stakeholders and can therefore be an extended process. The Watershops Pond Dam project should, however, have the advantage of being relatively un-controversial due to its limited potential for impacts on natural resources.

Schedule of Filings and Project Implementation Milestones	
Proposed Events	*Time for Completion*
Submit PAD and NOI	Oct. 2016 - Nov. 2016
Joint Meeting	Dec. 2016
License Application Process / Consultations / Permitting (Study Plan to Issuance)	Jan. 2017 – June 2019
Conduct Additional Studies as Necessary	Jan. 2017 – May 2019
Final Design	May 2019 – Aug. 2019
Bidding and Contracting	Sept. 2019 – Nov. 2019
Final Interconnection Study	Jan. 2020 – Aug. 2020
Construction and Commissioning	Dec. 2019 – Aug. 2021

Design and construction of the project in a manner which is cost effective will require careful design and planning. The site is very tight, with limited access potential. The location of the proposed powerhouse is within the waterway, which will necessitate special water control measures. GZA has already developed a number of conceptual schemes to facilitate project construction, including timing the initial work on the powerhouse for low flow season and the use of temporary pumping and diversion dams on top of the lowered bascule gate. Early outreach to turbine manufacturers will also be important to allow for the selection of the appropriate turbine and subsequent layout of the powerhouse.

While this project presents a number of challenges, the GZA team has the experience with both similar hydropower projects and the Watershops Dam site to provide the City with a unique ability to advance this project through all phases of design, licensing, construction, and commissioning.



GZA Profile

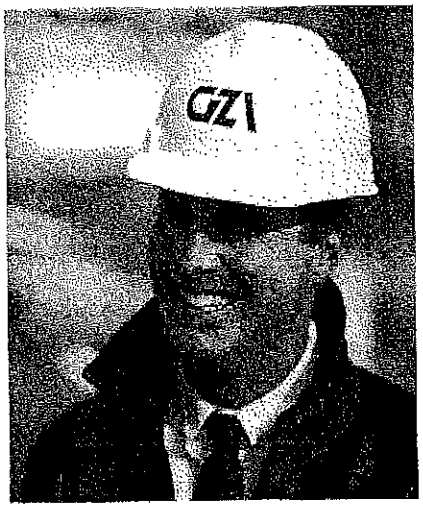
Founded in 1964 as Goldberg-Zoino & Associates, Inc., a soils and foundations specialty consultant, GZA GeoEnvironmental, Inc. (GZA) has grown into a full-service company providing its clients with highly diversified technical services supporting our core practice areas. GZA employs 580 engineers, scientists, and technical support staff in 26 offices in the U.S. (primary operations in Northeast, Mid-Atlantic, Mid-West, and Appalachian regions) and is currently ranked #116 in the ENR's 2014 Top 500 Design Firms list and #95 in ENR's annual list of the top 200 environmental firms. GZA is an employee-owned firm with gross revenues last fiscal year of $124 million, a record in our 50-year history.

With a legacy of experience in geotechnical and environmental engineering, GZA has expanded its core services to include water, ecology, and construction management services. These five branches of service excellence are born from the same corporate tree. One Company: Five core services supporting 10 client sectors in numerous geographic locales throughout the United States. As a result, GZA leverages our in-house capabilities including environmental engineering, permitting, structural engineering, public health, project management, environmental compliance auditing, industrial hygiene, pollution prevention, and air quality services to develop an approach for each project that maximizes value to our clients.

Proactive communication is our company commitment. GZA is Proactive by Design®. We plan and perform our work better through taking complete responsibility for understanding your goals, needs, and project constraints. We develop a project-specific communications plan to meet your need for face-to-face, phone, email and written communications about your project's progress. You are kept up to date on work status, often before you think to ask. You are advised and consulted on your most important project and risk options before work begins. We take a forward thinking "ownership" perspective on your project's critical success factors in partnering with you as a trusted advisor on your team.

Because GZA experts are trained across disciplines, clients benefit from the knowledge and experience of all of our staff, and resources are in-house and available for every project at any time. With the ability to manage unpredictability, remain nimble, and mobilize quickly, GZA responds to client inquiries with urgency, sensitivity, knowledge and value, while remaining mindful of project costs and schedule.

Excelling as a multi-disciplinary, multi-office firm of proactive, bright, and dedicated people, we provide value to our clients and our profession. We are Proactive by Design. We are One Company. **We are GZA.**



With a staff of interrelated professionals dedicated to providing high-level expertise on complex projects above, below and at ground-level, GZA's experts provide seamless integration across practice areas, client type, and location. As an employee-owned, private company, GZA's staff is motivated to propel the firm forward, seeking integrated, complex, and interesting projects that underscore a commitment to client satisfaction, environmental stewardship and best practices in science, engineering and construction.

GZA's Core Services

- Geotechnical
- Environmental
- Ecological
- Water
- Construction Management

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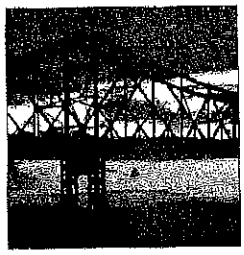
GZA Profile

Proactive by Design. Our Company Commitment. Excelling as a multi-disciplinary, multi-office firm of proactive, bright, and dedicated people, GZA supports our clients and our profession through demonstrated expertise in each of our five core service areas. Woven together, these services integrate with each of our client-focused markets, providing unparalleled value from a single company. **We are Proactive by Design. We are One Company. We are GZA.**

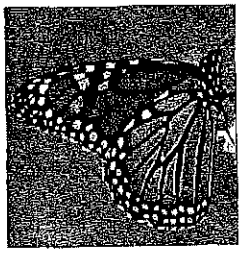


Geotechnical Services

- Subsurface Investigations
- Deep and Shallow Foundation Solutions
- Rock Slope Characterization, Stability Assessment, Rock Fall Mitigation
- Soil Slope Analysis and Stabilization Design
- Tunneling and Underground Construction
- Earth Support Design and Dewatering
- Seismic Evaluation
- Geothermal System Design
- Landfill Design
- Instrumentation and Deep Foundation Testing

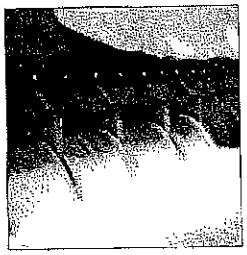
Environmental Services

- Environmental Site Assessment and Investigation
- Site Remediation
- Environmental Health and Safety Regulatory Compliance
- Air Quality
- Hazardous Materials Management / Demolition
- Sustainability Advisory Services



Ecological Services

- Wetland Delineation, Assessment and Design
- Biodiversity, Habitat and Rare Species Assessment
- Aquatic Toxicity Testing
- Environmental Impact Studies
- Natural Resource Permitting
- Erosion and Sedimentation Control Design and Compliance Monitoring
- Ecological Restoration Design
- Invasive Species Management
- Water Quality Assessment and Planning
- Marine and Freshwater Habitat Analysis

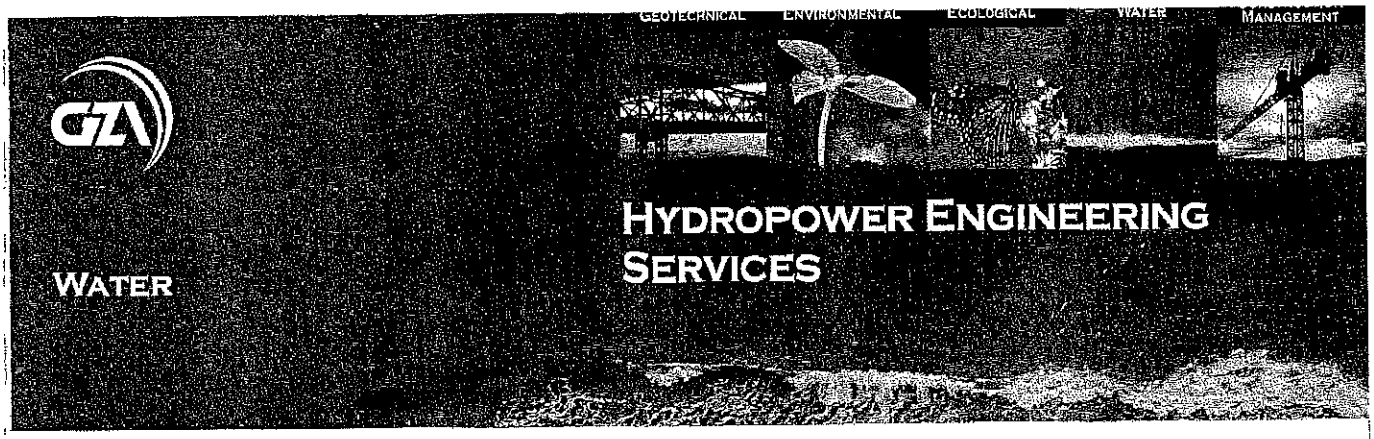


Water Consulting Services

- Marine and Waterfront Structures
- Dams and Levees
- Water Resources
- Climate Change and Hazard Planning

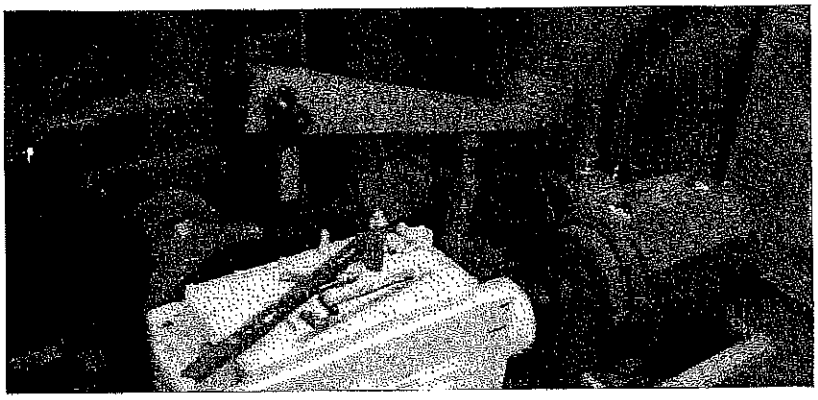
Construction Management Services

- Project Management
- Program Management
- Demolition and Decommissioning
- High Risk Remediation/ Specialty Clean Construction
- Construction-related Building Services
- Asbestos, Lead, PCB's, and Mold Abatement



WATER

HYDROPOWER ENGINEERING SERVICES



GZA is proactive by design. GZA has been providing services to the hydropower industry for decades. The hydropower industry is a multi-disciplinary sector, and GZA is a multi-disciplinary firm. Owners of hydroelectric dams have long counted on GZA's extensive experience in the fields of civil, hydrologic, and dam engineering to assist them in constructing, repairing, and maintaining their structures. GZA now provides a wider range services, including licensing, permitting, environmental studies, and design of new or rehabilitated small hydroelectric facilities.

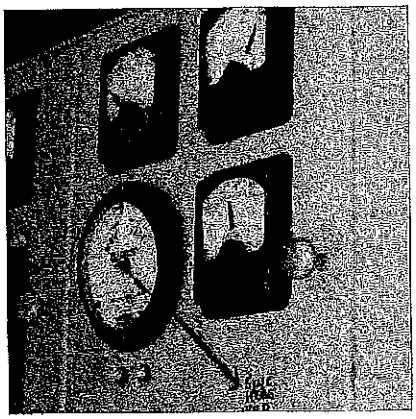
GZA understands that licensing and permitting can often be the biggest challenge to successfully bringing a hydroelectric project on-line. GZA can guide a client through the Federal Energy Regulatory Commission (FERC) licensing process by providing technical, environmental, and filing preparation services all the way from the Preliminary Permit application through the License or Exemption process. State and local permits are important too, and GZA's experience in dealing with multi-agency permitting situations is invaluable for such projects.

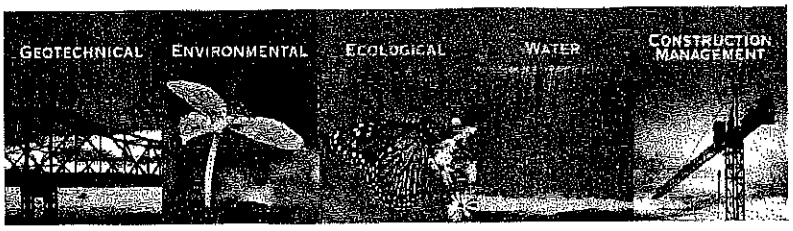
GZA has provided engineering services at projects from 900 MW to 40 kW in size. We understand that each project has a unique set of challenges and opportunities. GZA has key knowledge about the particular issues involved with developing hydropower at existing dams, including fisheries issues and certification by LIHI. We have successfully helped numerous clients obtain financial assistance for investigation, design, and construction of efficiency improvements and new projects. We are prepared to work with clients on a wide range of project sites and project scales. Our goal is to help bring clean, renewable, cost-effective power on-line in a way that benefits the owner, the environment, and the nation.

SERVICES SPOTLIGHT

Key Capabilities

- Hydropower Studies
  - o Preliminary Resource Assessment
  - o Feasibility Study
  - o Hydrology Analysis
- Hydropower Project Design
  - o Turbine Selection
  - o Civil Works
  - o Dam, Outlet, Spillway Structures
  - o Construction-Phase Services
- Dam Safety Engineering
- Environmental Studies
- FERC Compliance
  - o Preliminary Permits
  - o Licensing/Relicensing
  - o PFMA/Part 12 Inspections
  - o EAPs





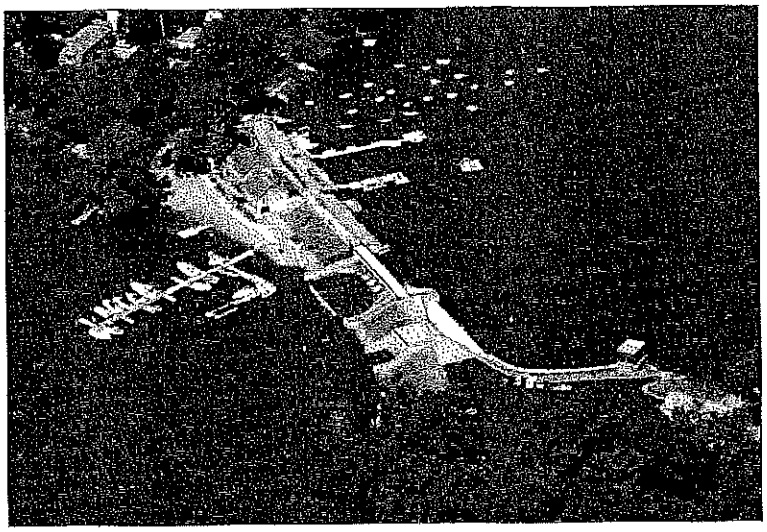
Proactive by Design

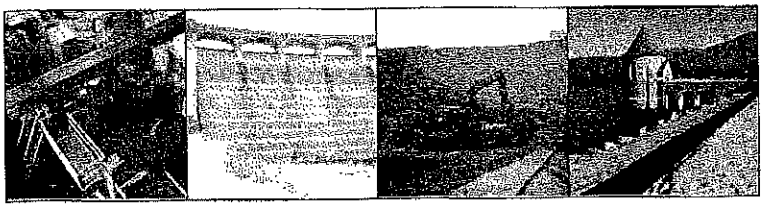
Statement of Qualifications

DAMS and LEVEE SERVICES

Dams and Levee Services

- Dam Safety Inspections
- Condition Investigation and Assessment
- Geotechnical Engineering
- Structural Engineering
- Hydrology and Hydraulics
- Instrumentation, Monitoring, Testing
- Hydropower Services
- Emergency Action Planning
- Repair and Rehabilitation Design
- Permitting
- Construction Support





GZA GeoEnvironmental, Inc.
249 Vanderbilt Avenue | Norwood, MA 02062
Telephone Number 781.278.3700

26 Offices Nationwide
www.gza.com

Statement of Qualifications

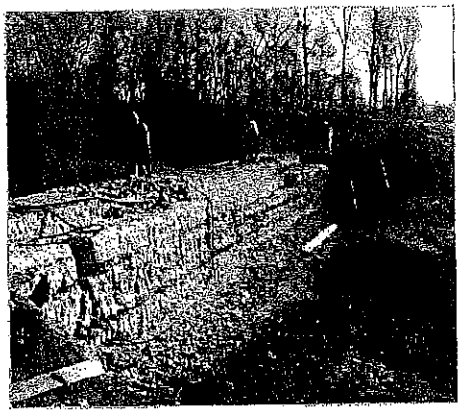
DAMS SERVICES

GZA is proactive by design. GZA maintains a strong service base and expertise in our original specialty of geotechnical engineering. Over the years, our engineering capacity has broadened to general civil engineering services with an emphasis in environmental, geo-structural engineering and site civil applications, such as solid waste engineering, stormwater management, site design, and dam engineering. GZA has over 30 qualified engineers in our New England offices with relevant dam safety engineering expertise.

Through integration of our dam safety, geotechnical, environmental, and civil engineering expertise, GZA offers a broad range of technical expertise to achieve cost-effective and technically appropriate solutions to our clients' problems. We have taken the additional step to tailor our integrated services around the specific needs of various client groups such as water suppliers, retailers, site developers, the power industry, government agencies, industrial and commercial land owners, and contractors, to name a few. This approach allows us to provide the technical expertise, innovation, sensitivity to client needs, and responsiveness to the unique permitting, engineering, or construction issues associated with each client group. **Choose GZA.**

Proactive By Design

Proactive communication is our company commitment. GZA is Proactive By Design – We plan and perform our work better through taking complete responsibility for understanding your goals, needs, and project constraints. We develop a project-specific communications plan to meet your need for face-to-face, phone, email and written communications about your project's progress. You are kept up to date on work status, often before you think to ask. You are advised and consulted on your most important project and risk options before work begins. We take a forward thinking "ownership" perspective on your project's critical success factors in collaborating with you as a trusted advisor on your team.



Recent concrete repairs to primary spillway at MDC West Hartford Reservoir Dam #2

We leverage and share our company's diverse technical experience, best practices, and business knowledge via information technology systems, professional practice training programs, and GZA's annual in-house technical conference. All of our employees are connected and accessible through technology, allowing efficient transfer of knowledge and expertise to our project team members and our clients.

GZA's project management team, project staff and technical specialists are experienced in collaborating in large multiple-stakeholder project teams on: dam engineering, environmental consulting, Licensed Environmental Professional services, foundation engineering, seismic analysis, site engineering, planning and development, tunneling, ground improvement engineering, geology, lateral earth support systems, slope stability, rock engineering, excavation analysis, and construction observation and testing. GZA has expertise in the design of varied foundation types, including piles, footings, caissons, compacted fill, and mats. In addition, GZA is recognized nationally for expertise in tunnel design, underpinning and support of braced excavations.

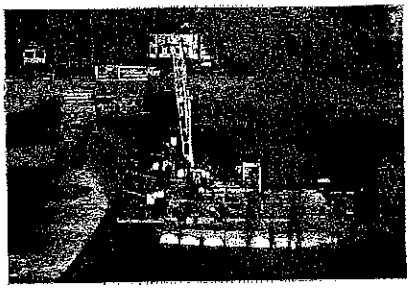
GZA offers a multi-disciplinary technical approach that provides our clients with cost-effective and technically appropriate solutions while considering sustainability in our services and designs. Technical expertise, innovation, sensitivity to client needs, and proactivity are the "trademarks" of GZA. This practical solutions-oriented framework has helped GZA set a 50-year record of accomplishment for attention to detail and consistent financial performance in our industry through growing and declining economic and real estate market cycles.

GZA'S DAM ENGINEERING QUALIFICATIONS AND TECHNICAL CAPABILITIES

GZA has been involved in site inspections, investigations, design, construction, and seismic evaluation of more than 1,000 dams and water control structure throughout the United States. GZA's experience in dam engineering consulting extends over 45 years. The projects include small dams, large, high hazard dams, water supply structures, flood control structures, dikes, and levees. GZA's dam experience includes performing Phase I Level (as per U.S. Army Corps of Engineers) dam safety inspections, Phase II Engineering investigations, preliminary and final designs for rehabilitation of existing earth embankment, concrete, and stone masonry gravity dams. We typically also provide permitting and construction-phase services on these projects.

General Description of Dam Engineering Services

The client may require the myriad of technical services normally associated with dam safety engineering. These services usually include:



GZA's Phase II subsurface explorations at dams often occur in environmentally sensitive areas with difficult access conditions

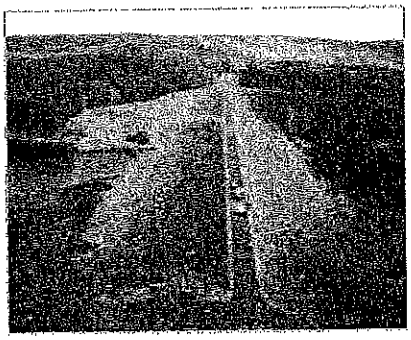
- Visual Dam Inspections;
- Detailed field inspections including underwater diving and remote operating vehicle (ROV) observations;
- Subsurface explorations; in-situ permeability and packer testing; geophysical testing and installation of instrumentation such as observation wells and piezometers;
- Seepage and slope stability analyses for earth embankment and gravity stability analyses for concrete dams and spillways;
- Structural engineering assessment and design including repair of concrete and masonry gravity structures;
- Hydrologic and hydraulic assessment of design floods, including PMF, and analysis of spillway capacity and outlet structures;
- Evaluation of gates and valves of outlet works, including replacement/rehabilitation of sluice gates, gatehouses, piping and appurtenances;
- Executing and facilitating Potential Failure Mode Analyses (PFMA's);
- Development of final construction drawings and technical specifications for dam rehabilitation;
- Environmental permitting support;
- Engineering services during construction including resident inspection;
- Emergency Action Plan (EAP) preparation and update, including dam failure analysis, inundation studies and inundation Mapping preparation;
- Operation and maintenance (O&M) Plans;
- Training dam owners on performing self-inspections;
- Evaluation and retro-fit upgrades to existing and proposed hydroelectric facilities;
- Capital planning and dam repair prioritization for dam portfolio owners; and
- Peer review of analyses, reports, and designs completed by others.

Over the past five decades, GZA has a proven track record of routinely providing these services for our numerous dam owner clients, especially those in the public sector, responsible for water supply to towns, cities and regional areas. Typically, our clients will rely upon our services and professional opinions when executing their capital improvement planning process for their dam and reservoir infrastructure.

The following paragraphs provide a brief overview of our in-house technical capabilities as they apply to our practice of dam safety engineering.

Geotechnical Engineering

GZA's geotechnical engineers initially review existing data and then develop subsurface exploration programs to obtain necessary data to evaluate seepage and slope stability of embankment and gravity dams. The historic drawings (if available) are integrated with subsurface data to develop soil and groundwater models of the dam.

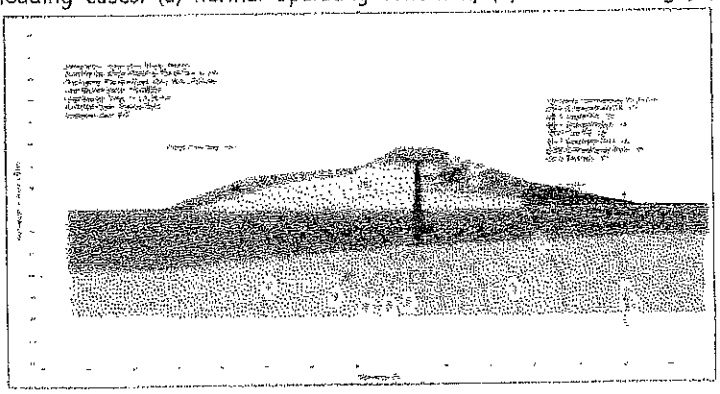


GZA performed instrumentation installation on the Army Corps of Engineer's Everett Lake Dam in Contoocook, NH

Typically, we use the GeoStudio computer software to evaluate seepage considerations and slope stability. The input parameters are based on estimates of each dam's as-built dam geometry and soil strength parameters correlated from data obtained from subsurface exploration programs. The SEEP/W simulation is used to estimate seepage exit gradients, to evaluate the potential for a piping failure mode. The pore water pressure values, obtained from the seepage (SEEP/W) analysis, are incorporated in the SLOPE/W simulation to estimate the factor of safety against slope instability. The SLOPE/W runs are used to calculate the factors of safety against slope failure for the dam embankment under normal, unusual, and extreme conditions, including design floods, earthquake, and sudden drawdown conditions.

The estimated factors of safety are compared against the minimum values established by either State Dam Safety Regulations or accepted dam engineering guidelines from the U.S. Army Corps of Engineers, Bureau of Reclamation, or the Federal Energy Regulatory Commission. The factors of safety against sliding and overturning for gravity dams and spillways are done using the gravity method of analysis. Typically, our analyses begin as 2-D analyses. However, for complex geometries, we will incorporate 3-D models.

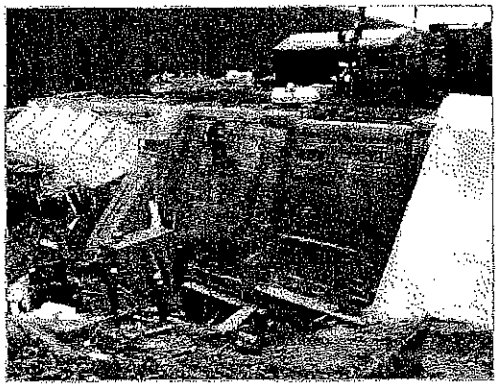
GZA also has the proven capability to assess concrete gravity dams by reviewing as-built information, performing subsurface investigations and developing cross-sections through the dam and performing two-dimensional (2-D) stability analyses. The analyses allow us to estimate the factors of safety against sliding along the dam's base and foundation interface or other critical planes through the dam above the foundation, as appropriate. The calculations are usually performed for the four loading cases: (a) normal operating condition; (b) flood discharge; (c) ice loading; and (d) normal operating with earthquake. Our concrete analysis examines overturning resistance based on resultant force location. When the level of structural complexity warrant, we are equipped to refine our investigation by conducting analytical and numerical three dimensional (3-D) stability analyses, which evaluate the hydrostatic and dynamic load transfer and available shear capacity between adjacent monolithic sections of the concrete dam.



Flow net generated for an embankment dam using SEEP/W computer software

Structural Engineering

GZA's structural engineering staff have significant experience with water control structures including spillways, training walls, and abutments, and appurtenant structures such as bridges. In addition, our experience includes nondestructive testing of concrete and steel structures using methods such as delamination sounding, pachometer surveys for rebar cover, chloride content analysis, petrographic study, compression strength testing, and ultrasonic testing; structural analysis for existing structures, including complex three-dimensional analysis design of concrete repairs for non-structural cracking, structural cracking, spalling, scaling, and abrasion-erosion, along with development of standard details for these repairs for state agencies; rehabilitation design for concrete and steel structures; design of structural modifications to improve strength, functionality, and/or durability; and design of new and replacement concrete dams, wingwalls, drainage structures, culverts, bridges, and other structures.

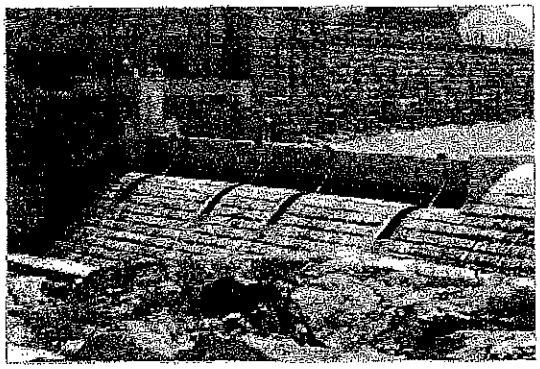


GZA engineers designed and inspected concrete repairs to the overflow sections of Lake Ladore Dam in Waymart, PA

Hydrology/Hydraulics

Hydraulic and hydrologic engineering are the foundation of GZA's water resources expertise. Our team personnel have the training and hands-on experience to plan and conduct riverine and coastal analysis as well as design of hydraulic structures and flood mitigation. Much of this expertise supports our dam and levee assessment and design engineering practices. Our rainfall-runoff modeling capabilities typically use Corps' HEC-HMS computer program, where we apply proven hydrologic techniques including the Snyder, Clark, and Dimensionless Unit Hydrograph Methods. Inflow Design Flood hydrographs are developed through rigorous calibration and verification efforts for both gaged and ungaged watersheds. Our water resource engineers utilize hydrologic results to compute hydraulic profiles in riverine and other open channel as well as pipe flow configurations to assess and design various water conveyance structures, including:

- Spillway weirs & discharge channels;
- Energy dissipaters & stilling basins;
- Low level outlets, release chambers; and gates & valves;
- Hydropower penstocks & tailraces; and
- Pump stations and stormwater drainage systems.



Construction of the new spillway at Wachusett Dam in Clinton, MA

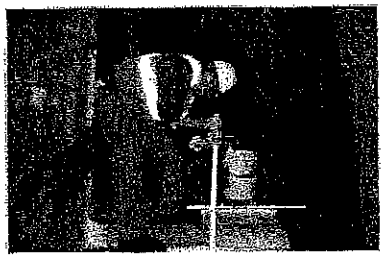
Much of our hydraulic engineering evaluations and designs utilize proven and verifiable Corps software products including HEC-RAS and HEC-GeoRAS. Our projects have included river modeling of major waterways such as the Mississippi River, Arkansas River, Hudson River, and Connecticut River. In certain instances, GZA uses FLO-2D when complex site conditions involve two dimensional flow patterns and momentum fluxes. GZA has training in and experience with the 2-D capabilities in HEC-RAS 5.0; however because the model is in beta we have not used it in our project work. GZA also has training and experience in conducting dam breach simulations (using both one and two-dimensional model approaches) and developing inundation maps as part of our Emergency Action Planning services.

GZA is experienced in the calculation of the Probable Maximum Flood (PMF) and the Probable Maximum Precipitation (PMP) using methods from HMR-51/52. Working closely with our meteorological subconsultants, GZA has performed PMF studies derived from site-specific PMP calculations.

In most cases, requirements for embankment overtopping protection and issues related to estimated minimum freeboard are assessed by our engineers by estimating wind setup and wave run-up using published Corps references including EM-1110-2-1420 (Hydrologic Engineering Requirements for Reservoirs) and EM 1110-2-1414 (Water Levels and Wave Heights for Coastal Engineering Design) and the US Bureau of Reclamation's Design Standards (DS No. 13, Chpt 6, Sept 2012).

Instrumentation, Monitoring, and Testing

Since 1968, GZA has provided instrumentation services on over 500 major civil engineering and mining projects. This "hands on" experience is supported by access to the resources of the entire GZA organization, including the services of over 300 professional engineers and scientists practicing geotechnical engineering, rock mechanics, hydrogeology, chemistry, toxicology, geology, hydrology, and chemical engineering. We have designed and installed computer-based data acquisition and data reduction systems for use at dams, mines, tunnels, deep excavations and deep foundations. Our experience with foundation instrumentation also includes static and dynamic measurements on soils and structures. Our underground activities include in situ soil and rock testing and the design and installation of stability monitoring systems. We have extensively measured soil and rock deformations using inclinometers for measurement of horizontal movements and tape extensometers for measurement of deformations between fixed points in tunnels or open cuts.

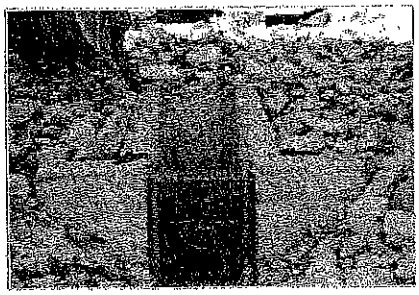


GZA inspection of relief wells in the Nepaug Dam gallery

Gate and Valve Evaluation and Design

Many of our dam projects require designing hydraulic improvements for existing dams to safely pass the specified design flood and/or to provide flexibility in normal and flood pool manipulations. Our team brings together the expertise via the multi-disciplines of hydrologic/hydraulic, geotechnical and structural engineering to conduct alternatives analyses leading to final design drawings and specification for gate and valve improvements to spillways and associated outlet works.

GZA's staff includes Mr. Richard Scott who joined GZA in 2012 after a 30-year career with the Rodney Hunt Company, where he progressed to the position of Engineering Manager. During his time at the Rodney Hunt Company, Mr. Scott was engaged in all aspects of product design, performance and manufacture of Rodney Hunt gates and valves for numerous dam projects across the United States. The addition of Mr. Scott to the GZA team allows us to provide a tremendous value to our clients when evaluating options to address their gates and valves needs on their existing dams.

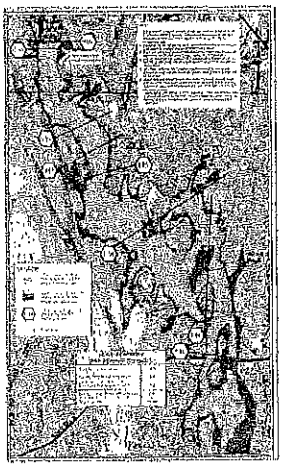


GZA designed this retrofit consisting of an angled slide gate and operator at the MDC Hartford's Reservoir No. 2 in West Hartford, CT

Emergency Action Plans & Dam Safety Training

Associated with most dam safety inspections are formal, written Emergency Action Plans (EAPs), which are usually required for Significant and High Hazard dams. GZA has prepared over 100 written EAPs for dams over the past 20 years. EAPs are necessary to outline an organized response to emergency situations associated with a sudden, rapid, and uncontrolled release of water from a dam. The major components of an EAP include detailed procedures for emergency identification, repair, notification, and evacuation.

Key elements of EAP development include dam breach simulation and floodwave routing in order to produce Inundation Maps. Ultimately, the EAP helps owners in maintaining a safe structure and assists public safety. Our services in this area have including developing and conducting orientation meetings and communication drills that focus awareness and tests the readiness of the plan. Often times our work includes specialized training in instrumentation reading and basics of routine dam inspection to the dam operators and their related staff.



GZA uses its hydrologic and hydraulic expertise to conduct dam breach simulations and inundation mapping.

Diving and ROV Services

GZA's diving services have provided waterfront-underwater inspection services to both private and public clients including; state and federal agencies, municipal governments, public and quasi-public authorities, marine terminals, marinas and boatyards. GZA has provided these SCUBA diving services for over 25 years on over 1,600 waterfront projects throughout New England and the East Coast.

GZA's experienced in-house Engineers/Divers have specific experience with New England waterfront structures with design insight of the structural significance of the damage observed. Investigation services include visual and tactile inspection, scour evaluation, underwater photographs and videos, UT (ultrasonic thickness) tests, timber coring and materials testing. GZA has provided Engineer/Divers on all underwater inspection projects utilizing in-house staff and will specialized sub-consultants to assist on particular project tasks as necessary.

GZA Engineer/Divers perform the underwater inspections in accordance with OSHA Subpart T- Commercial Diving directives and the American Society of Civil Engineers (ASCE), Underwater Investigations, Standard Practice Manual, No. 101. For most inspections, VA will use Self Contained Underwater Breathing Apparatus (SCUBA) with two-way, diver internal communication system to describe conditions observed to the topside diver/tender.

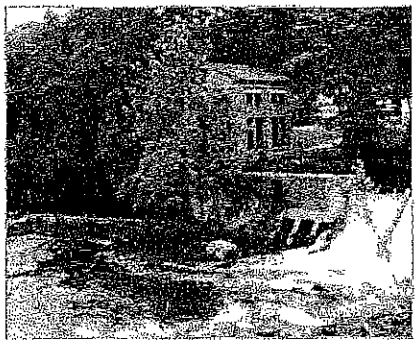
Typical inspection procedures include documentation of typical and abnormal conditions of the various components of the substructure by field notes, sketches, photography, videography and non-destructive testing. In the event the structures are inaccessible by divers, or to supplement the diver's inspections, GZA will utilize a VideoRay Pro XEGTO, submersible Remote Operated Vehicle (ROV) to perform the necessary inspection. The inspection results will be in a standardized format suitable for use in database management system.

Environmental Permitting Support

Most of our dam engineering design projects require a significant level of environmental scrutiny prior to obtaining approval. The nature of most major dam improvements and repairs requires some unavoidable alteration of vegetated wetlands and other sensitive resource areas due to the need to bolster a dam's footprint and/or to temporarily control water during construction. Our team of environmental engineers and scientists has the technical training and practical experience to assess wetland, wildlife habitat, and other applicable ecological impacts and to incorporate mitigation measures within our dam improvement designs that fulfill Federal, state and local regulatory requirements.

Hydropower Services

GZA has been providing services to the hydropower industry for over 20 years. The hydropower industry is a multi-disciplinary sector, and GZA is a multi-disciplinary firm. Owners of hydroelectric dams have long counted on GZA's extensive experience in the fields of dam engineering and hydrology to assist them in constructing, repairing, and maintaining their structures. GZA is also providing wider services, including permitting, environmental studies, design of new or rehabilitated small hydroelectric facilities as well as FERC Part 12D Dam Safety Inspections.



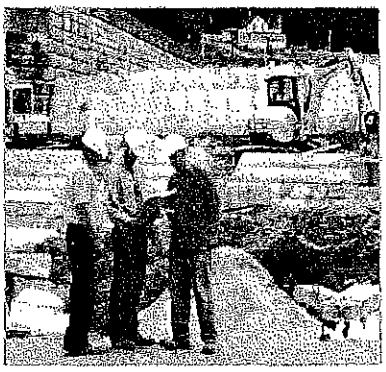
GZA performed a hydropower feasibility study for the Upper and Lower Collinsville Dams in Canton, CT

GZA has provided engineering services at projects from 900 MW to 40 kW in size. Our work scope includes full range of studies and design tasks to assist in the assessment and development of hydropower projects from conception to commissioning. This includes turbine selection and physical/structural upgrades of the powerhouse and related appurtenant facilities.

Recent projects have included resource assessments for hydropower potential at more than 300 dams owned by the Commonwealth of Massachusetts; feasibility studies for hydropower installation at two existing dams owned by the New Jersey Water Supply Authority; feasibility studies for hydropower re-development at the Collinsville Upper and Lower Dams in Canton, CT; preliminary design of a new conduit hydropower project for the Massachusetts Water Resources Authority; and design and licensing services for retrofit small hydropower facilities for two industrial clients.

Engineering Services During Construction

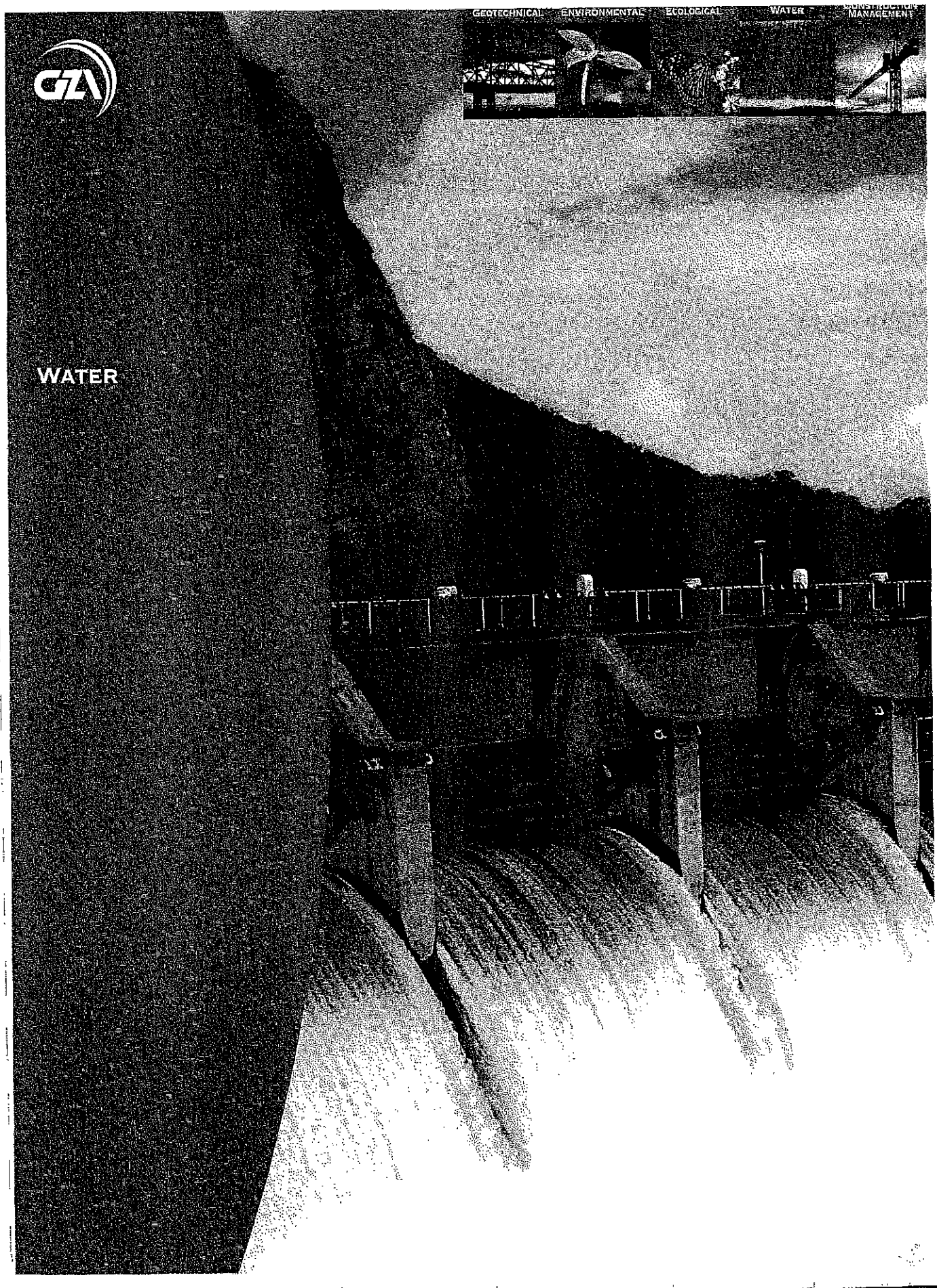
GZA routinely provides engineering support services to our clients during the construction phase of our dam repair projects. We strongly believe that the design engineer-of-record be retained to provide a minimum level of field engineering services during construction to allow us to assess compliance by the contractor with plans and specifications and to make adjustments to the design to meet potentially unanticipated conditions encountered during construction.



GZA regularly provides field engineering support services during the dam construction phase.

Typical tasks include: (a) attendance at routine construction progress meetings; (b) review of contractor's submittals; and (c) respond to requests for clarifications and changed conditions. A critical part of these services deal with resident inspection where our field engineer would observe and document the progress of construction, conditions encountered, contractor effort and personnel, and compliance of the work with the project plans and specifications.

Our field engineer would act as the client's liaison with the contractor and would interface with both GZA's project manager and the client's operations staff. Our field engineer's duties will include photo-documentation of the progress of construction and preparing weekly reports documenting activities, conditions, and progress.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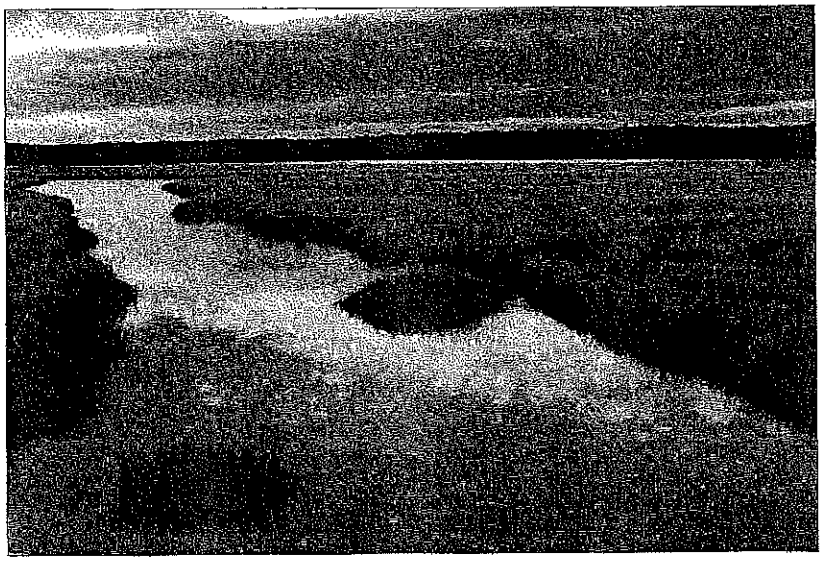


GZA specializes in the protection and restoration of ponds, rivers and wetlands

GZA is proactive by design. We are passionate about partnering with clients to meet the water-related challenges of climate change, resiliency, sustainability and building where the water meets the land.

Water constitutes 70 percent of the Earth's surface and 65 percent of the human body. It is the highway for 90 percent of all commerce, and the water's edge is home to 80 percent of the world's population. **Water matters.** During the last 30 years, we have successfully completed hundreds of water-related projects throughout the United States. As a full-service engineering and applied science consulting firm, we bring to each project not only our water expertise, but also our combined experience in geotechnical and civil engineering, ecological, environmental science and construction management.

PROJECT SPOTLIGHT

Post-Fukushima Flood Studies U.S. Nuclear Power Plants

THE CHALLENGE

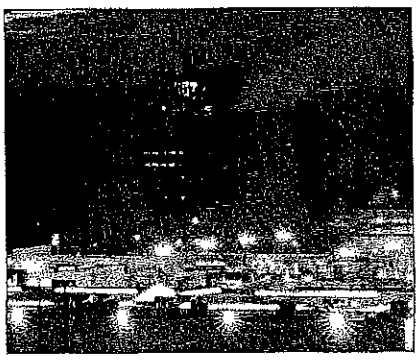
After the devastating earthquake and tsunami at Fukushima, Japan, the NRC required all U.S. nuclear power plants re-evaluate their flood vulnerability, with the evaluations to be completed within three years. GZA was retained to characterize flood hazards at 35 percent of U.S. nuclear power plants.

OUR SOLUTION

GZA introduced state-of-the-art technologies such as region-specific meteorology studies, probabilistic analysis of flooding due to storm surge, and hydrodynamic computer modeling for analysis and visualization of river, storm surge and waves, and local precipitation flooding.

THE RESULT

GZA's studies assessed the flood hazard of most U.S. major river watersheds, the Gulf of Mexico and the U.S. East Coast. Twenty-three power plants were evaluated in three years, meeting NRC's schedule. The results are being used to assess the vulnerability of these critical facilities and to create flood mitigation measures and response plans.

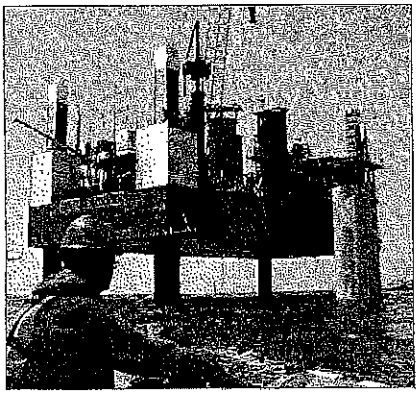


GZA nuclear power plant flood studies

GZA's water services staff includes planners; civil, geotechnical and structural engineers; ocean and coastal engineers; hydrologists and geohydrologists; oceanographers; meteorologists; ecologists; and natural resource specialists. We focus on four primary practice areas:

Marine and Waterfront Engineering

We provide engineering and environmental expertise in the design, permitting and construction of marine and waterfront facilities. Our services include site investigation, condition surveys, waterfront structure design,



A GZA marine and waterfront project in Mexico

permit preparation and construction management. We also provide complete coastal engineering services, including hydrodynamic modeling of waves, storm surge and beach processes, coastal resiliency and estuary management. Clients include port authorities, industry, power generation and transmission, marine and heavy construction, developers, marinas, and local, state and federal government agencies.

Dams and Levees

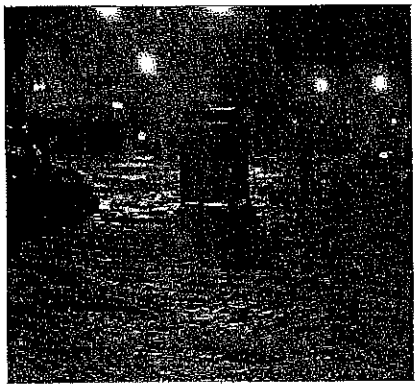
GZA excels in the assessment, design and construction of new dams and levees, and the rehabilitation and decommissioning of aging facilities. Projects have included public and privately-owned dams, dikes and levees, and hydraulic, flood and drainage control structures for power plants, municipal, industrial and mining facilities. With more than 1,000 dam projects successfully completed, GZA has earned a national reputation in this practice area.

Water Resources

Our engineers and scientists offer integrated, multidisciplinary expertise and experience in the investigation, planning and protection of water resources. We specialize in water supply investigations (surface and groundwater), sustainability, watershed management, diagnostic evaluations and the restoration of rivers and ponds, stormwater management and infrastructure design, permit support, environmental resource management, and construction support services. We also provide complete hydrodynamic modeling of groundwater aquifers, rivers, coastal processes, sediment transport and estuaries. Our laboratory, New England Bioassay, is one of the leading ecological and whole effluent toxicity testing laboratories in the United States.

Climate Change and Hazard Planning

Addressing the challenges of natural hazards and climate change requires a broad spectrum of skills and experience. GZA's climate change team includes



GZA assists municipalities with mitigating urban flooding

specialists in planning, meteorology, hydrodynamic flood modeling, hazard mitigation, vulnerability assessment, benefit-cost analyses, resiliency and river, ocean and coastal engineering. As a nationally-recognized leader in natural hazard assessment, mitigation and climate change adaptation, we have been responsible for assessing the hazard vulnerability of some of the most critical infrastructure in the United States.

When water matters, choose the company with national experience. **Choose GZA.**

WATER SERVICES

- MARINE AND WATERFRONT STRUCTURES
- DAMS AND LEVEES
- WATER RESOURCES
- CLIMATE CHANGE AND HAZARD PLANNING

REFERENCES LIST

Byron Weston Hydroelectric Project
Crane & Co.
Mr. James Beaudin Sr., Senior Project Manager
413-684-6835

Pine Grove Hydropower Project
Chester Water Authority
Ms. Sharon Fillmann
717-529-2244

Ware Disinfection Facility CVA to Hatchery Hydroelectric Project
Massachusetts Water Resources Authority
Ms. Pamela Heidell
617-788-1102

Spruce Run and Round Valley Feasibility Studies and Resource Evaluation for Proposed Hydroelectric Systems Along the Delaware and Raritan Canal.
New Jersey Water Supply Authority
Mr. Aimer Garcia
908-638-6121

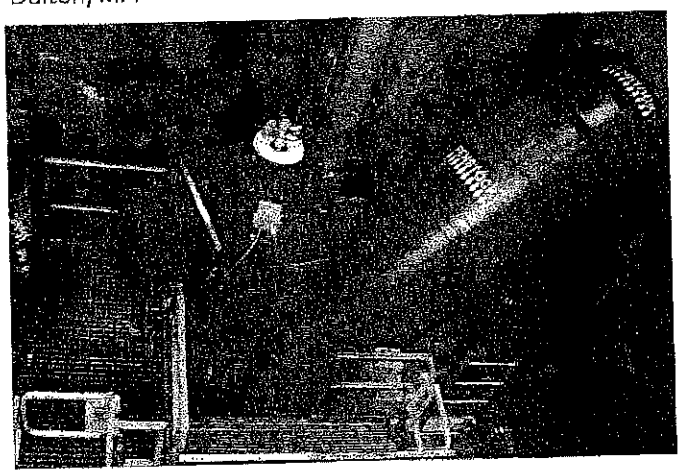
Blenheim Gilboa Evaluation of Geotechnical Instrumentation (and Multiple Other NYPA Projects)
New York Power Authority
Jim Liang, Senior Civil Engineer
914-287-3266

Blenheim Gilboa Concrete Testing
New York Power Authority
Lori Gale
914-681-623

PROJECT PROFILE

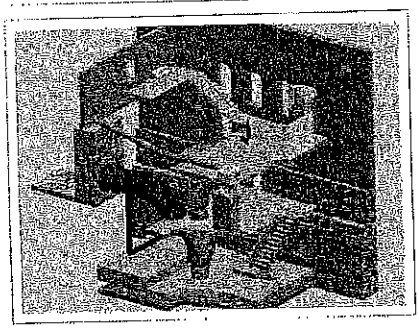
Byron Weston Mill Dam No. 2 Hydroelectric Project

Dalton, MA



Project Highlights

- 250 kW small hydropower project
- Successfully provided several aspects of GZA's engineering and scientific services including hydrology/hydraulics, wetland and aquatic habitat assessment, and civil engineering
- Successfully assisted the client in getting an MTC Feasibility, Design, and Construction Grants
- Successfully obtained a FERC 5-MW Exemption
- Project designed by GZA, constructed, and brought on-line



Crane & Co. is the owner of a number of dams on the East Branch of the Housatonic River. These dams are associated with Crane-owned paper mills which are adjacent to the river. The dams were originally built to provide water and hydromechanical power to the nearby mills but generally no longer serve any function related to mill operations. Crane & Co. engaged GZA to assist in exploring the possibility of upgrading the existing facilities at one or both of the Byron Weston Dams to provide for hydroelectric generation. Both the Byron Weston Mill Dam No. 1 and Dam No. 2 were considered in the initial assessment.

GZA completed an initial resource assessment study in 2007 which formed the basis of an application to the Massachusetts Technology Collaborative (MTC) Feasibility Grant application. The grant was awarded and GZA prepared a full Feasibility Study to further investigate the potential for hydropower generation at one or both dams based on the available head, available flow, and physical configuration of the facilities. GZA provided technical and economic assessment of hydropower generation and developed an optimized configuration which maximizes Crane's return on investment. GZA also investigated potential environmental and regulatory considerations connected with installation of hydropower generation at the site. GZA created a concept level design for the preferred hydropower alternative.

The result of the Feasibility Study process was the selection of a preferred alternative involving installation of hydropower generation equipment at Byron Weston Dam No. 2. This alternative was selected based on power generation potential, availability of existing infrastructure, and favorable permitting conditions. The hydropower generation potential is 250 kW. The total annual energy output for the facility was estimated at approximately 837 MWh during an average flow year. GZA prepared an MTC Design and Construction Grant application for the proposed project and Crane was awarded $500,000.

GZA prepared all FERC licensing documents and conducted all stakeholder meetings and coordination. GZA assisted Crane with developing a water quality study plan resulting from agency consultation comments. GZA prepared a draft and final exemption application for the project, as well as all final design plans, specifications, and contract documents. Design elements included interior structural work, penstock transition piece, and tailrace bulkhead. FERC issued a 5-MW Exemption for the project. Construction was completed and the project commissioned in 2013.

PROJECT PROFILE

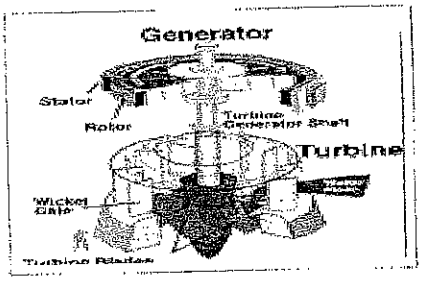
Collinsville Hydroelectric Project Feasibility Study

Canton, Avon, & Burlington, CT

Project Highlights

- Conducted a full Feasibility Level study for re-powering two existing dams on the Farmington River
- Developed multiple conceptual alternatives for generation and studied technical and financial feasibility of each.
- Assessed environmental consequences, including fish passage issues, of resuming hydropower generation.
- Made multiple public presentations to explain the benefits and costs of re-powering the dams.

GZA was selected by a commission comprised of representatives from three towns to perform a feasibility study to evaluate the technical and economic feasibility of restoring hydroelectric power generation at the Collinsville Upper and Lower Dams on the Farmington River in Connecticut. Both dams had previously been used for the production of hydropower, but generation had been discontinued and equipment removed. The local communities were interested in re-powering the sites, but only if environmental, aesthetic, financial, and other concerns could be addressed. GZA assembled a team of specialized sub-consultants to assist in the completion of a comprehensive feasibility study.



The broad-ranging scope of the study included not only technical analyses of the potential for power and energy production, but also assessment of environmental, historical, and regulatory issues. No fish passage facilities currently exist at either of the two dams, so conceptual plans for the siting, design, and operation of new fish benefit of hydropower redevelopment, but this required consideration of capital costs and impacts on flow available for generation in the feasibility study. Similar consideration was given to the level of conservation flo required to maintain water quality and aesthetics. Additional issues which were considered included pre-historic sites, historic resource wetlands, and recreation

GZA developed a number of conceptual alternatives for configuring power generation at both dams, including consideration of both typ and size of turbines. Turbine manufacturers were contacted to obtain information regarding availability and cost of various turbines. GZ also assessed several combinations of generation at the Upper and Lower Dam. Analyses included: detailed examination of financi benefits of each alternative, including sensitivity analysis for energy prices change in energy prices, financing interest rates, and grar availability. GZA provided pro formas for each viable alternative and including variation in the key financial parameters.

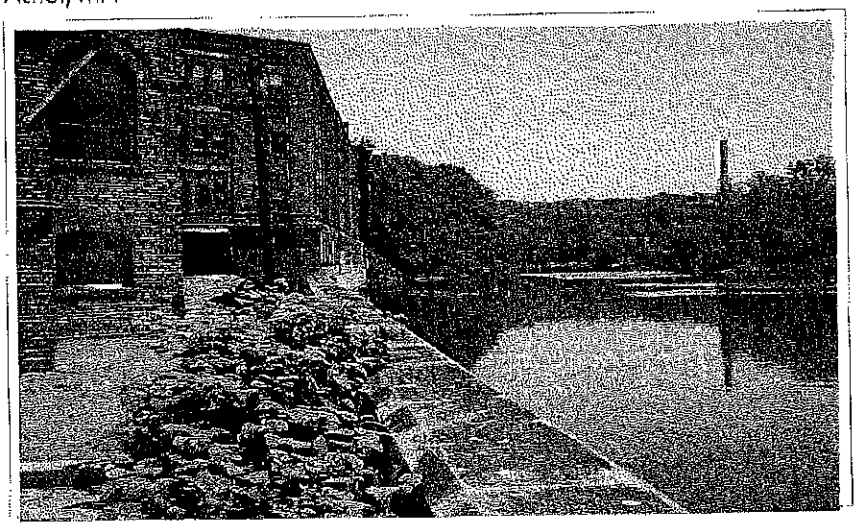
GZA also provided realistic discussion of the permitting and licensing process required to obtain approval for a hydropower project. Thi included feedback obtained from letters of inquiry sent to various regulatory agencies and stakeholder groups. The process of obtainin a FERC license was discussed in detail.

GZA made multiple presentations to the Committee, Town Selectmen, and the public. GZA assisted all stakeholders in the decision-making process regarding when, if, and under what terms to move forward with the project.

PROJECT PROFILE

Crescent Street Dam Hydroelectric Project

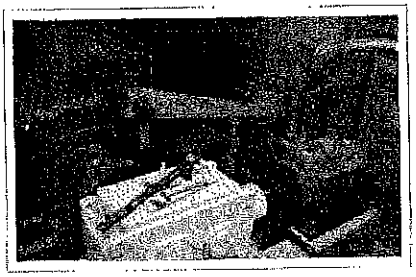
Athol, MA



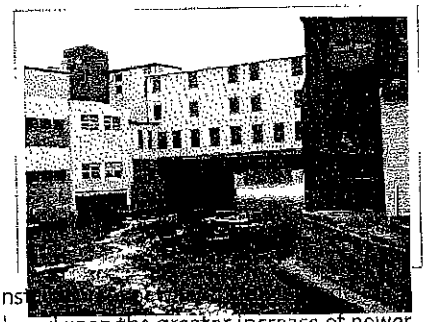
Project Highlights

- Proposed 270 kW small hydropower project
- Project will pay for itself in 3 years
- Successfully assisted the client in obtaining MTC Feasibility, Design, and Construction Grants
- Provided engineering and scientific services including hydrology/hydraulics, hydropower analysis and civil engineering

The L.S. Starrett Company (Starrett) is the owner of the Crescent Street Dam Hydroelectric Project. The project is located on the Millers River in the Athol, Massachusetts. The Crescent Street Dam Hydroelectric Project included two 250 kW turbine generator sets. One of the turbine generator sets was no longer usable and the other turbine generator sets was generating a reduced output of 80 kW. The project has been operating under a Federal Energy Regulatory Commission Order Finding Licensing of Hydroelectric Project Not Required.



GZA was initially retained by Starrett to perform a resource assessment for increasing hydropower generation and preparing a Massachusetts Technology Collaborative (MTC) Feasibility Study Grant application. The grant was awarded in May 2007 and GZA prepared a full Feasibility Study to further investigate the potential for replacing either one or both of the turbine generator sets based on the available head, available flow and physical configuration of the facilities. GZA provided technical and economic assessment of hydropower generation options and developed an optimized configuration which maximizes Starrett's return on investment and minimizes Starrett's expenditures. GZA also investigated potential environmental and regulatory considerations connected with improved hydropower generation at the site. GZA created a concept level design for the preferred hydropower alternative.



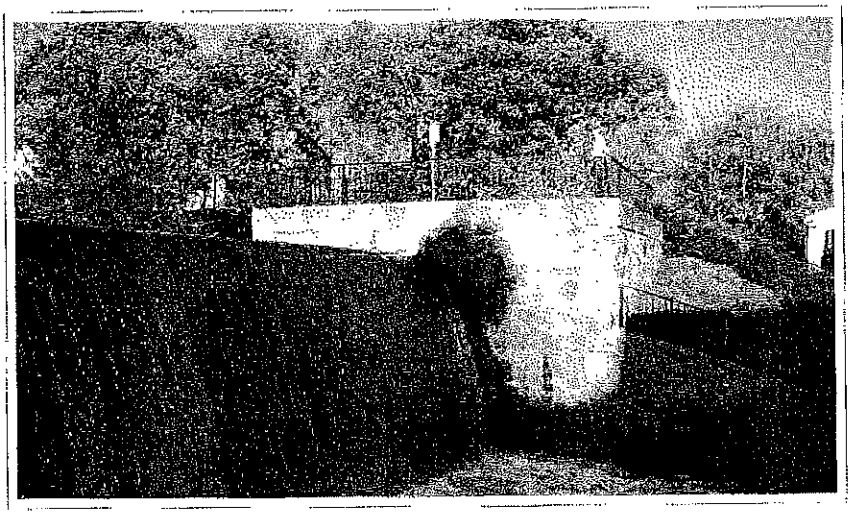
The result of the Feasibility Study was the selection of a preferred alternative involving inst equipment at the location of the non-functional equipment. The location was selected based upon the greater increase of power generation potential that could be achieved. The expected hydropower generation potential from the new equipment is 270 kW and the total generation capacity of the project is expected to be 350 kW. The total annual electricity output for the new equipment was estimated at approximately 1,800 kWh during an average flow year. GZA prepared a MTC Design and Construction Grant application for the project and Starrett was awarded $500,000. With MTC (now RET) assistance, the payback period is expected to be approximately 3 years.

GZA structural engineers designed a concrete arch structure for the rehabilitated tailrace portal for flow discharge back into the river. Working with the contractor, GZA designed a temporary underpinning system to support the overlying structure during construction. GZA has also assisted Starrett with negotiations with fisheries agencies and stakeholders groups regarding operations rules and fish passage mitigations.

PROJECT PROFILE

Commonwealth-Owned Dams Statewide Hydroelectric Power Potential Assessment

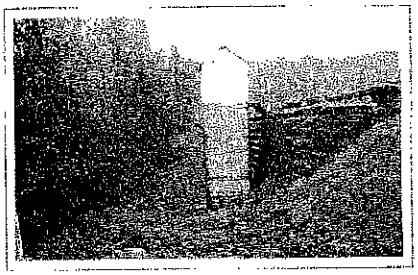
Massachusetts



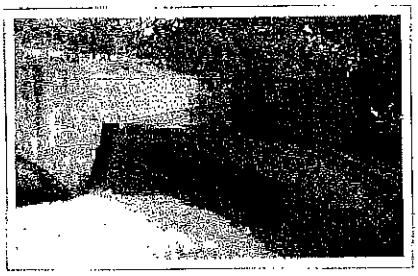
Project Highlights

- Utilized existing publicly-available data to perform a screening level assessment of the hydroelectric generation potential of hundreds of dams
- Identified dozens of dams where hydroelectric development could be both technically and economically feasible

The Commonwealth of Massachusetts Department of Conservation and Recreation (DCR) is the primary natural resources management agency for the state. The DCR owns and manages more than 350 dams as part of flood control projects, water supply systems, and state parks. These dams provide important services to the people of the Commonwealth, but the DCR recognized that the potential for hydroelectric generation at some of its dams might provide additional value. In addition to potentially producing revenue for DCR and the Commonwealth, generation of clean, renewable, carbon-free hydroelectricity at existing dams also is consistent with the Governor's directive for state agencies to reduce their carbon-foot print and his desire to make Massachusetts a renewable energy leader.



GZA was engaged by the DCR to perform a screening-level assessment of hydropower generation potential at each of its dams. This assessment was meant to be used as an initial evaluation tool to identify those dams where a significant amount of hydropower potential exists and thereby focus on the dams where development might be most viable.



GZA utilized information contained in the DCR's dam safety database, as well as the National Inventory of Dams, and GZA's own extensive knowledge of the dams of Massachusetts to develop information regarding the physical characteristics at each dam pertinent to hydropower generation. GZA then accessed USGS historic streamflow gage data to create proxy flow duration curves at each of the dam sites.

Based on this data, GZA estimated the power (kW) and average annual energy (kWh) production potential at each of the dams in the DCR's inventory. GZA identified those dams where further investigation of hydropower generation presently made sense, those which might be examined in the future, and those dams where low head, low flow, or both makes hydropower generation economically infeasible for the foreseeable future.

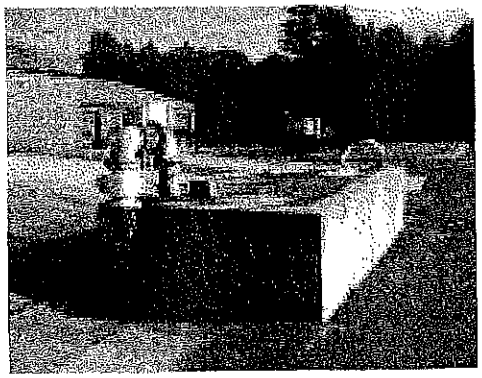
Based on the screening analysis, GZA assisting DCR with more detailed evaluations of hydropower potential at certain dams and with preparing applications for FERC preliminary permits for 20 of the dams. Generation of hydropower at DCR dams could be a source of revenue for the state and an example of good environmental stewardship.

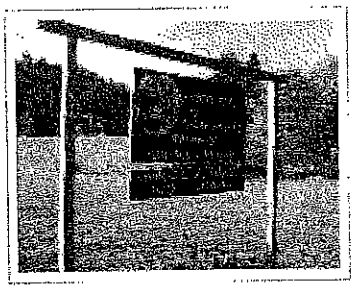
PROJECT PROFILE

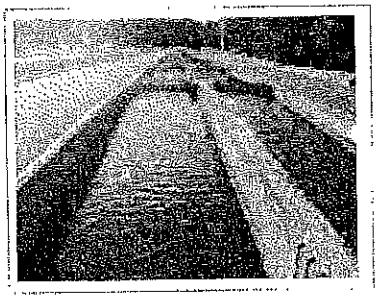
Feasibility Study for Conduit Hydroelectric System in Proposed Transmission Line from Chicopee Valley Aqueduct to McLaughlin Fish Hatchery

Project Highlights

- Performed technical analysis and cost estimate on an expedited timetable.
- Identified equipment that meets "Buy American" provisions for ARRA funded projects.







The Massachusetts Water Resources Authority (MWRA), which provides a dependable source of water to the greater Boston area, is investigating the idea of constructing a transmission line to convey water from the Chicopee Valley Aqueduct (CVA) to the Massachusetts Division of Fisheries and Wildlife (DFW) McLaughlin Fish Hatchery. The conduit would provide high quality water for use at the hatchery. In performing preliminary design of the transmission line, the MWRA identified a residual head that could be utilized to generate hydroelectricity. The project would supply power for on-site use to partially offset existing power demands at the adjacent Ware Disinfection Facility (WDF).

The MWRA engaged GZA to perform the technical analysis and to develop a cost estimate on an expedited basis such that the study could be completed in time to meet the deadline for funding from the Massachusetts Clean Energy Center (MassCEC).

GZA performed a technical evaluation of the transmission line including the impact of constructing the project using pipes of different diameters. Two potential locations were considered including at the low point in the system (adjacent to the WDF) and the discharge point to the hatchery. The site adjacent to the WDF was ultimately selected based upon the ability for the MWRA to utilize the energy onsite as well as their desire to develop the project on MWRA property.

Three equipment types were considered including utilizing traditional Kaplan turbines with either fixed or adjustable runner blades, using crossflow turbines, and utilizing pumps as turbines (PAT), (i.e., an ordinary pump running in reverse). PATs were preliminary selected for the purpose of the feasibility study; however, additional consideration will be given to traditional turbines in the design phase.

The preferred alternative includes utilizing a single PAT that uses a design head of 84 feet and a design flow of 6 mgd. The proposed equipment would generate a peak power of approximately 50 kW of power and produce approximately 396,000 kWh of energy during an average year.

GZA estimated the total cost of developing the preferred alternative, including estimated engineering costs (but not including permitting costs) to be approximately $600,000. MWRA is awaiting the announcement of the MassCEC grant awards, to evaluate moving the project forward to the design phase.

PROJECT PROFILE

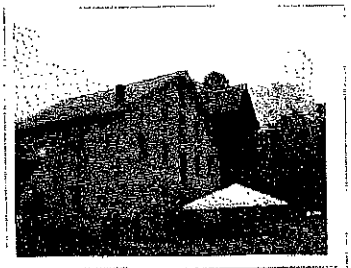
New Jersey Water Supply Authority, Resource Evaluation for Proposed Hydroelectric Systems along the Delaware and Raritan Canal

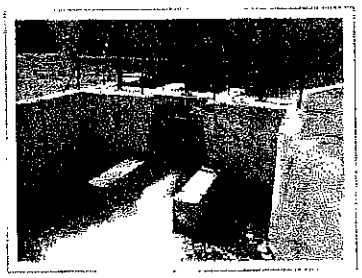
Central New Jersey

Project Highlights

- Proposed three "standardized" layouts for lock structure development utilizing existing infrastructure.
- Proposed alternatives that protected and enhanced the cultural and natural environment surrounding the Canal.
- Examined the costs and benefits of developing single sites and all viable sites.

The New Jersey Water Supply Authority (Authority) operates and maintains the Delaware and Raritan Canal (Canal) as part of a complex system to provide a dependable supply of water to central New Jersey residents. The Authority identified the potential for harnessing the energy contained in the existing water flows through the Canal and engaged GZA to investigate the feasibility of developing hydroelectric generation systems.





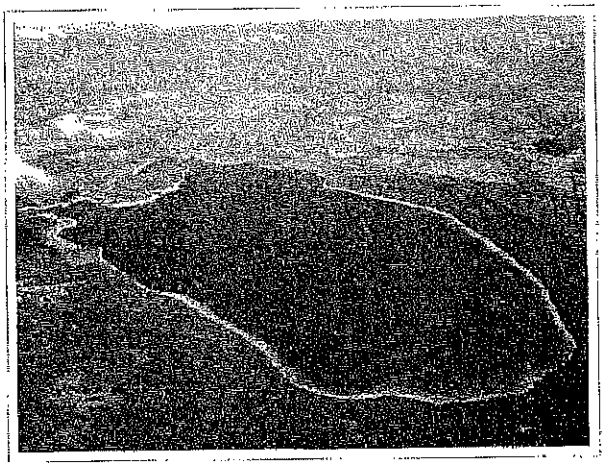
GZA performed an analysis of the technical, financial, and environmental feasibility of constructing and operating hydroelectric generation systems along the Canal at existing flow control structures. Three potential typical layouts were considered for the lock structures, while alternative development configurations were considered for the aqueduct and flood gate structures. The intent was to select a configuration to be installed in a standardized manner at each of the sites to maximize construction and development efficiency. The technical feasibility examined the amount of potential electric generation available at each site as a function of available flows, net head, system configuration and efficiency of the generation equipment. The potential impacts to the natural and cultural environment as well as the potentially associated mitigations were investigated. Additionally, potential permitting requirements for local, state and federal regulating agencies were identified. GZA examined options to protect and enhance the environmental, historic, and recreational attributes of the Canal. The economic feasibility of the project was performed for developing each of the sites individually as well as developing all viable sites together. The analysis utilized a range of costs and annual benefits, which were used to estimate a range of simple payback periods.

The results of the feasibility analysis indicated that at the majority of the sites studied, hydropower development was technically feasible. Based upon the financial analysis, GZA estimated that the simple payback periods would be in the order of several decades, even when considering the lowest cost and highest benefits scenario. The estimated peak power and average annual energy generation at the viable sites ranged from 16kW to 106kW and 123MWh to 582 MWh, respectively. If all viable sites were developed the estimated total peak power would be 400 kW with 2,877MWh of energy produced in an average year.

PROJECT PROFILE

New Jersey Water Supply Authority, Spruce Run and Round Valley Reservoirs Hydroelectric Feasibility Studies

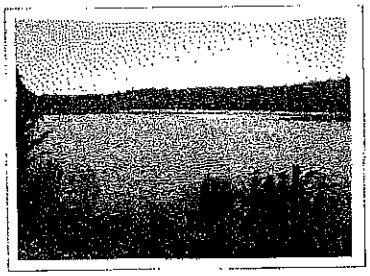
Clinton Township, NJ



Project Highlights

- Proposed layouts for three separate generating facilities focused on utilizing existing operating conditions
- Provided innovative solutions to meet the Authority's various generation restrictions
- Provided assistance with FERC Preliminary Permit Application

The New Jersey Water Supply Authority (Authority) owns and operates the Spruce Run and Round Valley Reservoirs as part of a multi-reservoir complex to provide a dependable supply of water to central New Jersey residents. The Authority identified the potential for harnessing the energy contained in the existing water releases from their reservoirs and engaged GZA to investigate the potential for developing hydroelectric generation.



The Spruce Run Reservoir is an on-stream water storage reservoir while the Round Valley Reservoir operates as a pumped storage system. The Spruce Run Reservoir has one water release structure and the Round Valley Reservoir has two (North and South).

GZA completed three separate hydroelectric feasibility studies for the Authority which focused on the Spruce Run Reservoir, the Round Valley Reservoir North Dam and the Round Valley Reservoir South Dam. An analysis of the technical, the economic and the environmental/permitting feasibility of the installation of a hydroelectric generation system were completed for each site. The technical evaluation included an estimation of the gross head and head losses to approximate the available net head as well as an analysis of historic flow releases at each discharge site. Pumps operating as turbines (PATs) in addition to several different types of traditional turbines were evaluated for varying performance characteristics. The various potential environmental impacts of the projects were investigated including the associated permitting requirements for local, state and federal regulating agencies. Finally, a project economic analysis was conducted for each site. This included a cost estimate, average return on investment and simple payback period.

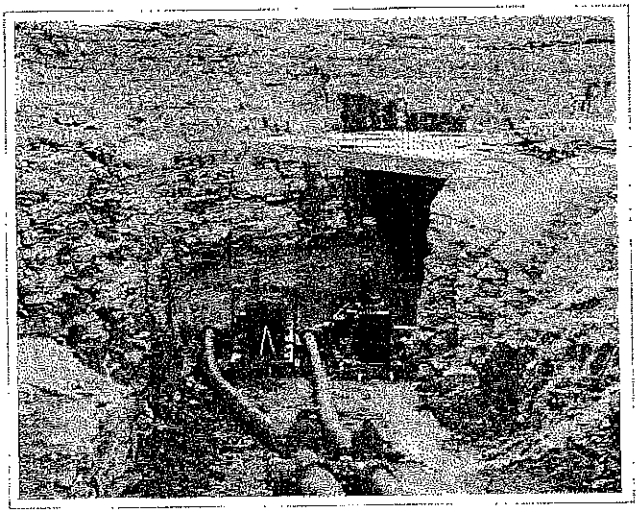
The results of the feasibility analyses indicated that due to the Highlands Act, modifying existing structures to operate as powerhouses was the preferred option of any installation. Due to this consideration as well as a lower initial capital cost and smaller equipment footprint, the use of PATs at each site was the preferential equipment option. The preferred generation location for Spruce Run was within the outlet vault structure, for Round Valley North was the control valve vault and for Round Valley South was the Hamden Pump Station. The estimated peak power and average annual energy generation was estimated to be 75 kW / 421 MWh for Spruce Run, 300 kW / 121 MWh for the North Dam and 420 kW / 72 MWh for the South Dam.

GZA performing Phase II of the Authority's Hydroelectric investigations which explore the technical, environmental/permitting and economic potential of hydroelectric generation within the Authority's Raritan Canal structures.

PROJECT PROFILE

Un-Watering for LEM Upper Reservoir Water Control Blenheim-Gilboa Pumped Storage Project

North Blenheim, NY



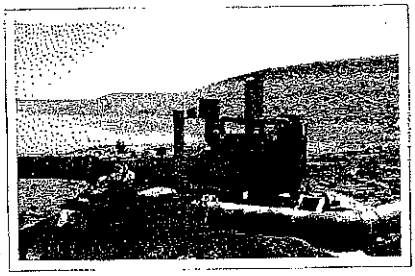
Project Highlights

- Identified potential critical issue through pre-project analysis.
- Developed instrumentation and data collection program to increase certainty regarding vital parameters.
- Assisted Client in decision-making regarding operations planning and developed evaluation thresholds
- Provided round-the-clock instrumentation monitoring.
- Worked with Client to move project forward on-schedule with no damage to project structures.

A Life Extension and Modernization (LEM) program at Blenheim-Gilboa Pumped Storage involved complete un-watering of its subsurface Water Conveyance Structures that connect Lower Reservoir(LR) on Schoharie Creek and Upper Reservoir (UR) constructed on the west side of Brown Mountain. The operational water level for UR varies between elevation 1,950 and 2,000 ft, while that in LR typically varies between 860 ft to 900 ft. The structures consist of a 1,143 ft deep concrete vertical shaft and horizontal power tunnel, which separates into four steel-lined 12-ft diameter penstocks through a manifold structure located halfway from UR to LR.

Un-watering was planned in following steps: (a) lowering the upper reservoir to 1,940ft; (b) constructing a temporary cofferdam at the UR; (c) further lowering the UR to 1910ft; (d) constructing a permanent cofferdam; (e) de-watering vertical shaft to 898ft; (f) pumping out power tunnel, manifold and penstocks.

GZANY provided engineering analyses and recommendations water control at the Upper Reservoir. Because there was no permanent control structure at the upper end of the shaft, a cofferdam needed to be constructed to prevent water from entering the shaft after dewatering of the Upper Reservoir. At the same time, it was determined to be beneficial to leave a residual pool in the Upper Reservoir to maintain fish habitat and provide volume to refill the tunnel and shaft at the end of each work cycle. GZANY analyzed the potential for direct precipitation and runoff into the Upper Reservoir and the potential effects on freeboard at the cofferdam. In conjunction with NYPA engineers and the Board of Consultants, GZANY made recommendations regarding a water control system that used pumps outboard of the cofferdam to maintain pool elevation and inboard of the cofferdam to prevent direct flow into the shaft. GZANY prepared designs for the discharge pipe over the Upper Dike embankment and to a drainage course down the side of the mountain which ultimately discharged back into the Lower Reservoir. The system was successfully installed for all four years and functioned as intended.



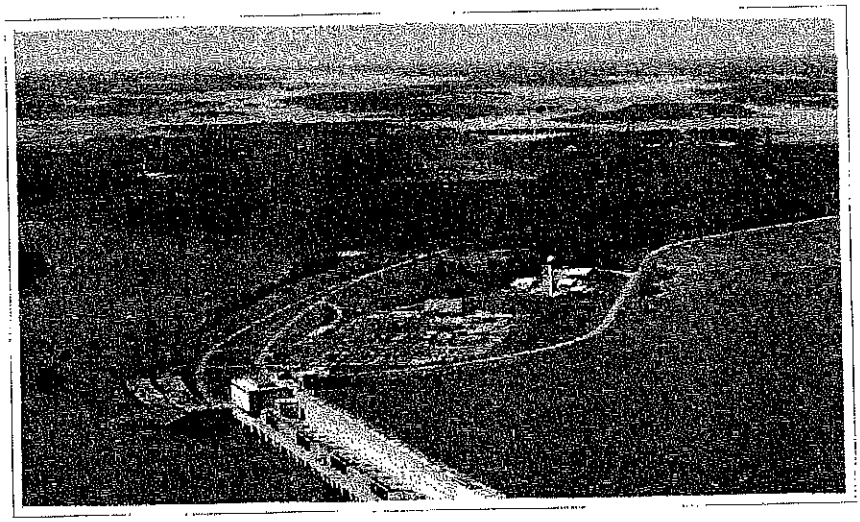
PROJECT PROFILE

New York Power Authority, Robert Moses Power Dam, Automatic Monitoring of Foundation Seepage

Massena, NY

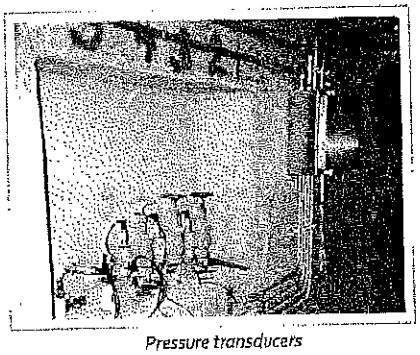
Project Highlights

- Automatic monitoring of pressure and flow meter instruments in power dam
- PC-based data acquisition
- RS485 serial network



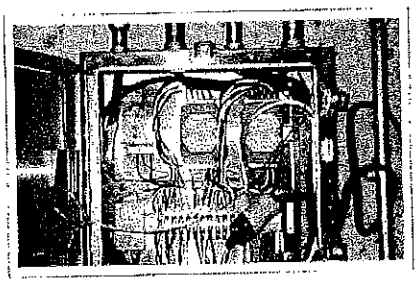
The Robert Moses Power Dam (RMPD), the main component of the St. Lawrence-FDR Power Project., stretches 3,200 feet across the St. Lawrence River. It has two generating plants, divided by the U.S.-Canadian border and operated separately by the New York Power Authority (NYPA) and Ontario Power Generation. Each utility has 16 turbine-generators that can produce about 60,000 kilowatts apiece.

NYPA had manually performed quarterly measurements of foundation seepage flow and uplift pressure inside the RMPD since 1961. To obtain more short term variations of seepage flow and uplift pressure, NYPA embarked on a program to install an automatic data acquisition system allowing authorized users to monitor and report data from 44 monitoring points in real time from a host computer within the NYPA computer network.



Pressure transducers

The first phase of this program was a pilot system that automated the monitoring of two flow meters and five pressure transducers within the dam. For the pilot, the monitoring data was available only on the host computer but not on the NYPA computer network. The data acquisition pilot system comprised two flow meters with sonic receivers and five uplift pressure transducers connected to two datalogger units located in the dam's inspection gallery. The two datalogger units were in turn connected to a serial converter by means of a very long RS485 serial cable. The serial converter box was connected to the data acquisition computer.



Data acquisition units

GZA was contracted by NYPA to procure, install and configure the software needed to perform the automatic data acquisition for the pilot system. In addition GZA prepared an Operations & Maintenance (O&M) Manual for the system and trained NYPA personnel in the use of the system.

Table of Contents

Established in 1894 by Worcester Polytechnic Institute, Alden's initial interest in hydraulics was driven by an emerging hydropower industry. Today, Alden is a private entity, but its roots in hydropower have remained strong throughout the years. Alden is the largest and oldest private hydraulic modeling organization in North America. In the past 25 years, its services have grown to include gas flow modeling and environmental engineering and assessment for water intakes. These capabilities have allowed Alden staff to develop extensive experience in addressing and resolving all types of issues related to hydroelectric power generation. Alden's professional staff includes several nationally renowned engineers and biologists who have been leaders in the assessment and mitigation of environmental impacts at hydro dams. Studies conducted by Alden for entities such as the New York Power Authority (NYPA), New York State Research and Development (NYSERDA), the Electric Power Research Institute (EPRI), and the U.S. Department of Energy (DOE) have resulted in the development of data and technologies that have been applied by project owners and accepted by resource and regulatory agencies. This experience provides Alden with a unique knowledge of hydropower projects and turbines and informs the practical engineering studies we undertake and strategies that we apply for our clients to successfully negotiate the licensing process and meet requirements of their existing FERC licenses.

"They'd be the only people I'd consider. You don't mess around with something that works. We have established such a good working relationship. I know that if there was a problem, I could pick up the phone and get it resolved quickly." - Edmond Pepper, Vice President, Pepper & Associates

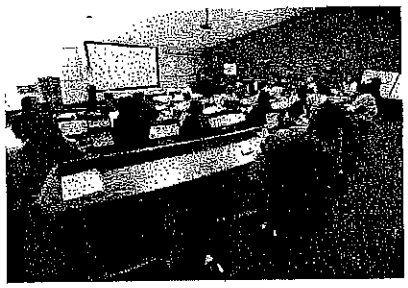
Survival testing of rainbow trout passing through a hydrokinetic turbine at Alden

Alden's wide-ranging experience with many aspects of hydroelectric power generation provides us with a practical element to balance our research background. Alden has provided services such as feasibility studies, detailed design, construction oversight, economic analysis, energy optimization, hydraulic evaluations, due diligence evaluations, modeling, field measurements, FERC licensing support, and a variety of other services to both the private industry and large utilities. We are also well respected and considered as experts by many of the state and federal resource agencies typically involved in hydroelectric development and compliance. Additionally, Alden biologists and engineers have actively participated in consultations with numerous agencies throughout the U.S. Alden has specialized expertise in upstream and downstream fish passage issues at hydroelectric facilities and recently completed the development of a model for the National Marine Fisheries Service (NMFS) to estimate the survival of

federally-listed endangered Atlantic salmon passing downstream at hydroelectric projects in support of the restoration efforts on the Penobscot River. Our staff has extensive experience with FERC licensing and compliance including development of FERC license applications, capacity amendment applications, study plans, and exhibit drawings.

"The work that Alden did for us is ground-breaking." Ann Lowery, Deputy Commissioner Mass DEP; regarding the In-Conduit Screening Tool Development

Alden has conducted numerous hydraulic model studies of hydroelectric stations and related structures such as intakes, outlets, spillways, stilling basins, fish ladders, and navigation locks. Model studies have been conducted for a variety of phenomena related to low and high head hydro power and pumped storage. Complimenting these laboratory studies are numerous field measurements of turbine performance using the various code accepted methods of flow measurement, as well as Computational Fluid Dynamics (CFD) studies. Dam and spillway evaluations including hydrology, hydraulics, geotechnical and structural analysis have also been completed.



In-Conduit Screening Tool Public Training Session held in Alden's

Alden is a leader in North America for providing physical hydraulic and computational fluid dynamics (CFD) modeling in support of hydropower facilities design and retrofit, fish passage facilities, total dissolved gas (TDG) abatement, compliance with ESA regulations, dam safety analysis, risk reduction and remedial design, and design of various flood control measures such as levees and barrier structures.

Brief Descriptions of selected hydropower-related projects that Alden has been involved with are provided below.

SELECTED NEW YORK EXPERENCE

FERC Licensing Studies and Support

Black Rock River Fishery Study (Black River Energy LLC) – As part of a development and licensing effort for two breached dams on the Black River in New York, the NYDEC required Black River Energy LLC (the potential licensees) to conduct a walleye spawning survey and habitat assessment in the vicinity of the two dams. Alden conducted a review of previous studies in the region and developed a study plan for updated field research. Alden was also part of the field study team who survived the area for suitable spawning habitat and collected species samples with electrofishing techniques.

Market Analysis

Alden Turbine Market Analysis (NYSERDA, New York) – Alden completed a state-wide hydropower analysis in the State of New York. The study focused on identifying suitable sites for the installation of the Alden fish-friendly turbine at both developed and undeveloped dams. This was completed by estimating the available power potential and comparing it to the existing generation (if any). Where suitable resources were available for an Alden turbine installation, power and energy estimates were completed.

Feasibility Studies

School Street Alden Turbine Feasibility Study (Brookfield) – The Brookfield Renewable Energy Group was considering the addition of a fish friendly Alden turbine at their School Street Plant in Cohoes, New York. To determine the feasibility of this installation Alden collected field data to validate the head loss in the project's feed canal. These and other data were used to estimate power gains and conduct an economic analysis for the potential expansion project.

Crescent and Vischer Ferry Turbine Replacement Feasibility Study (NYPA) – As part of planed plant overhauls; NYPA was considering retrofitting the Crescent and Vischer Ferry Hydroelectric Plants with fish-friendly turbines to help minimize the cost of downstream fish passage compliance. Alden developed the baseline fish passage survival, developed conceptual designs for an Alden fish-friendly turbine and modified Kaplan and Francis installations, and evaluated the economic and environmental benefits of each redesign.

Installation of Hydrokinetic Turbines Downstream of a Traditional Hydro Project Feasibility Study (Confidential Client) – A hydropower owner was considering the installation of a hydrokinetic turbine array downstream of an existing project New York State. Due to the size of the proposed hydrokinetic project, the installation could impact tailwater elevations and affect the gross head at the existing project. Alden conducted numeric and CFD modeling simulations to generate water surface profiles and ultimately determine the feasibility of the project.

New Technology Testing and Development

Modular Inclined Screen (MIS) Development – Developed the Modular Inclined Screen, designed for diverting fish from water intakes at high velocities (up to 10 feet

per second). Laboratory testing conducted at Alden with ten species of fish including Pacific salmon fry demonstrated survival near 100% for most species. Field testing was conducted in 1995 and 1996 at a prototype test facility installed at the Green Island Hydroelectric Project on the Hudson River in New York. This project was a Tailored Collaboration Program funded by EPRI, Niagara Mohawk Power Company, New York Electric Energy Research Corporation, New York State Energy Research Development Authority, New England Power Company and the California Department of Water Resources. Reference: Electric Power Research Institute. 1994. *Biological Evaluation of a Modular Inclined Screen for Diverting Fish at Water Intakes*. EPRI TR-104121. Electric Power Research Institute. 1996. *Evaluation of the Modular Inclined Screen (MIS) at the Green Island Hydroelectric Project: 1995 Test Results* EPRI. TR-106498.

Spillway Safety

Upper Niagara River Ice Flow Model (NYPA, New York) – A physical model study was performed by Alden to investigate the relationship between the design and operation of the Niagara Power Project and the formation of ice stoppages and jams in an 18,000 ft length of the Grass Island Pool reach of the Upper Niagara River. Horizontal and vertical scales of 1:120 and 1:50, respectively, were selected for the model; polyethylene plastic pieces, replicating typical sizes, buoyancy, and internal-resistance strength were used to model ice. The model was calibrated for six open-water flow conditions, and three ice-affected flow cases. The physical model provided the information and data needed to address to meet the goals of the study, offered substantial insights into the characteristics of flow and ice transport, and enabled a reliable assessment of the performance of potential mitigation measures.

Field Performance Testing

Lewiston Hydroelectric Station (NYPA, New York) – Alden completed field flow measurements at the Lewiston Hydroelectric Project in support of turbine performance testing. Banks of Ott meters were deployed to develop velocity profiles that were used to determine turbine flow rates.

Fish Passage Feasibility Study and Conceptual Design

Iroquois Dam Eel Passage (Versar & EPRI) – Alden developed conceptual designs with order of magnitude costs and general engineering support for eel diversion structures at Iroquois Dam on the St. Lawrence River in New York.

Quassaick Creek Fish Passage Feasibility Study – Alden evaluated various fish passage options including, dam removal and technical fishways at a non-hydro dam on Quassaick Creek in New York. Alden efforts included performing field investigations, sediment sampling and analyses, hydrology and hydraulic computations, a habitat assessment, and an evaluation of fish passage and dam removal alternatives.

Quassaick Creek

Bronx River Fish Passage Design Development

Bronx River

Alden teamed with Milone & MacBroom, Inc., Environmental Research and Consulting, Inc., and Fitzgerald & Halliday, Inc. to complete the Phase II Fish Passage Design Development Project for three dams on the Bronx River (182nd Street Dam, the Bronx Zoo Dam, and the Snuff Mill Dam). The Bronx River Alliance and the New York City Department Parks and Recreation Natural Resource Group teamed with the Bronx Zoo/Wildlife Conservation Society, the New York Botanical Garden, and NOAA to make upstream habitat in the Bronx River accessible to river herring. This phase of the project involved the evaluation of three fish passage alternatives for each dam. Because of their cultural and aesthetic value, all three dams will remain, but the contemplated fish passage facilities will be as natural as possible. Consequently, the project approach is emphasizing landscape architectural design as thoroughly as ecological engineering. Alternatives being considered are rock ramps, nature-like bypass channels, and conventional fishways.

Bard College Eel Ladder

Saw Kill River Eel ladder Design – In the spring of 2006, Alden designed, fabricated, and installed an eel ladder on the Saw Kill River, a tributary of the Hudson River, at Bard College, New York. This eel ladder was designed to be used by Bard College to collect, count, and release upstream migrating eels. A key feature of this ladder was that it needed to be designed as a temporary, free standing structure that could be easily removed. The ladder also included a predator cover and various types of substrate to aid in the passage of eels. A second eel ladder of this design was sent to NOAA for display at the 10th anniversary celebration of the NOAA Community-based Restoration Program.

FERC LICENSING STUDIES AND SUPPORT

Water Quality Monitoring at Two Vermont Hydro Projects (Eagle Creek Renewable Energy) – Alden prepared water quality monitoring study plans that were required by the FERC licenses and State 401 Water Quality Certifications of the Ball Mountain and Townshend Hydroelectric Projects located on the West River in Vermont. Alden is also performing the water quality monitoring study at each project, which includes the installation of water quality meters and analysis of temperature and DO data. Alden staff developed the study plan in consultation with the state and federal agencies and submitted the final plan to FERC. Alden completed an interim report for the first year of data collection (2015) and submitted it to FERC following an agency review.

PIT-tagged shortnose sturgeon used for an evaluation of a fish exclusion rack and bypass

Fish Passage Design and Effectiveness Study Plans for Two Vermont Hydro Projects (Eagle Creek Renewable Energy) – Alden prepared Fish Passage Design plans and a combined Fish Passage Effectiveness Study Plan for the Ball Mountain and Townshend Hydroelectric Projects located on the West River in Vermont. Alden developed these plans in consultation with state and federal resource agencies and submitted the final plans to FERC.

Instream Flow Study for the Riverdale Mills Project (Riverdale Power & Electric Company, Massachusetts) – Alden conducted an instream flow study at the Riverdale Mills Hydroelectric Project on the Blackstone River in Massachusetts. The study plan was developed by Alden in consultation with state and federal resource agencies. Alden performed the field work and prepared a study report that was submitted to FERC. Using the data collected during the study, Alden assisted the project owner in negotiating a reasonable minimum flow rate for the project's bypass reach.

Instream Flow Study for the Cargill Falls Project (Putnam Green Power, Connecticut) – Alden conducted an instream flow study at the Cargill Falls Hydroelectric Project on the Blackstone River in Massachusetts. The study plan was developed by Alden in consultation with state and federal resource agencies. Alden performed the field work and prepared a study report that was submitted to FERC. Using the study results, Alden assisted the project owner in negotiating a reasonable minimum flow rate for the project's bypass reach that was incorporated into the project license.

FERC Environmental Assessment for the Occum Project (FERC, Connecticut) – Alden staff prepared the aquatic resources impact section of the FERC EA developed

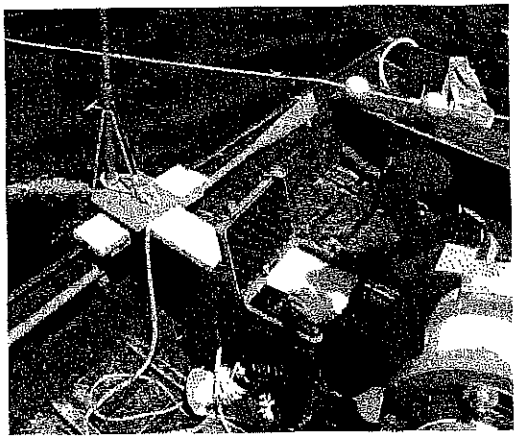
for the relicensing of the Occum Hydroelectric Project located on the Thames River in Connecticut. Alden staff participated in scoping meetings and agency consultations as part of the environmental assessment.

Field measurements of flow velocities and water quality

FERC Environmental Assessment for the Middlebury Lower and Weybridge Projects (FERC, Vermont) – Alden staff prepared the aquatic resources impact section of the FERC EA developed for the relicensing of the Middlebury Lower and Weybridge Hydroelectric projects located on Otter Creek in Vermont. Alden staff participated in scoping meetings and agency consultations as part of the environmental assessment.

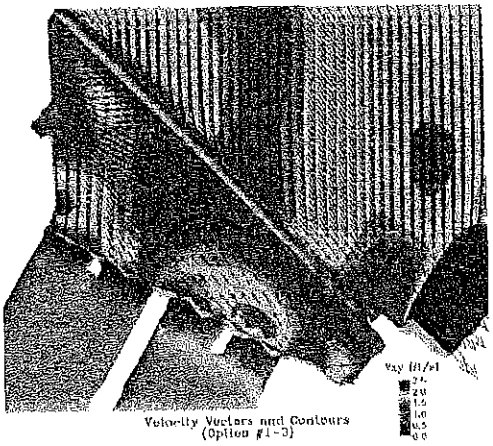
FERC Environmental Assessment for the Vergennes Project (FERC, Vermont) – Alden staff prepared the aquatic resources impact section of the FERC EA developed for the relicensing of the Vergennes Hydroelectric Project located on Otter Creek in Vermont. Alden staff participated in scoping meetings and agency consultations as part of the environmental assessment.

Northfield Mountain Pumped Storage Stop Log Lifting Device Repair Design (First Light, Massachusetts) – As part of a FERC relicensing effort, Northfield needed to restore this lifting beam to its original condition and replace the hydraulic components used to break the top stop log free when filling the tailrace tunnel. Alden inspected and evaluated the existing lifting beam, and developed a repair scope of services to restore the lifting beam to its original functionality, provided inspection services and progress reports of the lifting beam during its repair, designed and specified a new hydraulic system for breaking the top stop log free during the re-filling procedure, and provided a procedure to install and remove stop logs.



Putnam Hydroelectric Project Trash Rack Headloss Evaluation (Putnam Hydro, Connecticut) – In order to address an agency request for reduced trash rack bar spacing to protect downstream migrating fish, Alden completed an evaluation estimating head losses associated with the existing conditions and for a variety of potential variations. The variations evaluated included: clear spacing (existing 1.5 inch; proposed 0.75 inch), bar profile (square, semi-circular leading edge), an overlay option, and debris loading (0%, 30%, 50%). Some practical design considerations such as commercial availability of bar shapes and typical overlay designs were incorporated into the analysis, as well as in-situ measurements.

Boundary Dam, Pend D'Oreille River (Seattle City Light, Washington) – Alden was contracted to provide consulting services to evaluate the production of Total Dissolved Gas (TDG) and options for mitigation in support of the FERC relicensing efforts. The hydrologic and water quality data were analyzed and a study plan was developed for field data collection to identify optimized operations for minimizing TDG production. A physical hydraulic model was used to simulate the Project spillways, low level outlets, and plunge pool area. Modifications to the model were made to minimize the amount of air entrainment. A CFD model was also used together with a TDG prediction program to guide design revisions.



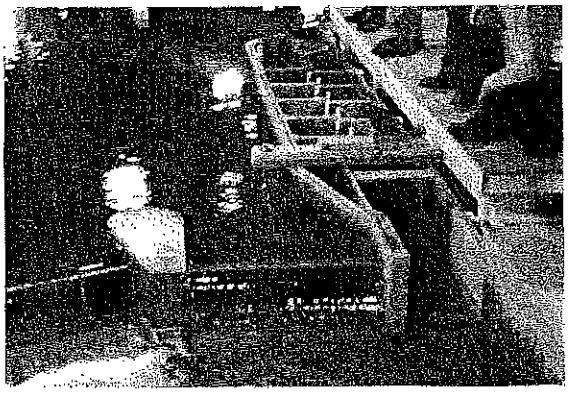
Computational model of a fish guidance structure and bypass proposed for a hydropower project

Cabinet Gorge Dam, Clark Fork River (Avista Corporation, Idaho) – Alden was contracted to develop a bypass tunnel design and physical model that will minimize total dissolve gas (TDG) production in the spillway of the Cabinet Gorge Hydroelectric Development Project. The physical model is being used as a tool to investigate various configurations of the bypass tunnel outlet that would minimize TDG production. Alden also provided input to and consultation on CFD modeling of the tunnels as part of the design development and performance assessment.

DESIGN OF HYDRAULIC STRUCTURES

Robertsville Hydropower Station, New Canal Head Gates (First Light, Connecticut) – Alden completed the design of two new canal head gates at the Robertsville Hydropower Station. This included calculation of gate operating loads, preparation of fabrication drawings, development of technical specifications, review of shop drawings, and preparation of as-built drawings.

Scotland Station Trash Rack Structure Design (First Light, Connecticut) – Alden developed the design of a support structure that was needed for a new trash conveyor at the intake structure of the Scotland Hydroelectric Project. The design effort included the evaluation of the existing support structure for the loads of the new structural components and conveyor, preparation of drawings to fabricate and install the new structure, technical specifications, review of shop fabrication drawings, technical support during fabrication and installation, and preparation of as-built drawings at the completion of installation.



Hydraulic model of a hydro project spillway and fish ladder

Falls Village Station Log Handler Design Review (First Light, Connecticut) – Alden performed a design review that included an initial structural assessment and design refinements, a site visit, a review of existing site drawings, a structural evaluation of associated structures, and working with the equipment supplier to finalize a workable design.

Robertsville Canal Head Gate Design (First Light, Connecticut) – Alden designed new head gates for the inlet canal at the Robertsville Hydroelectric Project. The scope or work included an initial site visit to obtain field dimensions and design information, calculation of gate operating loads, preparation of drawings to fabricate and install the new gates, technical specifications, review of shop fabrication drawings prepared by fabricator, and preparation of as-built drawings at the completion of installation.

Flow Induced Vibration Mitigation (Confidential Client, Pacific Northwest) – Alden evaluated vibration problems of a turbine unit and advised the manufacturer on a methodology for conducting scale physical and CFD modeling designed to resolve the issue.

Hadley Falls Exclusion Rack Design (Holyoke Gas & Electric, Massachusetts) – After completion of a 30% design by others, Alden developed a revised fish exclusion rack and downstream bypass design that reduced costs by 60%. The rack and bypass are intended to primarily protect ESA-listed shortnose sturgeon from entrainment into

Hadley Units 1 & 2, but are also expected to provide downstream passage for several other migratory species (blueback herring, American shad, and American eel). The scope of work for this project included development of a less costly alternative rack design, determination of a preliminary velocity distribution for the alternative design using CFD modeling, and conducting interviews with industry experts regarding the design and constructability.

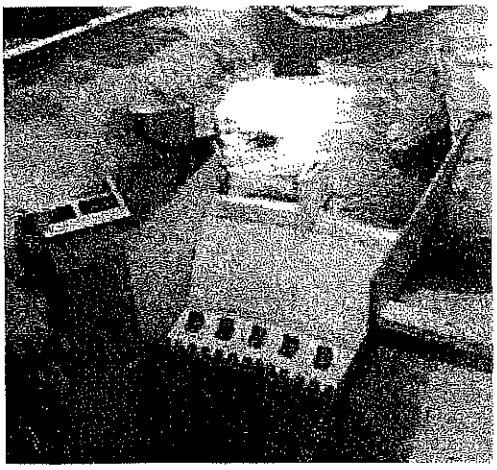
SPILLWAY SAFETY

Canton Dam Emergency Spillway (Hydroplus, Oklahoma) – Alden conducted an integrated numerical and physical model study of a proposed spillway system to ensure that it could safely discharge the PMF. Based on the modeling results, a favorable design was selected, constructed, and tested.

Oahe Emergency Spillway Erosion and Stability Analysis (USACE, South Dakota) – Alden performed geotechnical investigations, erosion analyses, and structural stability analyses for the Oahe emergency spillway and downstream unlined trapezoidal channel. This work featured erosion analyses for a series of hydrographs. The study results revealed that cutting could reach the apron for several flow conditions.

Folsom Dam Auxiliary Spillway, California – Alden developed a CFD model to determine the horizontal forces on each step of a proposed stepped spillway. The model results included shear stress along the top and face of each step and the pressure distribution on the steps. Validation of the numeric model was provided through a comparison with experimental data collected at St. Anthony Falls Laboratory in a 1:26 Froude Scale physical model. This work was sponsored by the Biedenharn Group and the USACE.

Smith Mountain Dam Spillway, Virginia – Smith Mountain dam is an existing structure for which the PMF was recently re-calculated and found to be greater than the design flow. The dam has two discontinuous flip bucket spillways that were evaluated in a physical model by Alden in 1959, prior to construction. Alden recently used a CFD model to predict the spillway performance at flows the exceeded the original design flow. After validating the CFD model with the 1959 physical model results, the CFD model was used to predict the change in flow trajectory onto the apron, showing that cavitation or erosion were unlikely to occur.



Spillway hydraulic model

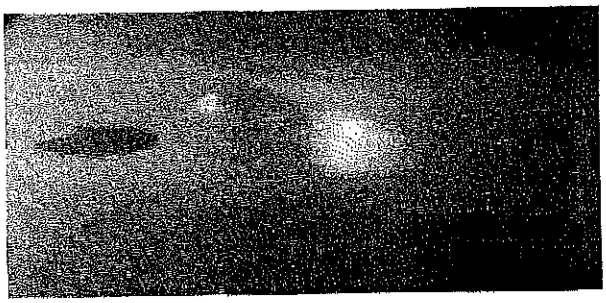
NEW TECHNOLOGY TESTING AND DEVELOPMENT

DOE Sponsored Model Turbine Performance Testing (Confidential Client) – Alden completed performance testing for a new low head turbine concept. Testing included measuring head, flow, power, and speed over a variety of design points to assess performance.

Fish Friendly Turbine Development (DOE, EPRI) – Alden developed the Alden fish-friendly turbine with support from DOE, EPRI, and the hydropower industry. The turbine is designed to reduce or eliminate injury and mortality of entrained fish. Alden developed the conceptual design, conducted pilot-scale biological testing, and performed CFD modeling to improve power performance without comprising fish-friendliness. The Alden turbine has been licensed to Voith Hydro and is commercially available.

FIELD PERFORMANCE TESTING

Lay Hydroelectric Station (Southern Company, Alabama) – Alden conducted flow measurements for a 32-MW turbine. Flow rates were calculated by integrating the velocity distribution at two gate slots upstream of the unit. The velocity distributions were measured by sixteen Ott type A current meters. Individual racks of eight current meters were simultaneously traversed vertically in each of two separate intake slots.



Rainbow trout entering the runner of the Alden fish-friendly turbine during pilot-scale laboratory testing

Dietrich Drop Hydroelectric Station (Hydro West Group, Inc., Idaho) – Alden conducted turbine efficiency testing for a 6-MW Francis unit using the dye dilution method for measuring flow.

Karriba Dam (Zambezi River Authority, Zimbabwe) – Alden used the dye dilution flow measuring method to calibrate Winter-Kennedy taps of three 170 mw units at a hydro project in Zimbabwe. The purpose of the tap calibrations was to allow their use as flow meters and flow loggers when combined with a computer-based recording system.

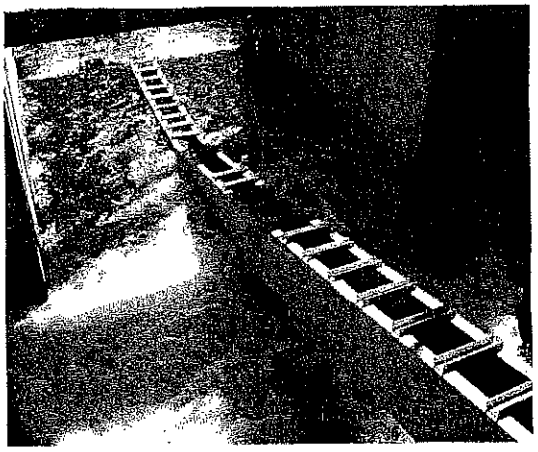
DUE DILIGENCE STUDIES

Buyer in Northern New England (Confidential Client) – Alden staff completed a due diligence review of a hydroelectric project on behalf of a potential buyer. The focus of the review was on civil structures including the dam, powerhouse, water control features, hydraulics, tailrace, and site access. Assessments of the turbines, electrical, and control system were made as well.

Review of Applications for the Massachusetts Clean Energy Center (MassCEC) – Alden reviewed applications that were received in response to a MassCEC Hydropower Program Solicitation. This effort included reading and understanding the solicitation and application forms as well as reviewing the goals of the Commonwealth Hydropower Program (CommHydro). Alden also reviewed unsolicited applications and advised the MassCEC on applicability to the CommHydro Program.

Review of Oak Ridge National Laboratory's Report to Congress on In-Conduit Hydropower Development Opportunities (BCS Incorporated, Locations throughout the U.S.) – Alden conducted a technical report review and provided ORNL with comments on a report prepared for in-conduit power developments. Comments were based upon Alden's experience in evaluating feasibility for hydropower development at water treatment and distribution facilities.

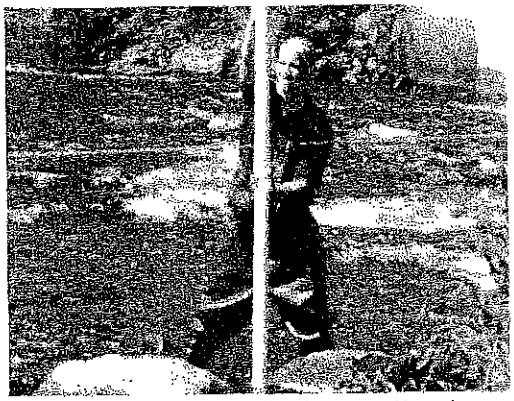
FISH PASSAGE DESIGN



Steeppass fish ladder designed by Alden for passage of river herring

Howard Hanson Dam Fish Passage Facility, Green River (USACE, Washington) –Alden conducted CFD and physical modeling to refine the design of a downstream fish passage facility at a flood control dam. The reservoir was simulated using STAR-CD CFD software in order to determine the upstream boundary location and conditions for the ensuing physical model study. A 1:15 scale physical hydraulic model of the fish passage facility was developed and used to investigate overall performance. A 1:8 scale physical hydraulic model was also constructed and used to develop an acceptable fish screen design.

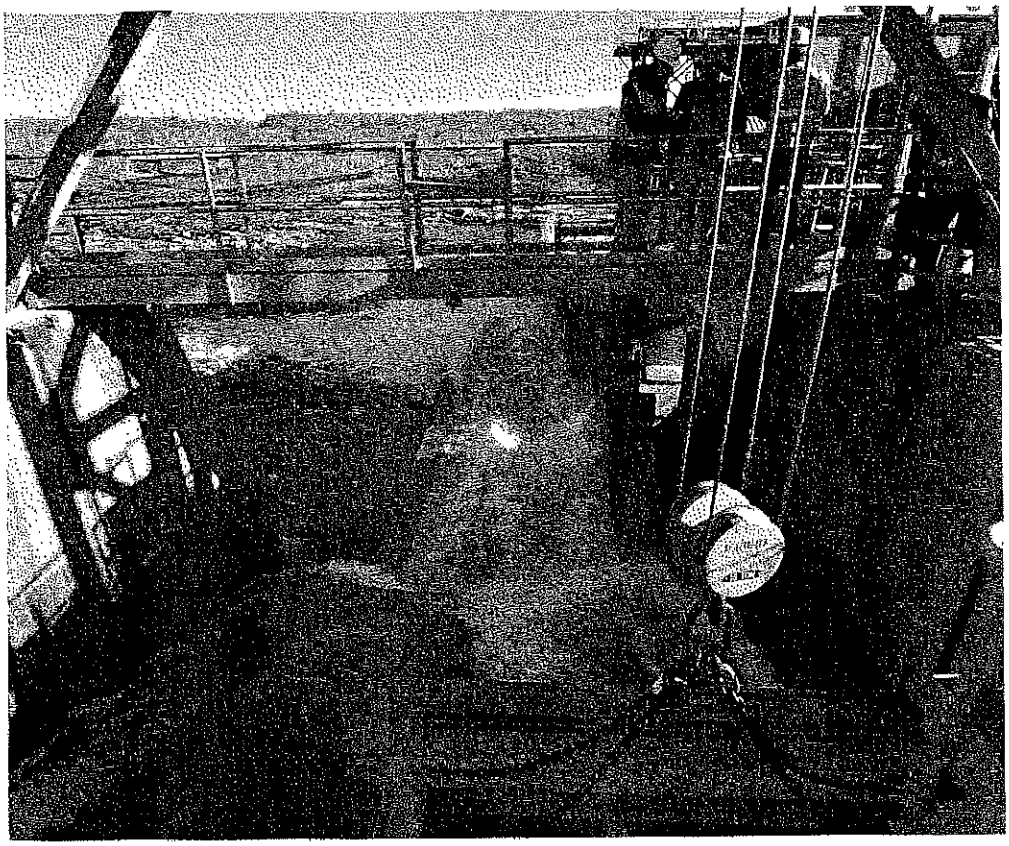
Development of a More Effective Approach Channel to Existing Fish Lift Entrances (PPL Holtwood, Pennsylvania) – A major generation upgrade at the Holtwood Hydroelectric project doubled the flow in a combined tailrace and fish channel leading to an existing fish lift at the upstream end of the channel. Fish passage efficiency of the fish lift was considered poor due to unsuitable hydraulic conditions for the target species (American shad). The main objective of a CFD study performed by Alden was to improve fish passage with double the flow in the tailrace due to the increase in generation. This was achieved by developing tailrace excavation geometries that would allow for a contiguous and sufficiently low velocity path along one side of the channel leading to the fish lift entrances. This fish path was designed using the CFD model to meet agency criteria for maximum velocity and minimum flow width and depth criteria for American shad. Numerous tailrace excavation scenarios were explored within the constraints of excavation equipment.



Instream flow study data collection

Modifications to a Fish Ladder (confidential client) – Alden performed detailed CFD simulations for the portion of a fish ladder that was designed to pass fish from a power canal into the project's impoundment. The CFD model was used to understand the present conditions and to develop possible changes to the ladder design that would result in more favorable flow conditions for fish passage. Initial simulations of existing conditions were made to verify the efficacy of the CFD model. Modifications to the attraction flow system were also developed as part of an additional weir concept to control flow quantities in the ladder and at the fish entrance in the power canal. Flow

patterns in the power canal were studied to evaluate whether more fish could be attracted to the ladder entrance.



Inspection of downstream fish passage facilities conceptually designed and computationally modeled by Alden for the Hadley Falls Hydroelectric Station on the Connecticut River

HERITAGE SURVEYS, INC.

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GENERAL BACKGROUND INFORMATION

January 1, 2014

Heritage Surveys, Inc., was established as a Land Surveying firm in October 1975, and has grown from a few to approximately fifteen full time employees. The firm is located in a building at the corner of College Highway (Route 10), and Clark Street, in Southampton, MA. The building has been recently upgraded and expanded to approximately twice its original size, to accommodate a steady increase in growth of the surveying business. Some of the services provided include:

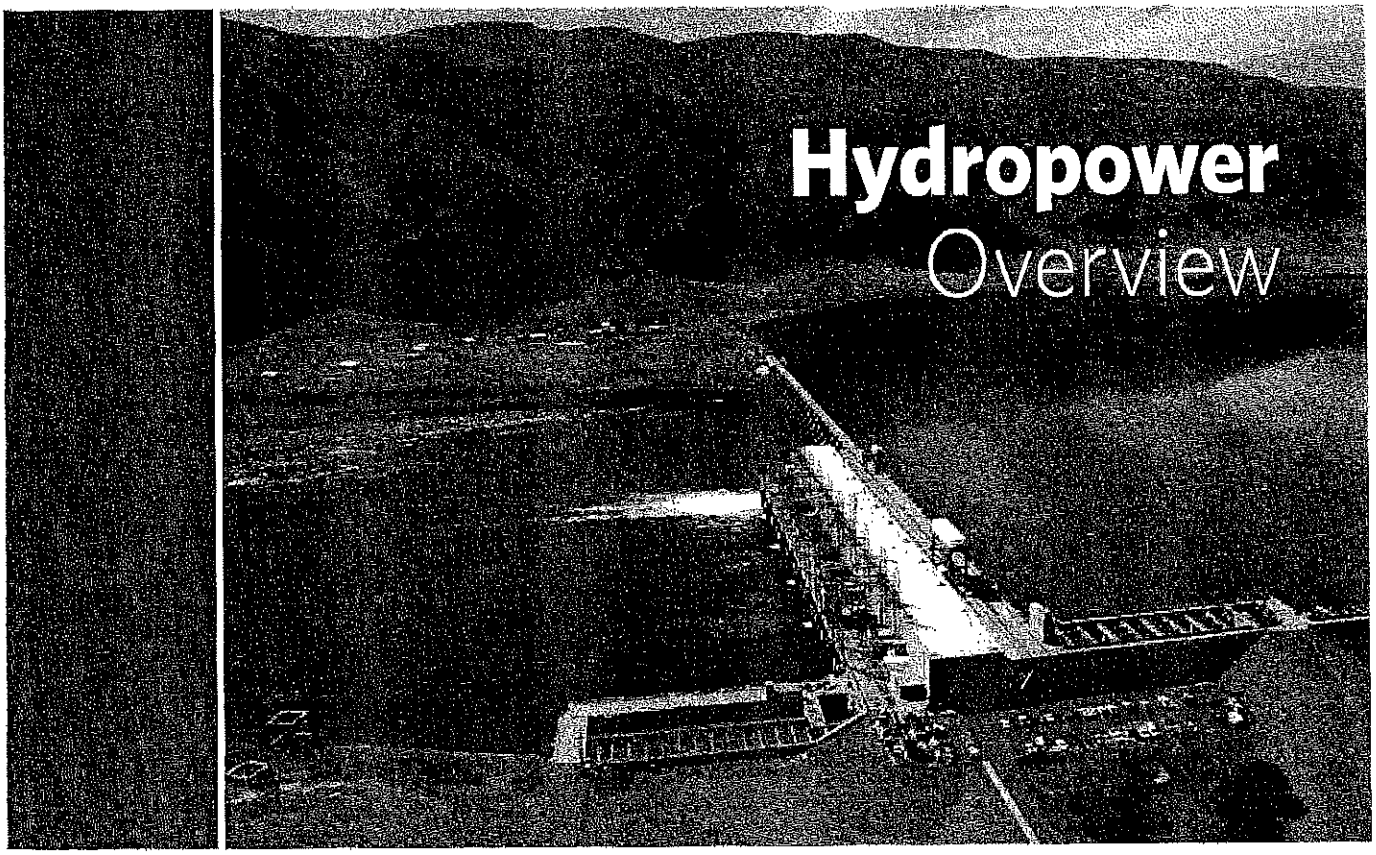
- Residential, Commercial, & Municipal Surveying and Engineering
- CAD design for Architects & Engineers
- Engineering design for Roadways, Subdivisions, and Individual Sites
- Mortgage, Title Insurance, & Land Court Surveys
- Deed Studies & Historical Research
- Soil Evaluation & Percolation Testing
- Wetland Identification and Permitting

Most employees have worked at Heritage more than fifteen years, with several having more than 25 years of service. There is very little turnover of employees and many clients appreciate the continuity of service and the ability to work with the same persons over long periods of time. Building from an established base of information for individual projects often provides time and cost savings that would not otherwise be possible.

Heritage works cooperatively with other consultants and professionals working as architects, engineers, attorneys, landscape architects, foresters, photogrammetrists, and environmental professionals. Heritage will frequently pull together a team of professionals that they work with often, and will provide comprehensive supervision and coordination of all services for a particular project. In this way, Heritage is able to augment in-house capabilities with other professionals that are experienced and qualified in their areas of expertise.

Heritage has been on the leading edge of technological improvements since founded. It is one of the first firms to use and become proficient with AutoCAD and Softdesk computer software. For many years employees have been obtaining field measurements of angles and distances electronically, and downloading the data into a state of the art networked computer system. Extensive Windows NT based software used for the business operations of the company is interfaced with the surveying software for the free exchange of electronic mail and document text when required. Employees have undergone training courses in the use of field and office equipment, and regularly attend courses and seminars to keep abreast of the latest improvements. Heritage received several winning awards in the Cadastral Survey, Title Insurance Plan, and Engineering Site and Subdivision Plan categories, at the Massachusetts Association of Land Surveyors Conventions in recent years. Additional information can be found at the heritagesurveys.com website.

HDR



Hydropower Overview

At HDR, we offer comprehensive expertise to maximize your existing or potential hydropower resources. Our ability to craft innovative and flexible options for a successful and balanced energy portfolio is what sets us apart.

You can be confident knowing you are working with an industry leader in hydropower and complementary renewable solutions. Our multi-disciplinary teams combine the specialized technical hydropower expertise and industry leadership with the full range of engineering, environmental and consulting services. From large 2,000 MW projects to micro-hydro applications of several kilowatts, we understand how to keep your hydropower project operating at the highest levels of performance while minimizing operating cost and risk.

The combined HDR dams and hydropower business practices include more than 300 engineers, scientists and regulatory specialists who are focused on the challenges of hydroelectric and dam development, design, modernization and/or rehabilitation, and operation. These include some of the most experienced and capable hydroelectrical, mechanical, geotechnical, structural, hydrologic/hydraulic and I&C engineers, aquatic and terrestrial scientists, and project management professionals in the industry. The average industry experience of our staff is approximately 20 years. Our experience can minimize much of the effort in planning and design; with our level of depth and in-house expertise, HDR is able to provide cost-effective and value driven solutions well beyond the scope of traditional engineering and consulting firms in a cost-efficient manner.

Services

From greenfield studies to plant start-up, we offer a complete suite of services for your new or existing hydro project:

- Site reconnaissance and feasibility studies
- Environmental and regulatory support
- Detailed engineering and design
- Construction management

Expertise

Engineering Services

We offer a full range of hydroelectric engineering and construction management services provided by technical professionals with solid experience, using either a traditional or EPC model including:

- Civil
- Structural
- Electrical
- Geotechnical
- Hydro-mechanical
- Hydraulics and hydrology

Environmental Sciences

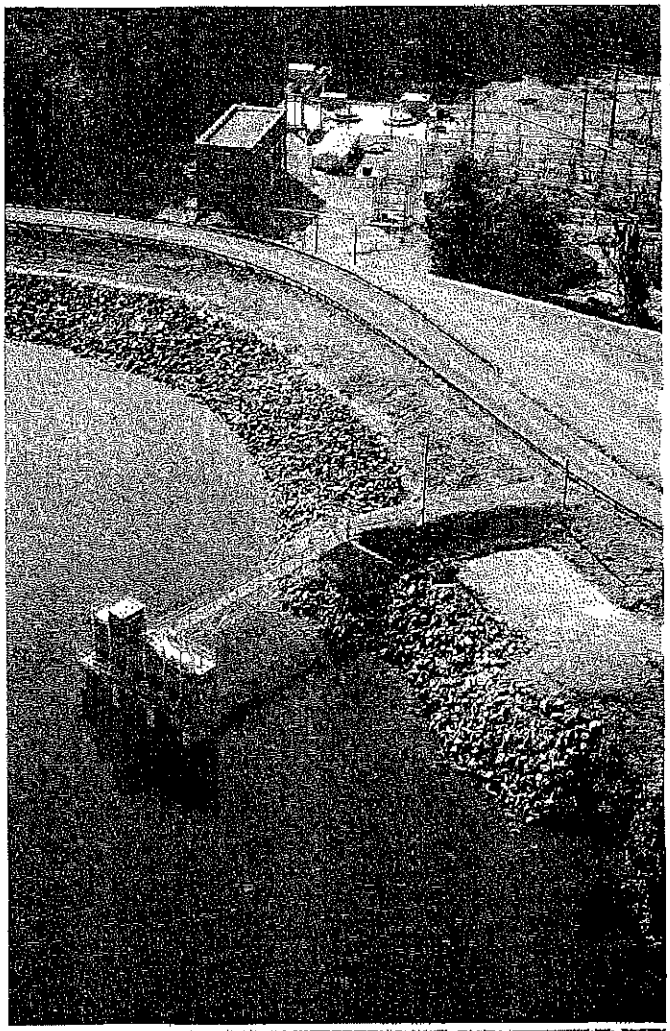
Our environmental expertise covers a wide range of disciplines to meet all planning, permitting and resource analyses needs, with specialties including:

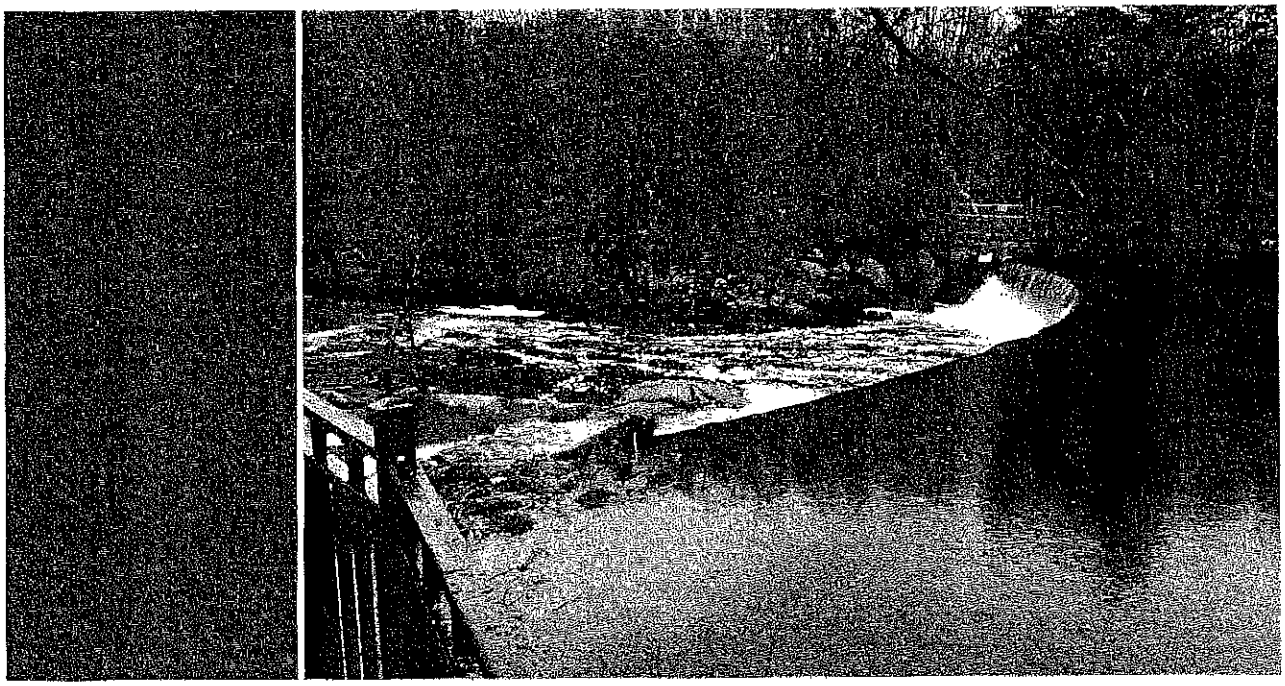
- Aquatics and fisheries
- Terrestrial and wildlife
- Water quality
- Instream flow
- Rare, threatened and endangered species
- Wetland assessment and mitigation
- Recreation studies and facilities design
- Visual assessment

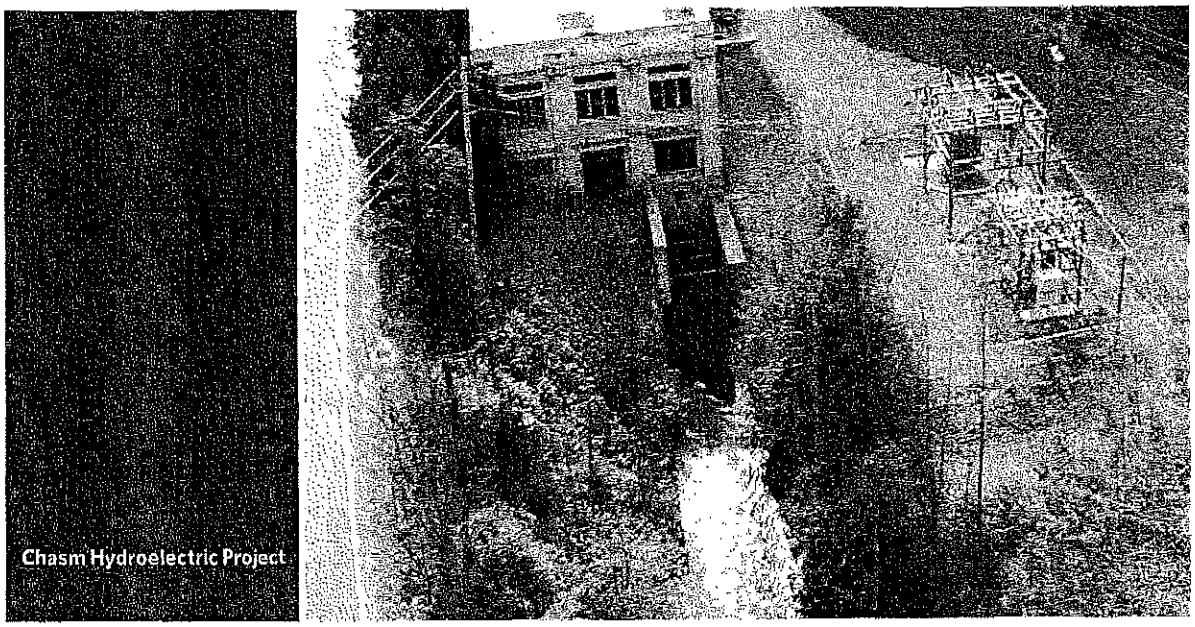
Regulatory Support

Our participation in over 110 project licensings over the last 10 years, representing more than 11,000 MW of installed capacity, translates to a skillful understanding of the complex and rapidly changing regulatory climate. We have extensive experience with all of the Federal Energy Regulatory Commission (FERC) licensing processes, including:

- Traditional (TLP)
- Alternative (ALP)
- Integrated (ILP)







KEY FEATURES

- **FERC TLP process**
- **Strategic planning and lead consultant**
- **NOI and PAD preparation**
- **Agency consultation**
- **Completion of resource studies**

Chasm Project Relicensing

Erie Boulevard Hydropower, L.P. | Franklin County, NY

Erie Boulevard Hydropower, L.P. (Erie) owns and operates the 3.35 MW Chasm Hydroelectric project, located on the Salmon River. The project began operating in 1913 and has operated in a similar manner since that time. The project is licensed by the Federal Energy Regulatory Commission (FERC), and the current license expires on June 30, 2015.

HDR is providing strategic and technical services to relicense the project under the Traditional Licensing Process (TLP), including:

- Submitting the Notice of Intent (NOI) to file an application for new license,
- Preparation of the Pre-Application Document (PAD), and
- Conducting the Joint Agency/Public meeting required by the TLP.

HDR prepared and is currently maintaining an overall relicensing project schedule to ensure regulatory activities and deadlines are met. To assist in developing the NOI and PAD, HDR generated and distributed questionnaires to interested parties to help identify sources of existing, relevant, and reasonably available information outside of Erie's project documentation.

HDR also prepared a two-volume PAD, which provided substantial information relevant to the project including background, relicensing process and schedule, operations, engineering, environmental and natural resources, recreation, cultural resources, and socioeconomic resources.

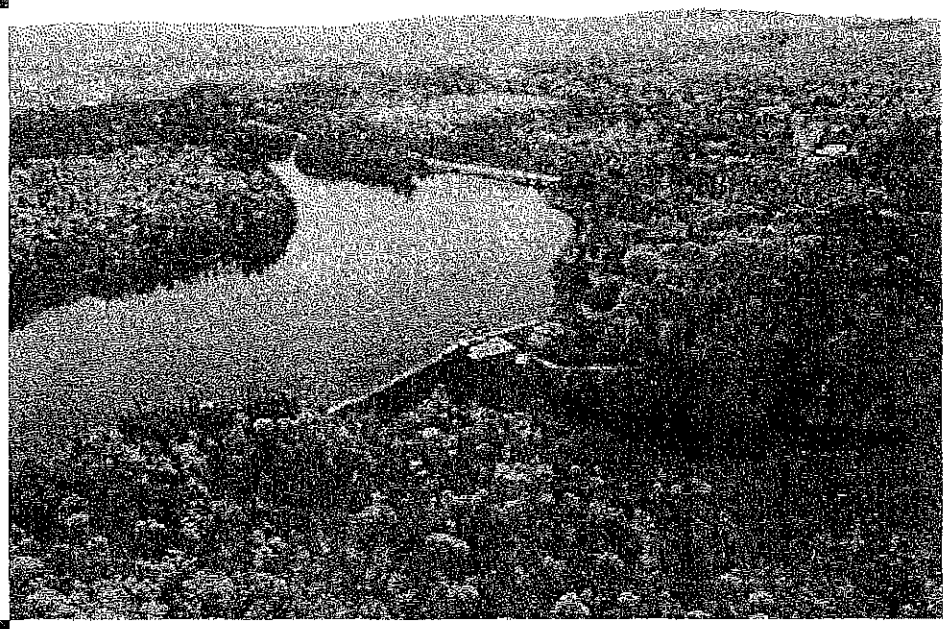
The NOI and PAD were submitted to the FERC in June 2010, followed by a Joint Agency/Public meeting in September 2010. Resource studies were performed in 2011, and study reports were issued to stakeholders in 2012. The Draft License Application was submitted in March 2013, and the Final License Application was filed with FERC in June 2013.

Erie Boulevard Hydropower is a wholly owned subsidiary of Brookfield Renewable Energy Group.

HDR

KEY FEATURES

- Project includes six powerhouses
- FERC ILP process
- Lead consultant
- Agency consultation, field studies and license application preparation
- Key issues included impoundment fluctuation and water quality



Oswegatchie River Hydroelectric Project

Oswegatchie River Project, Strategic Planning and Relicensing

Erie Boulevard Hydropower, L.P. | St. Lawrence County, NY

Erie Boulevard Hydropower, L.P. owns and operates the 30.32 MW Oswegatchie River Hydroelectric Project, located in upstate New York in the St. Lawrence River Watershed. The project comprises six developments, including Browns Falls, Flat Rock, South Edwards, Oswegatchie, Heuvelton and Eel Weir. The project is licensed by the Federal Energy Regulatory Commission (FERC), and was facing a license expiration of December 31, 2012.

HDR provided strategic and technical services under the Integrated Licensing Process (ILP) to relicense the project. This included:

- Submitting the Notice of Intent (NOI) to file an application for new license;
- Preparation of the Pre-Application Document (PAD) and study plans;
- Assistance in developing an online public library;
- Completion of resource studies, including fisheries, macroinvertebrate, Common Loon, Bald Eagle, invasive species, and wetland surveys; water quality, fish protection/passage, and Delphi studies; and historical/cultural resources and recreation needs assessments; and
- Participation in client, stakeholder, resource committee, and settlement agreement meetings.

HDR prepared and maintained an overall relicensing project schedule to ensure regulatory activities and deadlines were met. To assist in developing the NOI and PAD, HDR generated and distributed questionnaires to interested parties to help identify sources of existing, relevant, and reasonably available information outside of Erie's project documentation. The resulting two-volume PAD provided substantial information relevant to the project.

The NOI and PAD were submitted to the FERC in December 2007. The Preliminary Licensing Proposal was filed in August 2010, and the License Application was filed in December 2010. Additional filings included a Historic Properties Management Plan, a Recreation Management Plan, an Invasive Species Management Plan, and applicable Supporting Design Reports.

In addition, HDR developed revised Exhibit F and G drawings, and drafted the Settlement Agreement among the project Stakeholders.

Hydropower Consulting Specialists

HCS's sole focus is on assisting hydropower and dam Owners with safe and efficient operation of their projects maximizing value while addressing regulatory needs. HCS was founded in April 2015 by Celeste N. Fay; however, Ms. Fay's experience and connections in the hydropower industry are extensive. Ms. Fay is second generation hydropower engineer and Owner and can provide expertise in the following areas:

- Licensing & Relicensing
- Hydrologic & Hydraulic Evaluations
- Regulatory Reviews for Compliance
- FERC Authorization
- Data Analysis
- Cost Estimating
- Energy Modeling
- Financial Analysis
- Turbine Procurement
- Turbine Inspection
- Fish Passage

Ms. Fay's early years in hydropower were typically field oriented, assisting William K. Fay, P.E. with dam safety inspections, surveys and equipment inspections. She spent several years working as a hydropower/turbine mechanic for Swift River Hydro providing a solid base knowledge of the practical workings of hydropower. Upon graduation with a civil engineering degree, Ms. Fay joined GZA GeoEnvironmental for several years working on hydropower project development, FERC licensing & compliance, H&H modeling and dam inspections. Following her time at GZA, Ms. Fay spent several years as a lead engineer and project manager at the Alden Research Laboratory working on fish passage and protection design, resource evaluations, turbine performance testing and hydraulics. In addition, she was the lead engineer on a variety of research related documents such as a fish friendly turbine market study of New York State for the New York State Energy Research and Development Authority (NYSERDA) and the development of an in-conduit guidance document and screening tool for the State of Massachusetts. HCS and Alden also recently teamed on the development of an in-conduit hydropower guidance document for the Electric Power Research Institute (EPRI).

Ms. Fay has worked on turbine performance testing, vibration analysis due to flow induced vibrations, pumped storage projects and a variety of other hydropower related tasks. Throughout this time, she has also been the Owner of several small hydropower projects

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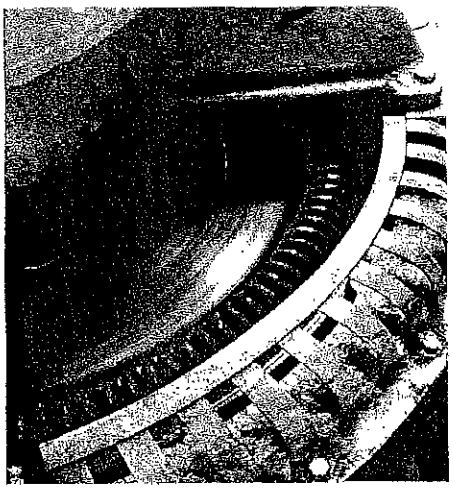
ranging from 100-800 kW in New England. Ms. Fay's experience as a hydropower Owner gives her a unique insight into the challenges associated with hydropower generation.



HCS is assisting several hydropower Owners in New England with tasks such as the addition of minimum flow turbines to increase generation, regulatory & compliance issues, new project development, FERC licensing/relicensing, energy modeling, replacement of mechanical components, and condition assessment. Each job that HCS takes on is more than just consulting; it is a personal challenge to make the project successful and the Owner excited to be part of the industry.

Ms. Fay works with a solid team of hydropower engineers including Mr. William K. Fay, P.E bringing HCS's combined hydropower experience to over 50 years. In addition, all HCS staff engineers personally own small hydropower projects in New England bringing a unique experience and skill set to the industry.

GZA

Proactive by Design

Section 4.

Professional Personnel

PROFESSIONAL PERSONNEL

Key to providing successful professional services is the quality and experience of the team of personnel proposed to work for the City. GZA considers the caliber of our team members to be our number one qualification. Following are the resumes of those individuals with a minimum of 10 years' experience who are proposed to be assigned to work for the City.

Note that Thomas E. Jenkins, P.E. is GZA's proposed Project Manager and Principal-in-Charge and the prime contact for the City for all assignments. For the past 23 years, Tom has interfaced with the City on a regular basis and best understands the City's personnel, project deliverable expectations, and GZA team capabilities for each assignment.

Not only must individuals have the highest level of professional expertise, they must also be able to successfully collaborate in house as well as with the City. Most key individuals have in fact worked together for many years on numerous successful endeavors and know well the value of team participation toward the ultimate goal of a successful project and a pleased clientele.

Our personnel, as well as our firm as a whole, have a proven track record for interpreting, organizing, executing, budgeting, and coordinating assignments from the very complex to the basic. If selected, we will maintain this level of performance with a focus on communicating the findings and status of our technical services in a timely and concise manner.

RESUME

Thomas E. Jenkins, P.E.

Associate Principal

Summary of Experience

Mr. Jenkins is a civil engineer who serves as an Associate Principal and engineer for GZA, with a focus on projects involving natural and water resource protection, development, and restoration. His extensive background has provided both design and construction experience, with wide exposure to all aspects of civil engineering. This experience record has included the design and construction of commercial, industrial and municipal infrastructure systems and their respective components, especially for water conveyance. Other significant project experience includes dam reconstruction especially historic restoration, levee investigations, channel stabilization and improvement works, flood control facilities, freshwater dredging, stormwater systems, water supply facilities, and in-lake recreational structures.

Education

B.S., 1982, Civil Engineering, Georgia Institute of Technology

Registrations & Certificates

2001, Connecticut,
Professional Engineer, # 22349
1992, Massachusetts,
Professional Engineer, # 36450

Affiliations

- American Society of Civil Engineers
- Boston Society of Civil Engineers
- Association of State Dam Safety Officials
- North American Lakes Management Society

Areas of Specialization

- Land Development
- Freshwater Hydraulic Dredging
- Freshwater Mechanical Dredging
- Stormwater Management
- Hydrologic/Hydraulic Modeling
- Flood Control and Protection
- Historic Dam Restoration
- Water Resources Engineering
- Construction Cost Estimation

Relevant Project Experience

Principal Engineer, Watershops Pond Dam Hydroelectric Project Preliminary Resource Assessment, Springfield, Massachusetts. GZA was engaged by the City of Springfield to assess the potential for renewed hydroelectric generation potential at the Watershops Pond Dam on the Mill River. GZA visited the site and the former the powerhouse, which is located on private property. In order to avoid complex property issues, GZA proposed an alternative design involving the construction of a new freestanding powerhouse downstream of the dam. GZA prepared power and energy generation estimates and assessed preliminary financial returns for the project. GZA was then asked to prepare a Preliminary Permit Application for the site on behalf of the City, which was accepted by FERC in 2016.

Consultant Reviewer, Report on Permitting Small and Low Impact Hydropower Projects in Massachusetts. GZA was contracted by the Commonwealth of Massachusetts Department of Energy Resources to prepare a report on Permitting Small and Low Impact Hydropower Projects in Massachusetts. This report was commissioned at the request of the Legislature and summarize the permitting and licensing process for small hydropower project. It also compared state and federal systems for designation of low impact hydropower. As part of the study, GZA prepared and circulated a survey among a large group of hydropower stakeholders in the Commonwealth to gather feedback on government processes. The report examined net metering issues and the state RPS standards for hydropower. GZA also prepared a preliminary estimate of the generation potential at former mill sites throughout Massachusetts.

Principal Engineer, Camp STAR Angelina, Springfield, Massachusetts. GZA provided site civil engineering and landscape architectural services for the development of the new swimming pool, bathhouse, and camp infrastructure project, completed in 2015. The swimming pool includes a zero entry interface for full accessibility along with multiple waterspray play features interspersed throughout the shallow end. Site development elements include multiple rain gardens and other low impact development practices, water distribution systems for fire protection and domestic supply, sanitary sewage collection and pumping station, new electrical infrastructure for the camp, site lighting, and communications. In addition to the rain gardens, landscape elements include accessible parking and walkways, outdoor seating, picnic grove, and grass pavers for intermittent vehicular access to the

RESUME

Thomas E. Jenkins, P.E.

Associate Principal

bathhouse. The $1.8M project was funded by the Commonwealth of Massachusetts through the state's Signature Urban Park Program, numerous community businesses, parents and friends of Camp STAR Angelina, and the Springfield Council for Cultural and Community Affairs. Camp STAR Angelina offers inclusive recreational programs for youth and young adults (ages 3-22) with and without disabilities.

Principal Engineer, Remembrance Garden within Forest Park, Springfield, Massachusetts. Landscape improvements, plantings, and signage commemorating the 1916 Easter Rising of the Irish Volunteers and the Irish Citizen Army. The park improvements included accessible walking trails, seating, and tributes patterned after the Garden of Remembrance in Dublin, Ireland.

Principal Engineer, Development of North Riverfront Park, Springfield, Massachusetts. This new municipal park is located on the shores of the Connecticut River with a direct connection to the Connecticut River Walk and Bikeway. The passive recreation park is adjacent to City property leased by the Pioneer Valley Riverfront Club, a center for rowing, kayaking, canoeing, dragon-boat paddling and biking on the river. The project includes a fitness trail with exercise stations along Riverside Road and the River Walk. GZA's accessible designs feature a new gazebo, trellis overlook adjacent to the river, site lighting, open lawn and turf areas, plantings, benches and picnic tables, and landscape irrigation. Paving was reduced to minimize development impacts and low impact development stormwater management was employed throughout. GZA coordinated closely with the U.S. Army Corps of Engineers to obtain Section 408 approval to modify the adjacent federal flood control works to allow for the connecting ramps to the River Walk and Bikeway atop the Connecticut River levees.

Principal Engineer, Redevelopment of Nathan Bill Park, Springfield, Massachusetts. This park redevelopment project was partially funded by a Community Development Block Grant and featured new parking facilities, a new waterspray playground, improved picnic and pedestrian facilities, rehabilitated basketball courts and tennis courts, irrigation through-out the multi-ballfield park, and a new walking trail providing a 3,000 linear foot loop around the neighborhood park. In addition to the site civil and landscape design services, GZA pro-vided the services of our Licensed Site Professional to allow for construction within an Activities Use Limitation regarding portions of the park previously impacted by solid waste disposal.

Principal Engineer, New Outdoor Amphitheater at Camp STAR Angelina, Springfield, Massachusetts. GZA provided site and landscape design services and permitting for a new outdoor amphitheater providing intimate seating for up to 200 guests. The amphitheater is fully accessible and inclined walkways provide accessible routes to all three of its levels, surrounding an open fire pit and performance stage. Landscaping features include plantings, site lighting, and pedestrian walkways.

Principal Engineer, Development of Mary Troy Park, Springfield, Massachusetts. GZA provided site civil engineering and landscape architectural design services for this new municipal park, funded through the Commonwealth of Massachusetts Parkland Acquisitions and Renovations for Communities (PARC) grant program in combination with Community Development Block Grant funds. The project redeveloped a vacant brownfields lot into a new neighborhood park adjacent to a new senior center and offers a variety of recreational opportunities to meet the diverse needs of the neighborhood. Site improvements are universally designed to provide engaging features for people of all ages and abilities and exceed ADA accessibility requirements. A series of freestanding play structures and exercise equipment positioned along a central pathway and within pockets encompassed by paved travel lanes allow users to actively engage in recreational amenities within the park. Each pocket area has either a wood fiber or rubberized safety surface that meets safety and accessibility standards. Additional amenities, such as a drinking fountain, trash receptacles, bike rack, benches and LED site lighting aid patrons in their use of the park. Park improvements include a patio area with picnic tables and gaming stations, eight park benches, a sensory garden planting, a waterspray splash pad, playground unit (ages 2-5 year olds), swing set, a fit course, lawn areas, new sidewalks, and new lighting. New plantings throughout the park include a variety of dogwoods, crabapple, honey locust, tulip poplar, ginkgo biloba, and a variety of shrubs and perennials (roses, rhododendron, boxwoods, etc.).

Senior Project Engineer and Consultant/Reviewer, Flood Control Works, Floodwall Repair Project, Chicopee, Massachusetts. Developed contract plans and specifications to reconstruct deteriorated portions of the existing floodwalls that exhibit surface and deep delamination, structural cracking, and the need for expansion joint resealing. Work

Thomas E. Jenkins, P.E.

Associate Principal

also includes modifications to an existing bridge to allow for the decommissioning of a stop log closure structure, thus facilitating flood control operations and significantly reducing maintenance requirements.

Principal Engineer, Rehabilitation of Benedict Pond Dam, Great Barrington, Massachusetts. Benedict Pond Dam was originally constructed by the CCC in the 1930s and is located within Beartown State Forest in Great Barrington. This project addressed deficiencies at the dam in order to raise the condition of the dam to from Very Poor to Good. The dam rehabilitation project included: reconstruction of The 530±foot long concrete masonry dam; raising the elevation of the top of dam to increase spillway capacity to accommodate the Design Flood; removal of large trees and regrading of the earthen embankment sections; replacement of the original spillway walkway with a new handicap-accessible walkway; replacement of the low-level outlet slide gate and controls; and relining of the low-level outlet pipe.

Principal Engineer, New Elias Brookings School, Springfield, Massachusetts. Mr. Jenkins was lead engineer and project manager for all site environmental, geotechnical, civil engineering, and landscape design for this new $22M elementary school in an urban setting. Site design included all utilities, grading and earthwork, parking and bus circulation, playfields, play structures, school garden, extensive site retaining walls, and pedestrian circulation and plaza areas. Due to the site's urban history, GZA provided direction to the City in proceeding with an early site preparation program to remove, condition, and replace 5,000 CY of environmentally-impacted urban fill prior to releasing the project for general bids. The old Brookings school was destroyed by a June, 2011, tornado. Under Mr. Jenkins' direction, GZA also performed rapid deployment geotechnical and site civil engineering services to help the City of Springfield establish a new 45,000 sq.ft. temporary school facility open within 12 weeks of the tornado.

Senior Project Engineer and Consultant/Reviewer, Environmental Permitting for Repairs to Connecticut and Chicopee River Flood Control Works, Chicopee, Massachusetts. Coordinated with the Corps of Engineers, Massachusetts Natural Heritage and Endangered Species Program, and MADEP regarding proposed deficiency corrections along the flood control works of two significant river flood protection works involving four separate systems.

Senior Project Engineer and Consultant/Reviewer, Contract Plans and Specifications for Maintenance Deficiency Corrections, Chicopee, Massachusetts. Developed construction contract plans and specifications for maintenance deficiency corrections along the seven miles of USACE-constructed flood control works within the in the USACE Rehabilitation and Inspection Program (RIP). Provided full time construction monitoring during the correction program.

Principal Engineer, Dryden School, Springfield, Massachusetts. Dryden School was heavily damaged by the June, 2011, tornado in Springfield. GZA provided all geotechnical, site civil engineering, and landscape design for the $12M repair and additions to this elementary school. Site design included all utilities, grading and earthwork, parking and bus circulation, landscaping, and pedestrian circulation and plaza areas.

Principal Engineer, New Public Works Facility, Bridgeport, Connecticut. GZA provided the City of Bridgeport with geotechnical and site civil engineering for their new 20,000 sq.ft. public works garage located on City-owned land in an urban setting. GZA provided all geotechnical, site civil engineering, and landscape design including all utilities, grading and earthwork, parking and vehicular circulation, landscaping, and pedestrian access.

Principal Engineer, 118-122 Elm Street, Enfield, CT. Provided site design and planning and zoning permitting services for a 7,800 SF retail building on a 0.89 acre parcel. Project tasks included layout of building and facility parking, site grading, stormwater management, utility coordination, sediment and erosion control, and landscape architecture. The project included a high-level stormwater overflow connection to a CTDOT-owned stormdrain.

Senior Project Engineer, Hadley Corner Retail Center, Hadley, Massachusetts. Mr. Jenkins was the site design civil engineer for this 325,000 SF retail development complex along busy Route 9 in Hadley, Massachusetts, in close proximity to Amherst, MA, and the University of Massachusetts. The designs included approximately 5,200 LF of single- and multi-lane circulatory roads, over 1,800 parking spaces, and complete site utilities and stormwater management systems in full compliance with the MA Department of Environmental Protection's Stormwater Management Policy. The facility water infrastructure included approximately 6,000 LF of 12" ductile iron main, and multiple domestic and fire service lines. Two live connections to the adjacent municipal water supply within Route 9 and Maple Street were also included, along with above-grade

Thomas E. Jenkins, P.E.

Associate Principal

master metering and backflow prevention.

Principal Engineer, Rehabilitation of Dean Pond Dam, Brimfield, Massachusetts. Dean Pond Dam is located within Brimfield State Forest and is owned and operated by the Massachusetts Department of Conservation and Recreation. This project made significant improvements to the earthen embankment dam to address numerous conditional deficiencies. The rehabilitation project included select demolition, repair of the low level outlet slide gate and replacement of the controls, installation of a new trash rack, masonry repairs along the spillway training walls and spillway steps, and regrading of the crest and slopes of the dam.

Principal Engineer, Church Street Culvert Improvement Project, Milford, Massachusetts. Mr. Jenkins led a multi-disciplinary team of professionals in the design and permitting of this sensitive culvert replacement project in a dense urban environment. The Project included a Hazard Mitigation Grant application to the Massachusetts Emergency Management Agency, including a detailed Benefit Cost Analysis. The project was successfully completed using 75% FEMA funding applicable to design, permitting, and construction costs.

Senior Project Engineer and Consultant/Reviewer, Comprehensive Inspection, Chicopee, Massachusetts. Participated in the field review of all earthen levees, flood walls, stop log, and pump stations as well as investigations into toe drains, and gate controlled outfalls throughout the four flood control systems within the City of Chicopee. Provided internal review of draft and final reports. Documentation of findings was based upon the USACE Flood Damage Reduction System Inspection Report standardized forms.

Senior Project Engineer and Consultant/Reviewer, FEMA Accreditation Submission, Chicopee, Massachusetts. Mr. Jenkins has been integrally involved in the overall planning and coordination of the civil, geotechnical, and structural evaluation of the four Chicopee flood control systems for submission to FEMA accreditation. Mr. Jenkins has managed the hydrology and hydraulics analyses of the accreditation submission, including internal flooding analyses for eight pumping stations, wave runup and overtopping potential, and velocity and scour analyses.

Environmental Impact Evaluation for Expansion of Somers Prison, Somers, Connecticut. Mr. Jenkins prepared the stormwater section of the EIE and developed a conceptual stormwater management plan to accommodate additional impervious surface area created by a proposed 720-bed facility and associated parking.

Principal, NPDES Phase II Small MS4 Stormwater General Permit Compliance, Milford, Massachusetts. The Town of Milford contracted GZA early in the 5-year permit term of the *2003 General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (MS4s)* to provide assistance with permit compliance. Mr. Jenkins supervised the preparation of the on-going Stormwater Assessment Program designed by GZA for the Town, and provided quality assurance and control for all aspects of the Program.

Devens Community Stormwater Management Program, Devens, Massachusetts. Mr. Jenkins served as Project Manager and Engineer for this 1.2 million stormwater management program for the Devens planned community or the reuse of Fort Devens Military base. The project included eight regional stormwater management basins designed to address past drainage problems and to compensate for the re-development of Fort Devens. Also included were program components to address environmental degradation caused by past indiscriminate practices at the base.

Senior Project Engineer, Freshwater Pond and Park Restoration Program, Enfield, Connecticut. This project included the dredging of 37,000 CY of accumulated sediments, pedestrian boardwalks and paved walkways, fishing pier, access points for winter activities, landscaping, and structured and hydraulic modifications to the freshwater pond dam.

Silver Lake Dredging Project, Meriden/Berlin, Connecticut. Mr. Jenkins is the Project Manager of the largest inland hydraulic dredging project in New England. Under the direction of the Connecticut Department of Environmental Protection, Mr. Jenkins developed design plans and specifications for the dredging of 600,000 cubic yards of sediment to implement the restoration of this State-owned recreational waterbody.

Project Engineer, Restoration of Nashawannuck Pond. Easthampton, Massachusetts. Conducted base investigations and prepared preliminary designs for the aquatic habitat restoration program in compliance with U.S. Army Corps of Engineers criteria for their Section 206 Aquatic Habitat Restoration funding program. Developed feasibility study and alternatives analysis for different dredging methodologies and sediment dewatering and disposal schemes. Prepared a detailed project report and

Thomas E. Jenkins, P.E.

Associate Principal

Massachusetts. Supervised and provided technical review of the preparation of Industrial SWPPP to comply with EPA NPDES requirements for New Bedford Regional Airport and assisted in SPCC preparation. Project included field review, record review, interviews and stormwater drainage system review, documentation of existing conditions, sediment and erosion control BMP concepts for project site with fine soils likely to require significant BMPs, including use of flocculents, SWPPP preparation, and SPCC assistance.

Senior Project Engineer and Consultant/Reviewer, SWPPP and SPCC Plan for Beverly Municipal Airport, Beverly, Massachusetts. Supervised and provided technical review of the development of a SWPPP for the Beverly Municipal Airport, including field investigation and mapping of stormwater systems, materials inventory, tenant interviews, and document preparation. Provided support on SPCC Plan development.

Project Engineer, Town of Wellesley Stormwater Master Plan Update, Wellesley, Massachusetts. Developed a Town-wide stormwater model, using XP-SWMM software. This work included field observation of over 15 miles of stream corridor and associated stormwater features, water quality sampling and data analysis, and stormwater modeling. This project generated a town-wide model for system capacity and water quality impacts analysis. Based on the model results and field observations, recommendations for system improvements were made.

Senior Project Engineer, Gateway Center Retail Development, Everett, Massachusetts. This project's site design required a sewer pump station and construction of a water distribution main through a tunnel beneath active railroad tracks. The site's complete water distribution system for fire protection and domestic use included approximately 9,000 LF of 8"-12" ductile iron pipe with associated valving, branching, hydrants, and other appurtenances. The site stormwater management facilities included detention basins with created wetlands for water quality treatment and hydrodynamic particle separators for enhanced sediment removal. The site fill requirements resulted in numerous retaining walls at the periphery of the project. The design of the site was constrained by the Activities and Use Limitations (AULs) resulting from the site remediation process. The AULs required that the ultimate development of the site provide a minimum of 6 feet of fill above a "marker layer" which denoted the limit of remediated soils.

Principal Engineer, Western Connecticut State University Master Plan EIE, Stormwater Master Plan, and STC Permit, Danbury, Connecticut. Reviewed EIE, conducted field review of stormwater system and campus layouts, reviewed drainage sections for STC permit and supervised and participated in preparation of Stormwater Master Plan for University and CT DPW use in obtaining Flood Management Certification for Master Planning activities. Worked as part of a multi-disciplinary team to identify existing issues at the campuses and outline potential impacts of proposed future Master Plan development. Stormwater Master Plan required compiling historic drainage plans, conducting field review to observe system, and preparing hydrologic watershed level modeling for two campuses, looking at past, present, and proposed future conditions to present need for detention and stormwater treatment as part of future development.

Principal Engineer, Emmett O'Brien (EOB) Technical High School Drainage Study, Ansonia, Connecticut. Provided oversight for team of engineers and scientists for this project which was a study to review potential causes of erosion downstream of stormwater outfall from EOB School. Project included field review; review of deeds and easements, stormwater system plans, current and historical complaints; interviews with City staff and residents; and watershed documentation. Next phase of project included development of conceptual solutions to address existing erosion and prevent future damage.

Principal Engineer, Central Connecticut State University (CCSU) Dining Hall Stormwater Review, New Britain, CT. Provided oversight for project which included SW peer review of an engineering firm's initial SW design, recommendations for and coordination with Client and Engineer on potential rain garden design and location, and providing regulatory guidance to Engineer.

Mr. Jenkins has served as lead engineer and manager on numerous projects involving floodway determination and floodplain analysis using HEC-2, WSP2, and HEC-RAS. He has over twenty years' experience in watershed and stormwater system modeling with TR-20 and HydroCAD®. Mr. Jenkins has recently led the preparation of several Emergency Action Plans (EAPs) for high hazard dams, including dam break modeling and unsteady flow analysis, using HEC-RAS, HEC-GeoRAS, and HEC-HMS. Currently, he is modeling the potential conversion of two-thousand feet of urban perennial stream, converting a closed conduit drainage system into a fully functioning riparian corridor providing enhanced wildlife benefits and aesthetic appeal for a developing municipal

Thomas E. Jenkins, P.E.

Associate Principal

parkland setting.

As Associate Principal, Mr. Jenkins has worked closely with the municipal, state, and federal agencies in major water resources projects. He has led design and permitting teams for numerous commercial and municipal dredging and drainage projects. Currently, he is the Principal-in-Charge for the hydraulic dredging of Silver Lake in Berlin and Meriden, for Connecticut DEEP, the largest on-going freshwater hydraulic dredging project in New England. Mr. Jenkins was also involved in the study and preparation of the dredging feasibility study and environmental assessment for Milford Pond in Milford, as well as the on-going pond restoration project in Easthampton for the Corps of Engineers, and has designed and managed numerous dredging projects in Massachusetts and Connecticut.

Mr. Jenkins works closely with the public agencies on a variety of projects. He was the design engineer and project manager for the preservation and restoration of the historic marble dam at Natural Bridge State Park in North Adams, a structure featured in the writings of Nathanial Hawthorne. Resulting from that project, his paper on the use of ground penetrating radar to determine the cross-sectional geometry of the historic dam was presented at the 5th International GPR Conference in Kitchener, Ontario. Mr. Jenkins was the project engineer for the reconstruction of Mill Pond Dam in Springfield, MA, a 300-year old structure that is believed to be the oldest dam in Hampden County still in operation.

RESUME

Chad W. Cox, P.E.

Principal/Civil Engineer

Summary of Experience

Mr. Cox has extensive experience in many aspects of civil engineering including dam safety and design, hydroelectric project development, water supply, transportation, and geotechnical construction. In addition, he is also well-versed in the permitting process which accompanies large civil works, having prepared permit applications required by the U.S. Army Corps of Engineers, EPA, NEPA, MEPA, and others as well as hydropower licensing documents for the Federal Energy Regulatory Commission. Mr. Cox has worked on numerous dams performing such tasks as inspection, deficiency evaluation, planning, hydraulic, structural, and geotechnical design, contract writing, contractor submittal review, and construction observation. Mr. Cox's hydropower experience extends the full range from resource evaluations to final design and construction. Before joining GZA, Mr. Cox was with The Benham Group where, in addition to working on dam projects, he was involved in highway planning and design. Mr. Cox served overseas with the Peace Corps for over two years as a water supply engineer. His duties included water system design and repair, extensive interaction with governmental and donor agency officials, and field visits into remote regions of the Himalayas. In 2005-2006, Mr. Cox proposed and facilitated a research trip for MIT graduate students to study water quality issues in Lake Yojoa in Honduras.

Education
B.S.E., 1992, Civil Engineering/Water Resources, Princeton University
M.Eng., 1999, Civil and Environmental Engineering, Massachusetts Institute of Technology

Registrations & Certificates
Professional Engineer – Massachusetts, #45856

Areas of Specialization
- Dam Safety and Design
- Hydropower Engineering
- Water Resources Engineering
- Geotechnical Engineering

Relevant Project Experience

Principal Engineer, Watershops Pond Dam Hydroelectric Project Preliminary Resource Assessment, Springfield, Massachusetts. GZA was engaged by the City of Springfield to assess the potential for renewed hydroelectric generation potential at the Watershops Pond Dam on the Mill River. GZA visited the site and the former the powerhouse, which is located on private property. In order to avoid complex property issues, GZA proposed an alternative design involving the construction of a new freestanding powerhouse downstream of the dam. GZA prepared power and energy generation estimates and assessed preliminary financial returns for the project. GZA was then asked to prepare a Preliminary Permit Application for the site on behalf of the City, which was accepted by FERC in 2016.

Principal-in-Charge, Report on Permitting Small and Low Impact Hydropower Projects in Massachusetts. GZA was contracted by the Commonwealth of Massachusetts Department of Energy Resources to prepare a report on Permitting Small and Low Impact Hydropower Projects in Massachusetts. This report was commissioned at the request of the Legislature and summarize the permitting and licensing process for small hydropower project. It also compared state and federal systems for designation of low impact hydropower. As part of the study, GZA prepared and circulated a survey among a large group of hydropower stakeholders in the Commonwealth to gather feedback on government processes. The report examined net metering issues and the state RPS standards for hydropower. GZA also prepared a preliminary estimate of the generation potential at former mill sites throughout Massachusetts.

Principal-in-Charge, Byron Weston Mill Dams No. 1 & No. 2 Hydropower Pre-Feasibility & Feasibility Studies and Final Design and Licensing, Dalton, Massachusetts. A project to rapidly assess the potential for hydroelectric power generation at two existing dams on the Housatonic River. Power and energy potential were preliminarily evaluated along with estimated costs and simple payback period.

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Principal/Civil Engineer

Results of the study were included in a grant application prepared by GZA and submitted to the Massachusetts Technology Collaborative (now Mass CEC). The grant application was approved, leading to a full feasibility study, including technical and economic analysis of a number of project alternatives. The Owner selected at preferred alternative and GZA prepared a second Mass CEC grant application, which was awarded. GZA prepared a Preliminary Permit application to FERC and has submitted a final FERC exemption application package to FERC. GZA is preparing final project designs.

Principal-in-Charge, Crescent Street Dam Hydropower Pre-Feasibility & Feasibility Studies and Final Permitting and Design, Athol, Massachusetts. A project to rapidly assess the potential for hydroelectric power generation at an existing dam on the Millers River. Power and energy potential were preliminarily evaluated along with estimated costs and simple payback period. Results of the study were included in a grant application prepared by GZA and submitted to the Massachusetts Technology Collaborative (now Mass CEC). The grant application was approved, leading to a full feasibility study, including technical and economic analysis of a number of project alternatives. One the basis of the completed feasibility study, the Owner chose a new turbine installation as the preferred alternative and sought a grant from Mass CEC. GZA prepared the grant application and the grant was awarded. GZA has prepared final designs and permit applications, including the Preliminary Hydropower Notification Form. The project was successfully constructed in 2010. GZA has also prepared concept designs for downstream fish passage facilities.

Principal-in-Charge, Pine Grove Dam Fisheries Protection Measures, Chester Water Authority. In response to a fish mortality event, GZA was asked to develop a plan to provide fish protection measures in the tailrace of the Pine Grove Dam Hydropower Project. GZA, with a fisheries subconsultant, prepared and submitted an alternatives analysis which examined multiple options. Provision of minimum flows to maintain water quality was the preferred alternative.

Principal-in-Charge, Statewide Hydropower Assessment, Department of Conservation and Recreation. The DCR was interested in assessing the potential for hydropower generation at its statewide inventory of dams. GZA prepared a screening-level analysis of more than 300 dams to make a conceptual estimate of the power and energy potential at each dam. On the basis of the screening analysis, approximately two dozen dams were selected for further analysis and on-site assessment. Each site was visited and a conceptual layout of a hydropower retrofit was developed. Resource assessment studies were prepared for each of these dams in the form of an enhanced FERC Preliminary Permit application.

Principal-in-Charge, New Jersey Water Supply Authority Hydropower Feasibility Studies, Clinton, New Jersey. A project to assess the feasibility of hydropower generation at two reservoirs owned by the NHWSA and at ten locations on the Delaware and Raritan Canal. GZA assessed various methods for retrofitting hydropower at the Spruce Run Reservoir and the Round Valley Reservoir. Technical, financial, and environmental issues were explored and final Feasibility Studies presented to the Authority. GZA also evaluated small hydropower generation at ten existing water control structures along the D&R Canal. The canal is an important historic, cultural, and recreational resource, as well as a critical part of the state's water infrastructure. GZA assessed the feasibility of retrofitting canal structures to produce hydropower in a manner consistent with site constraints.

Principal-in-Charge, Collinsville Hydropower Feasibility Study, Canton, Connecticut. A project to assess the feasibility of restoring hydropower generation at the Upper and Lower Collinsville Dams on the Farmington River in Connecticut. This study addresses multi-parameter decision points, including technical viability, historic resources, pre-historic resources, wetlands, fisheries, fish passage, recreations opportunities, regulatory issues, and financial viability. Each facility estimated to produce over 1,000 kW of power. Study include financial analysis which investigated sensitivity of project returns to financing period, interest rates, and grant funding. GZA produced multiple conceptual designs for rehabilitating both sites, recommended preferred alternatives, and made presentations to local selectmen boards to describe project.

Principal-in-Charge, Manville Dam Hydropower Feasibility Study, Cumberland, Rhode Island. A project to assess the feasibility of hydroelectric power generation at the existing Manville Dam on the Blackstone River. The intent of the project would be to generate power primarily for dedicated use by an adjacent affordable housing complex. The study examined multiple options for generating configurations, including the use of S-type Kaplan turbines and a lower impact option using siphon units. Financial viability was

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Principal/Civil Engineer

assessed using pro-forma methods, and environmental issues were explored.

Principal-in-Charge, Fish Hatchery Supply Pipeline In-Line Conduit Hydropower Generation Feasibility Study, Ware, Massachusetts. Under GZA's task order contract with the Massachusetts Water Resources Authority, GZA prepared a technical feasibility assessment for including in-line hydropower generation as part of a proposed pipeline to supply raw water to a fish hatchery facility. The power generated by the project would be used to supply a new ultraviolet potable water treatment facility. GZA assessed various locations for the proposed powerhouse and types of turbines. GZA prepared a project cost estimate for use in the project pro-forma.

Principal-in-Charge, Ipswich River Hydrokinectic Feasibility Study, Ipswich, Massachusetts. The owner of a major industrial facility on the Ipswich River was interested in the production of hydropower at its site. GZA produced a "fatal flaws" analysis which indicated that traditional hydropower was not a good option at the site. Hydrokinetic power, on the other hand, was judged potentially feasible. GZA completed a feasibility study which looked at various configurations and hydrokinetic generation equipment. Power and energy production estimates were made based on the hydrology of the river and expected velocities. A DC generator and deep-cell battery storage system was recommended. Permitting needs and estimated costs and benefits were discussed.

Principal-in-Charge, L.P. Athol Hydroelectric Feasibility Study, Athol, Massachusetts. An existing hydroelectric generator engaged GZA to study potential methods for improved generation at two sites on the Millers River. New generation equipment was assessed but not recommended. GZA recommended improvements to control systems and installation of automated trash raking machinery to improve operations and increase generation efficiency. GZA assisted in preparing successful grant applications for both the feasibility study and final design and construction from both Mass CEC and US Dept. of Agriculture.

Principal-in-Charge & Project Manager, Southworth Hydroelectric Project Resource Assessment and Feasibility Study, Turners Falls, Massachusetts. GZA was asked by Southworth to assist Southworth in preparing a grant application to the MTC for the purpose of rehabilitating their hydropower station off of the Turners Falls Power Canal. GZA prepared a successful grant application. GZA's feasibility study assessed the benefits of installing new generating equipment. The study included investigations of water rights and Southworth's water exchange agreement and a penstock inspection. A preferred alternative was selected and GZA prepared a second MTC grant application. The design and construction grant was awarded, but for business reasons Southworth asked GZA to assess the benefits of rehabilitation of the existing equipment.

Project Manager, Clock Tower Place Hydroelectric Project Feasibility Study and Preliminary Design, Maynard, Massachusetts. A project to rehabilitate and upgrade a non-functioning hydroelectric generation facility at an historic mill site on the Assabet River. Mr. Cox managed the preparation of a pre-feasibility study and worked with the Owner to secure a feasibility study grant from the Massachusetts Technology Collaborative (MTC). Mr. Cox then managed GZA's preparation of a full Feasibility Study, indicating that a cross-flow turbine installation could provide up to 300kW of power production at the site. The study was submitted to the MTC and used in the Owner's winning application for a Design and Construction grant. GZA then prepared a preliminary design for the proposed project, including plans and specifications. GZA also prepared a Preliminary Permit application which was submitted to FERC and resulted in FERC granting the preliminary permit.

Principal-in-Charge, Worcester Water Treatment Plant In-Line Conduit Hydropower Generation Feasibility Study, Holden, Massachusetts. A project to assess the feasibility of a hydroelectric generation project in-line in an existing raw water conduit at the City's water treatment plant.

Principal-in-Charge, Northampton Water Treatment Plant In-Line Conduit Hydropower Generation Feasibility Study, Northampton, Massachusetts. A project to assess the feasibility of a hydroelectric generation project in-line in an existing raw water conduit at the City's water treatment plant. Generator would replace an existing Pressure Reduction Valve at the plant.

Project Manager, Blackstone Valley Visitors Center Hydroelectric Feasibility Study, Worcester, Massachusetts. A project to assess the feasibility of a small hydropower generation project to be constructed as part of the visitor's center being constructed on the Blackstone River.

Project Manager, Museum of Science Hydrokinetic Resource Assessment, Boston, Massachusetts. As part of its sustainability / green energy initiative, the Museum of Science

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in Boston asked GZA to evaluate the potential for generation of hydrokinetic power from the flow of the Charles River through the old sluiceways under its parking garage structure. Mr. Cox made field measurements of current velocity and calculated power and energy potential.

Principal-in-Charge, Massachusetts Water Resources Authority Hydropower Project Development. GZA has been contracted to assist the Authority with developing hydropower generation at various sites.

Principal-in-Charge, Third Party Independent Review of Proposed Hydropower Development. GZA was contracted to assist in the evaluation of a proposal to the Connecticut Clean Energy Finance and Investment Authority for financial assistance for construction of a new hydropower facility. The proposed facility, to be constructed at an existing dam in Connecticut, would provide energy to an associated mixed commercial/residential development. GZA provide technical review assistance to verify power and energy production estimates, as well as to assess project financial performance estimates and identify uncertainties.

Publications and Presentations

Andersen, G.R., Chouinard, L.E., Hover, W.H., Cox, C.W. "A Risk Indexing Tool for the Prioritization of Improvements to Inventories of Embankment Dams." ASCE Journal of Geotechnical and GeoEnvironmental Engineering, April 2001.

Andersen, G.R., Cox, C.W., Chouinard, L.E., Hover, W.H. "Prioritization of Ten Embankment Dams According to Their Physical Deficiencies." ASCE Journal of Geotechnical and GeoEnvironmental Engineering, April 2001.

Cox, C.W., "Dam Removal Projects in the Eastern United States." Proceedings of the 81st Annual Meeting of the International Commission on Large Dams. 2013

Cox, C.W., "Dam Owner Risk" Presentation at Environmental Business Council of New England program of Dam Owner Liability. June 5, 2013.

Cox, C.W., et. Al. "History Re-made: The Rehabilitation of the Upper Mystic Lake Dam." Proceedings of the ASDSO Annual Conference, 2012

Cox, C.W. – Moderator. "Environmental Business Council Dam Management Program Series – Massachusetts Pending Dam Safety Legislation." April 26, 2012

Cox, C.W., et. al. "The Long Life, Lingering Sickness, and Quick Demise of the Forge Pond Dam." Proceedings of the ASDSO National Conference, 2011.

Cox, C.W., et. al. "Foundation Grouting at the Robert Moses Power Dam" Presentation at the ASDSO Northeastern Regional Conference. June, 2011.

Cox, C.W. and Galvin, M. "Makeover on the Mystic" BSCES News. March 2011.

Cox, C.W., Ekholm, K. and Fay, C. "Assessing the Feasibility of a Conduit Hydropower Project – Details Matter" Presentation at the NEWWA Annual Conference. March, 2011.

Cox, C.W. "Small Hydropower – Past, Present, and Future" Presentation to the Boston Society of Civil Engineers Section / ASCE GeoInstitute Conference. October 3, 2009.

Cox, C.W. and Fay, C.N. "Modern Hydropower and Lake Management – Together at Last!" Presentation to the 29th International Symposium of the North American Lake Management Society, October, 2009.

Cox, C.W., et. al. "Geotechnical Analysis and Instrumentation Monitoring During the Draw-Down and Rewatering of the Blenheim-Gilboa Pumped Storage Power Project." Proceedings of the USSD National Conference, 2008.

Cox, C.W., Diaz-Reck, D., and Ekholm, K. "Small Hydropower Potential – It may be Larger than you Think." Presentation to New England Water Works Fall Water Resources Symposium 2008.

Cox, C.W. "Economics of Small Hydropower." Presentation to Northeast Sustainable Energy Association (NESEA) BuildingEnergy 07 Annual Conference, March, 2007.

Cox, C.W. and Leone, D.M., 2006. "Dam Emergency Response – Suggestions for a Dam Safety Engineer's Toolkit and Checklist." Proceedings of ASDSO National Conference. 2006.

Cox, C.W. "New Massachusetts Dam Safety Regulations Come Into Effect" BSCES News. Feb. 2006.

Cox, C.W. and Baril, P.H. "Massachusetts Dam Safety Regulations – Part II" BSCES News. Oct. 2006.

Cox. C.W, P. Baril, W. Salomaa, and R. D. Clark. "A Possible Paradigm for Public Private Partnerships." Proceedings of the ASDSO National Conference, 2004.

Cox, C.W. Bjarngard, A.B., Hover, W.H. Investigations of Rock Foundation and Cyclopean Concrete at Gilboa Dam. Proceedings of Soil/Rock America Conference. 2003

Cox, C.W. and Leone, D.M., 2003. "Water Supply and Aquatic Habitat." Presentation to Clean Water Action Conference on Watershed Protection. , October, 2003.

Cox, C.W. and Leone, D.M., 2002. "Water Allocation Planning and Use." Presentation to Conference on Watershed Conservation 2002: Water Supply, Aquatic Ecosystems, and Planning, UMass Amherst. September, 2002.

Cox, C.W. "Incremental Risk Assessment Techniques for Choosing

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Inflow Design Floods at Dulce Lake Dam and Lower Mundo Lake Dam." Proceedings of ASDSO Western Regional Conference, pp. 173-182. 1997.

Hatem-Moussallem, M., Gaffney, Cox, & Batho. "Solutions to Water Scarcity in the Republic of Cyprus – A Proposal for Water Banking." MIT Dept. of Civil & Environmental Engineering Masters of Engineering Program, 1999.

Hersh, E. and Cox, C.W. "Dam Maintenance for Lake Management." Presentation to North American Lake Management Society National Conference – 2003. November, 2003.

Hover, W.H., Cox, C.W., Clark, R.D., Andersen, G.R., Chouinard, L.E. "Risk Indexing – A Technique for Prioritizing of Remedial Actions." Proceedings of ASDSO National Conference. 2000.

Hover, W.H., Cox, C.W. "Design, Permitting, and Construction of the Breaching of the Old Berkshire Mill Dam, Dalton, Massachusetts." Proceedings of the USSD National Conference, 2001.

Hover, W.H., Bjarngard, A.B., Cox, C.W., Costa, P. "Stability Analysis and Interim Safety Improvements, Gilboa Dam Spillway, Schoharie Reservoir, New York." Proceedings of the USSD National Conference, 2003.

Hydrovision 2012 – Panel Discussion "The Colorado MOU: Is this the Path for the Small Hydro Future?"

Leone, D.M, Cox, C.W., Keeffe, T.J. "Case Study in Practical Approaches for Water Supply vs. Aquatic Base Flow Needs." Presentation to New England Water Works Association 2005 Annual Conference, September, 2005.

Marcinkevage, C., Kretchmer, D., Kennedy, M., McGovern, T., Cox, C., Benoit, J., "Putting Dams in Order: A Program for Comprehensive Identification and Prioritization of Dam Management Actions" Presentation to ASDSO Northeast Regional Conference, June, 2009.

Schipper, D.J., Cox, C.W., and Gode-von Aesch, W.A. "Rehabilitation of the Hemlock Gorge Spillway Dike, Newton, MA" BSCES News. Jan. 2013.

Shipper, D.J, Cox, C.W., and Gode-von Aesch, W.A. "Fish Weir to Flood Control: Reconstruction of an Historic New England Dam." Proceedings of the ASDSO National Conference, 2013.

Taylor, M. A. and Cox, C.W. "Crest Gates on Historic Spillways: Lessons Learned." Presentation to the 2013 New England Water Works Association Annual Conference. April 2013

RESUME

William H. Hover, P.E.

Senior Principal/Director of Risk Management

Summary of Experience

William Hover's areas of expertise include: analysis and design of dam rehabilitation; decommissioning of dams; site investigations; underpinning design; shallow and deep building foundation design; slope stability analyses; utility engineering; design of braced excavations; design and construction of ground improvement techniques such as preloading, surcharging, wick drains, and grouting; bridge foundation and highway studies; engineering analyses for settlement, bearing capacity, groundwater flow, and lateral pressure; and studies relative to subsurface environmental issues.

Education
B.S., 1977, Civil Engineering, Northeastern University
M.S., 1979, Civil Engineering, University of Connecticut

Registrations & Certificates
Professional Engineer – 1985, Connecticut, #13667
Professional Engineer – 1990, South Carolina, #13714
Professional Engineer – 1995, Vermont, #6940
Professional Engineer – 1997, New York, #074410

Affiliations
- American Consulting Engineers Council
- American Society of Civil Engineers
- American Water Works Association
- Association of State Dam Safety Officials
- Boston Society of Civil Engineers
- Geo Institute
- International Society for Soil Mechanics and Foundation Engineering
- United States Society on Dams

Areas of Specialization
- Foundation Engineering
- Civil Engineering
- Dam Engineering
- Braced Excavations
- Bridges & Highways
- Landfill Engineering
- Geo-Environmental Engineering

Relevant Project Experience

Mr. Hover's areas of expertise include static and seismic analyses of existing embankment dams, hydraulic fill dams, gravity dams, stonewall-earth dams, rockfill dams, and timber crib dams; permitting, design and preparation of contract documents for remedial repairs and decommissioning; stability and seepage analyses; seepage control by grouting, pressure relief wells and seepage collection; design of new spillways and hydraulic improvements; construction engineering, performance of dam break analyses, preparation of inundation maps and emergency action plans. Mr. Hover is a FERC Approved Independent Consultant. Relevant project experience includes:

Principal-in-Charge, FERC Part 12D Dam Safety Inspection, Goodwin Dam, Hartland, Connecticut - The Metropolitan District (2010). Oversaw the field inspection, performed detailed review of the existing information, participated in Potential Failure Mode Analysis review and update, review and update of the Supplemental Technical Information (STI) document, evaluated the MDC's instrumentation and monitoring program at Goodwin Dam and prepared a Dam Safety Surveillance and Monitoring Plan (DSSMP) and Dam Safety Surveillance and Monitoring Report (DSSMR).

Principal-in-Charge, Detailed Investigation for the Reconstruction of New York City's Catskill and Delaware District Dams. Mr. Hover served as principal-in-charge of GZA's inspections, evaluations and reporting on the condition of 6 large, high-hazard dams and 6 large, high-hazard dikes which impound New York City's West-of-the-Hudson water supply, which provides about 1.2 billion gallons per day of drinking water to the City, as well as for development of inundation mapping and emergency action plans for these facilities. Dams evaluated in the Catskill System (built 1910-1925) include Gilboa Dam (Schoharie Reservoir); Olive Bridge Dam and 6 principal dikes (Ashokan Reservoir); Merriman Dam (Rondout Reservoir); Neversink Dam (Neversink Reservoir); Downsville Dam (Pepacton Reservoir) and Cannonsville Dam (Cannonsville Reservoir). These dams are 185 to 250 feet in height, and are either concrete gravity dams or earth embankments with central cutoff walls. The Ashokan dikes are 30 to 200 feet in height, and their total length is over 4 miles. Studies developed recommendations for rehabilitation and reconstruction of these dams for the next 50 years of service, including repairs totaling about $1 billion. Repairs will take place over a lengthy period following study completion. This assignment entailed complete topography mapping, underwater and physical

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inspections, hydrologic and hydraulic analysis, geotechnical, structural, mechanical and electrical evaluations.

Principal-in-Charge, Robert Moses Power Dam, St. Lawrence-Franklin Delano Roosevelt Power Project, Massena, New York. Investigation of underseepage beneath the American half of a 3,200-foot long, 165-foot high hydroelectric dam spanning the St. Lawrence Seaway between the USA and Canada. Focus of the phased investigation was to evaluate the potential for ongoing dissolution of gypsum from the bedrock foundation, and resulting potential for settlement. Discharge of seepage into the foundation relief wells is ongoing. Geophysical techniques including down-hole televiewer (optical and acoustic) to provide a 360-degree image of the relief well borehole and a heat pulse flow meter to measure flow rate and direction both up and down the borehole, were used to evaluate flow into (and out of) various bedrock formations encountered within relief wells. This is a new application of this technology to evaluate the underseepage of dams. Recommendations were developed to reduce the gypsum flow by grouting the relief wells in selected hydroelectric unit blocks from the bottom, up to a level above where most gypsum containing bedrock formations daylight into the wells.

Principal-in-Charge, Emergency Response to Stabilize Whittendon Dam, Taunton, Massachusetts. Served as expert consultant to the Commonwealth of Massachusetts Department of Conservation and Recreation to provide advice for addressing and stabilizing the Whittendon Pond Dam in Taunton, Massachusetts. There was concern that the rockfilled-timber crib dam would fail, and result in further flooding of areas of Taunton that had already been impacted by flooding from continuing heavy rainfall. Mr. Hover recommended to DCR that a nearby rock quarry be opened immediately, and that a rockfill berm be placed on the downstream side up to the top of the 10-foot high and 120-foot long run-of-river dam, which was in poor condition. These recommendations were developed within several hours of visiting the site and were conveyed to DCR and the Dam Owner's engineer, with concurrence of representatives of other state and federal agencies present. The rockfill berm, along with drainage culverts to carry spillway flows during berm construction, was designed in some detail by the Dam Owner's engineers and constructed over the next 10 hours to resolve the stability issue. Provided full-time observation and consulting to DCR during overnight construction. This event received national press and television coverage, and resulted in a strong initiative by the Commonwealth to address dam safety issues in Massachusetts, which was followed by other states in the Northeast.

Consultant/ Reviewer, Exploratory Grouting and Remedial Repairs to Lovell Pond Dam, Fitchburg, Massachusetts. GZA developed final design and bid documents and provided bid-phase services for a remedial grouting program to address potential internal erosion at this 1,000-foot long and 80-foot high earth-fill embankment dam. Remedial repairs also included filtered blanket drains along the downstream toe and abutment, downstream slope flattening, repair of deteriorated concrete spillway and supplemental instrumentation. Provided resident engineering services and prepared as-built records for the project.

Principal-in-Charge, Emergency Consulting at the Spicket River Dam, Methuen, Massachusetts. Immediate mobilization to the site to provide emergency dam engineering consulting services to the Massachusetts DCR Office of Dam Safety. Evaluated the stability of this 120-foot long, 20-foot high run-of- the-river stone masonry dam during severe flooding which occurred in May 2006 after a week-long period of approximately 1 foot of rainfall. Supervised hydraulic analyses for hypothetical dam breach analysis and flash board failure to evaluate inundation extent downstream. Provided results of potential further downstream inundation to local Fire Chief and Mayor for their use in evacuation planning.

Principal-in-Charge, Blenheim-Gilboa Pumped Storage Un-Watering Project Investigations, Messena, New York. Assisted the New York Power Authority (NYPA) in considering the implications of a proposed program to un-water the pumped storage generation facility for maintenance and repair for the first time since construction in the 1970's. Proposal was to drain virtually all of the Upper Reservoir and completely dewater a concrete-lined vertical shaft of more than 1,000 feet in depth, as well as a horizontal tunnel section and four steel-lined penstock tubes constructed under a mountain slope. GZA conducted analyses to investigate potential impacts of unbalanced hydrostatic head conditions on concrete and steel penstock liners and suggested potential methodologies for monitoring and mitigation. Location of a 40+-year-old borehole about 900 feet in depth that had been drilled between two penstock locations allowed the borehole to be retrofit with vibrating wire and hydraulic piezometers. These instruments were used to monitor the response of groundwater (hydrostatic) pressures in the bedrock while the water in the shaft was lowered in a controlled manner. This

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data was used to confirm maintenance of an appropriate factor of safety against buckling of the steel penstock liners as they were drained.

Principal-in-Charge, Spillway Improvements, Lakeville Reservoir Dam No. 3, Salisbury, Connecticut. GZA provided responsive field investigations and design services for expedient repair of the existing un- reinforced concrete spillway including reconstruction of a section that developed a diagonal crack that extended through the spillway and had displaced. Surface deterioration of a second area of the spillway was also recommended, including removal of deteriorated surficial concrete and repair with epoxy modified cement material.

Principal-in-Charge, Repairs to Willow Mill Dam, Lee Massachusetts. Design, permitting and construction engineering for re-lining of the stone masonry sluiceways with stainless steel; and construction of reinforced concrete buttresses at the left abutment and emergency spillway, to stabilize deteriorated stone masonry. Design of tie-down anchors and a toe buttress for future stabilization of the curved primary spillway.

Principal-in-Charge, Temporary Dam Design Review, Confidential Client, East Branch Housatonic River, Pittsfield, Massachusetts. Review of a temporary dam design across a river to allow changes in riverbed and bank geometry to be constructed in the dry. The dam is designed with braced steel H-piles and timber or aluminum lagging for hydraulic contact. Electric pumps and temporary culverts along the axis of the river were designed to pass seasonal low river flows.

Principal-in-Charge, Seismic Response Analysis of Cobble Mountain Dam, Russell, Massachusetts. GZA took on a major reevaluation of the 260 feet high and 730 feet long Cobble Mountain Reservoir Dam, located in Russell, Massachusetts. This dam is believed to be the highest hydraulic fill dam in the world. The end client was the City of Springfield, MA, who owns and operates the dam for its primary water supply. GZA analyzed the predicted two and pseudo three-dimensional behavior of the dam during various earthquakes; analyzed the dynamic response of the embankment, evaluated liquefaction potential of various zones of the dam; and estimated associated deformations. Six finite element programs were selected to perform the analyses. Special purpose programs generated intermediate results and modified input between programs. Where the standard procedures for evaluating soil performance were based on published graphs, equivalent analytical interpolation routines were developed. Colored contours and plots of deformations made the results readily understandable to a wide audience. Results indicated adequate factors of safety against liquefaction. Estimated deformations under the postulated earthquake were judged acceptable.

Principal-in-Charge, West Hill Dam, Uxbridge, Massachusetts. Developed 2-dimensional seepage flow models for a value engineering proposal for seepage control for the US Army Corps of Engineers' West Hill Dam. The effects of various embankment, foundation and cut-off wall permeability/hydraulic conductivities were evaluated, along with penetration of cutoff into bedrock. Project completed under tight deadlines and budget.

Principal-in-Charge, Risk Indexing of 10 Embankment Dams, Massachusetts. GZA assisted the Massachusetts Office of Dam Safety with development and application of a new computer program to compute a "risk index" for a dam based on characteristics and observed deficiencies. A "risk index" is a measure of how the observed physical conditions of a dam affects the probability of the failure of that dam. The simplified methodology is based on general approaches to risk analysis procedures developed and utilized by the U.S. Army Corps of Engineers. For this project, the ODS used risk indexing to help prioritize funding of dam safety projects to increase public safety.

Principal-in-Charge, Goodnough Dike, Quabbin Reservoir, Ware, Massaachusetts. GZA was engaged by the Metropolitan District Commission to conduct engineering investigations of sinkholes and seepage at the downstream toe of the 135- foot-high, 2,140-foot-long hydraulically filled embankment. The dike, along with the Windsor Dam, impounds up to 412 billion gallons of water which serves as the metropolitan Boston area's primary water supply. GZA's scope of work included monitoring of existing instrumentation, subsurface explorations including test pits, test borings with installation of piezometers, camera surveys of existing subsurface drainage systems, ground penetrating radar surveys and pump tests. GZA developed an opinion of the cause of the observed sinkholes and developed recommendations for expedient repairs within several weeks of engagement. GZA prepared contract documents and provided geotechnical monitoring services during construction of repairs. Repairs for a 200-foot-long, 30-inch-diameter corrugated metal pipe beneath the downstream toe consisted of dewatering, cleaning and installing a 160-foot-

William H. Hover, P.E.

Senior Principal/Director of Risk Management

long, 8-inch-diameter PVC subdrain backfilled by blowing fine to medium sand. Voids in the northern inaccessible portions of the pipe were filled by drilling two holes through the crown of the pipe and injecting sand suspended in a drilling slurry. In addition, a filtered toe drain and drainage blanket was constructed, along with combined dewatering/pressure relief wells. A new downstream toe area instrumentation system monitored at a central read-out location was installed, along with other surficial slope and drainage system improvements. Construction was completed in 1995. GZA provided full services, from design through construction. Directed installation of a crushed stone and filter fabric berm at downstream toe of Dam and a V-notch flow monitoring weir. Also provided recommendations and guidance to Client regarding temporary drawdown of the Reservoir. All evaluation and emergency work at Dam completed within 48 hours.

Principal-in-Charge, Embankment Subsidence Investigation, Weston Mill Dam, Weston, Vermont. Weston Mill Dam is a 12-foot-high, 156-foot-long stone masonry and earth embankment run-of-the-river dam across the West River. GZA performed an initial inspection, dye tests, installation of borings with piezometers and observation wells, with field permeability tests to investigate seepage through the left side of the dam abutment area into the waterhouse of the mill. Seepage control needed to address potential embankment, dam stability and safety concerns, particularly given the occurrence of depressions in the embankment just upstream of seepage discharge locations. GZA recommended repairs including repointing of upstream spillway training walls, reservoir bottom repairs, construction of a concrete seepage cutoff wall extending into hard bedrock upstream of the east abatement stone masonry mill wall, and penstock/ headgate repairs.

Principal-in-Charge, Gilboa Dam Interim Spillway Repair Project, Gilboa, New York. An emergency project to repair large erosion holes at the toe of the masonry overflow portion of the 175-foot high Gilboa Dam. Performed survey to assess extent of damage and provide basis for design. Designed and prepared construction contract for repairs, including mass concrete filling, using cyclopean masonry, of major erosion holes at toe of dam and reinforced concrete channel paving, within a one-month period. Applied for and rapidly secured expedited permits from NYDEC for execution of work. Provided resident engineering services for the $2.2 million repair contract. Entire project (design through construction) was completed within 4 months and within budget.

Consultant, Metrowest Water Supply Tunnel Project, Shafts E & N, Southborough and Weston, Massachusetts. Development of blast monitoring programs for existing dams, aqueducts, underground conduits, surface operational structures and closest residences to controlled blasting for construction of the 300- foot-deep Shaft E. Shaft E is located near the Sudbury Reservoir Dam, a 2,000-foot-long by 75-foot-high earth dam with stone masonry spillway and the Hultman Aqueduct, both of which are critical structures in Boston's water supply system. GZA prepared project technical specifications for controlled blasting, met with MWRA officials, the construction manager, Southborough Fire Chief, and representatives of the Southborough Working Group of community members, to develop a plan to satisfy concerns related to blasting. GZA reviewed on- going construction data for compliance with recommended threshold criteria given in the monitoring plan.

GZA performed similar design of technical specifications for controlled blasting and blast monitoring program for the Norumbega Dam and Schenck's Pond Dam at Norumbega Reservoir in Weston, Massachusetts. The 300-foot-deep Shaft N will be installed in proximity to Norumbega Dam and other hydraulic structures. GZA met with MWRA officials, the Weston Fire Chief and the Weston Working Group, to develop a similar program for Shaft E.

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Hover, W.H., "Criteria for the Use of Fabrics to Filter Soils", Unpublished thesis presented at the University of Connecticut for partial fulfillment of the degree of Master of Science, Storrs, Connecticut, May 1979.

Long, R.P., P.J. Carey, and W.H. Hover, "Determining the Shear Strength of Varved Clay Using Vane Shear", Joint Highway Research Advisory Council of Connecticut Department of Transportation, Report No. JHR 80 130, March 1980.

Long, R.P., and W.H. Hover, "Statistical Data Analysis for Sand Drained Areas", School of Engineering, the University of Connecticut, Storrs, Connecticut, Report No. CE 80 137, December 1980.

Long, R.P. and W.H. Hover, "Performance of Sand Drains in a Tidal Marsh", Proceedings 1st International Conference on Case Histories in Geotechnical Engineering, St. Louis, Missouri, Vol. III, pp. 1235 1244, May 1984.

William H. Hover, P.E.

Senior Principal/Director of Risk Management

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Hover, W.H., "Seepage Control Improvements, Goodnough Dike, Quabbin Reservoir", November 2, 1996 Seminar on Dam Inspection, Analysis and Rehabilitation, sponsored by The Geotechnical Group, Boston Society of Civil Engineers Section of ASCE, 6199.

Hover, W.H. and D.T. Kane, "The Dam Failed and It's Your Fault", Proceedings, The Eighteenth United States Committee on Large Dams Annual Meeting and Lecture Series, August, 1998.

Hover, W.H., C.W. Cox, R.D. Clark, G.R. Anderson and L.E. Chouinard, "Risk Indexing: A Technique for Prioritizing Remedial Actions", The Association of State Dam Safety Officials Annual Conference, September 28-30, 2000.

Hover, W.H. and A.B. Bjarngard, and K.M. Flood, "Inspection and Treatment of Surficial Conditions of Several Concrete Gravity Dams", The Twentieth United States Committee on Large Dams Annual Meeting and Lecture Series, pp. 571-586, September 2000.

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Bjarngard, A.B. and Hover, W.H., "Exploratory Grouting Program to Improve the Lovell Pond Dam", Proceedings, United States Society on Dams, 26th Annual Meeting and Conference, May 2006, pp. 131-140.

Cox, C.W., Xi, F., Davis, A.P., Knowlton, R. and Hover, W.H., "Geotechnical Analysis and Instrumentation Monitoring During the Draw-Down and Rewatering of the Blenheim-Gilboa Pumped Storage Power Project", Proceedings, United States Society on Dams, 28th Annual Meeting, March 2008, pp. 967-980.

RESUME

Kristina D. Ekholm, P.E.

Project Manager/Water Resources Engineer

Summary of Experience

Ms. Ekholm is a Project Manager in the Water Resources Group with a background in Environmental and Water Resources Engineering. Her responsibilities on projects include project management, dam inspection reporting, EAP development, hydropower evaluation and design, dam break analysis, drainage design and evaluation, and performing stormwater, pipeline and open channel modeling. She has AutoCAD, GIS, Modflow, HEC-HMS, HEC-RAS, FLO-2D, DAMBRK, SMPDBRK, HydroCad, CulvertMaster, FlowMaster and Visual Basic programming skills.

Education

B.S., 2001, Environmental Engineering, Tufts University

M.S., 2005, Environmental and Water Resource Engineering, Tufts University

Registrations & Certificates

2007, PE, MA 46880

Areas of Specialization

- Hydropower
- Hydraulic Engineering
- Computer Modeling
- Surface Water Hydrology
- Groundwater Hydrology
- Geographic Information Systems (GIS)

Relevant Project Experience

Project Manager, Watershops Pond Dam Hydroelectric Project Preliminary Resource Assessment, Springfield, Massachusetts. GZA was engaged by the City of Springfield to assess the potential for renewed hydroelectric generation potential at the Watershops Pond Dam on the Mill River. GZA visited the site and the former the powerhouse, which is located on private property. In order to avoid complex property issues, GZA proposed an alternative design involving the construction of a new freestanding powerhouse downstream of the dam. GZA prepared power and energy generation estimates and assessed preliminary financial returns for the project. GZA was then asked to prepare a Preliminary Permit Application for the site on behalf of the City, which was accepted by FERC in 2016.

Project Manager, Report on Permitting Small and Low Impact Hydropower Projects in Massachusetts. GZA was contracted by the Commonwealth of Massachusetts Department of Energy Resources to prepare a report on Permitting Small and Low Impact Hydropower Projects in Massachusetts. This report was commissioned at the request of the Legislature and summarize the permitting and licensing process for small hydropower project. It also compared state and federal systems for designation of low impact hydropower. As part of the study, GZA prepared and circulated a survey among a large group of hydropower stakeholders in the Commonwealth to gather feedback on government processes. The report examined net metering issues and the state RPS standards for hydropower. GZA also prepared a preliminary estimate of the generation potential at former mill sites throughout Massachusetts.

Project Manager, Testing of W4E Turbine. GZA assisted Walker Wellington in pitching a successful application for funding to the US Department of Energy. GZA developed a turbine testing protocol and oversaw the testing of Walker Wellington's W4E turbine at the Alden Research Laboratories. GZA evaluated the results of the turbine testing and prepared a summary report validating the data that was collected and reported. Ms. Ekholm managed the project, prepared the testing protocol and prepared the validation report.

Project Engineer/ Project Manager, Crane and Company Hydropower Prefeasibility and Feasibility Studies, and Design and Permitting, Dalton, Massachusetts. GZA was awarded a contract to perform a prefeasibility study on the practicability of resuming hydropower generation at the Crane and Company Paper Manufacturing Facility in Dalton, Massachusetts. GZA a prepared Massachusetts Technology Collaborative grant application for Crane and was awarded a contract to perform a

Kristina D. Ekholm, P.E.

Project Manager/Water Resources Engineer

feasibility study. Ms. Ekholm performed the feasibility studies. She used RET Screen along with available hydrologic information to evaluate turbine types and perform economic analyses. She also contacted vendors to obtain quotations for the new systems and prepared conceptual drawing. Crane was awarded a design and constructions grant worth $500,000 as a result of the feasibility study. Ms. Ekholm managed the design and permitting aspects of the project, including state and FERC permitting. She also performed portions of the design and permitting.

Project Manager, Worcester Water Treatment Plant In-Line Conduit Hydropower Generation Feasibility Study, Holden, Massachusetts. The City of Worcester was interested in constructing a hydroelectric generation project in-line in an existing raw water conduit at the City's water treatment plant. Ms. Ekholm evaluated several options for constructing the project and developed plans and specifications for developing the project in-line with American Recovery and Reinvestment Act/ State Revolving Fund requirements.

Project Engineer, Northampton Water Treatment Plant In-Line Conduit Hydropower Generation Feasibility Study, Northampton, Massachusetts. The City of Northampton was interested in constructing a hydroelectric generation project in-line in an existing raw water conduit at the City's water treatment plant by replacing an existing Pressure Reduction Valve with generation equipment. Ms. Ekholm performed the feasibility analysis for developing the project.

Project Engineer, Statewide Hydropower Assessment, Department of Conservation and Recreation. The DCR was interested in assessing the potential for hydropower generation at its statewide inventory of dams. Ms. Ekholm guided a screening-level analysis of more than 300 dams to make a conceptual estimate of the power and energy potential at each dam and identify dams for further investigation.

Project Manager, Manville Dam Hydroelectric Feasibility Study, Cumberland, Rhode Island. The Valley Affordable Housing Association received a grant from the Rhode Island Economic Development Corporation to study the potential for developing a hydroelectric project at the Manville Dam in Cumberland, RI. Ms. Ekholm managed the feasibility study and performed the economic analysis.

Project Manager New Jersey Water Supply Authority Feasibility Studies, Clinton, New Jersey. The NJWSA was interested in assessing the feasibility of hydropower generation at two reservoirs owned by the NHWSA and at ten locations on the Delaware and Raritan Canal. Ms. Ekholm managed the project and assisted in the feasibility analysis of the projects.

Project Engineer/ Project Manager, Dodge Mill Realty Prefeasibility and Feasibility Studies, and FERC Filings. Dodge Mill Realty is interested in pursuing hydropower development at their existing dam on the Ten Mile River. The project will include the construction of a new intake structure, penstock, and powerhouse as well as the installation of new hydroelectric equipment. Ms. Ekholm performed the technical and economic feasibility analysis for the project.

Project Manager, Ipswich River Hydrokinetic Feasibility Study, Ipswich, Massachusetts. The owner of a major industrial facility on the Ipswich River was interested in the production of hydropower at its site. GZA produced a "fatal flaws" analysis which indicated that traditional hydropower was not a good option at the site. Hydrokinetic power, on the other hand, was judged potentially feasible. GZA completed a feasibility study which looked at various configurations and hydrokinetic generation equipment. Power and energy production estimates were made based on the hydrology of the river and expected velocities. A DC generator and deep-cell battery storage system was recommended. Permitting needs and estimated costs and benefits were discussed.

Project Manager, Southworth Hydroelectric Project Resource Assessment and Feasibility Study, Turners Falls, Massachusetts. GZA was asked by Southworth to assist Southworth in preparing a grant application to the MTC for the purpose of rehabilitating their hydropower station off of the Turners Falls Power Canal. GZA prepared a successful grant application. GZA's feasibility study assessed the benefits of installing new generating equipment. The study included investigations of water rights and Southworth's water exchange agreement and a penstock inspection. A preferred alternative was selected and GZA prepared a second MTC grant application. The design and construction grant was awarded in 2008.

Project Engineer, Blackstone Valley Visitors Center Hydroelectric Feasibility Study, Worcester, Massachusetts. Ms. Ekholm performed a feasibility study to investigate the potential for developing a hydropower project to be

Kristina D. Ekholm, P.E.

Project Manager/Water Resources Engineer

constructed as part of the visitors' center being constructed on the Blackstone River.

Project Manager, Hydropower Prefeasibility and Feasibility Studies, Athol, Massachusetts. GZA was awarded a contract to perform a prefeasibility study on the practicability of resuming hydropower generation at the Starrett Precision Manufacturing Facility in Athol, Massachusetts. GZA prepared a Massachusetts Technology Collaborative grant application for Crane and was awarded a contract to perform a feasibility study. Ms. Ekholm performed the feasibility studies. She used RET Screen along with available hydrologic information to evaluate turbine types and perform economic analyses. She also contacted vendors to obtain quotations for the new systems and prepared conceptual drawing. Starrett was awarded a design and constructions grant worth $500,000 as a result of the feasibility study.

Project Engineer, Clock Tower Place Hydroelectric Project Phase 1 Design, Maynard, Massachusetts. Following the completion of the feasibility study and construction grant application by GZA, the Owner was awarded over $500,000 in grant funds to design and construct the proposed hydroelectric project. Ms. Ekholm prepared the FERC Preliminary Permit Application. She is currently developing the Phase 1 Plans and Specifications for the project.

Project Engineer, Clocktower Place Hydropower Pre-feasibility and Feasibility Studies, Maynard, Massachusetts. GZA was awarded a contract to perform a pre-feasibility study on the practicability of resuming hydropower generation at the Clock Tower Place Office Park in Maynard, Massachusetts. GZA prepared a Massachusetts Technology Collaborative grant application and was awarded a contract to perform a feasibility study. Ms. Ekholm performed the feasibility study. She used RET Screen along with available hydrologic information to evaluate turbine types and perform an economic analysis. She also contacted vendors to obtain quotations for the new system.

Project Engineer, Blenheim Gilboa Upper Reservoir Repairs. GZA was awarded a contract with the New York Power Authority to assist in developing plans to dewater the Upper Reservoir and to ensure that the repair area is not flooded during significant precipitation events. Ms. Ekholm performed HEC-HMS analysis to determine the expected runoff into the area under repair. She evaluated and recommended a pump for use to prevent damage caused by a 100-year flood. She also evaluated the hydraulic capacity of proposed culverts for the pump to discharge into. Ms. Ekholm designed the pump line for transporting the water and prepared the associated drawings.

RESUME

Education
B.S., Zoology,
University of Massachusetts
M.S., Zoology, University of Rhode Island
M.M.A., Marine & Environmental Policy,
University of Rhode Island
Ph.D., Biological Studies,
University of Rhode Island

Registrations & Certificates
Professional Wetland Scientist, Cert. # 00356
Certified Professional Soil Scientist, Cert. # 24837
Registry of Soil Scientists, SSSSNE

Affiliations
- Society of Wetland Scientists
- Soil Science Society of America
- North American Lake Management Society
- Society of Ecological Restoration
- Association of Massachusetts Wetland Scientists, Founding Member
- Massachusetts Airport Management Association, Environmental Regulatory Committee
- Board of Trustees & Visiting Professor for Environmental Sciences, American University of the Caribbean, Les Cayes, Haiti

Areas of Specialization
- Aquatic & Wetland Science
- Soil Science
- Ecological Restoration
- Wetland Mitigation Design
- Water Quality Analysis
- Ecology
- Marine Science & Limnology
- Microbiology
- Zoology
- Statistical Analysis

Paul G. Davis, Ph.D, PWS, CPSS

Principal Environmental Scientist

Summary of Experience

Dr. Paul Davis serves as a Principal for GZA as well as the Principal Environmental Scientist for the Springfield, Massachusetts Office, where he has worked since 1986. Dr. Davis has over 30 years of experience with wetland and aquatic resource assessment, mitigation design and permitting. His assignments include overall management and responsibility for the environmental staff in the GZA Springfield office and individual project responsibility for planning, coordination and implementation of various projects for which he is technical lead. Dr. Davis also serves as Technical Practice and Marketing Lead within GZA for natural resource and ecological services, networking and helping to develop the skills of over 30 professional scientists. His broad knowledge of many technical disciplines has facilitated successful management of many complex, large-scale interdisciplinary projects. These projects encompass a wide diversity of wetland and aquatic resource affected projects, and their permitting processes at the local, state and federal levels, including highway, rail, airport, utility, retail development, facility construction, recreation, natural resource management, and site remediation projects. Dr. Davis has previously worked as an oceanographer with the National Oceanic and Atmospheric Administration (NOAA) and as technical staff to the Merchant Marine and Fisheries Committee for the U.S. House of Representatives.

Relevant Project Experience

Principal Environmental Scientist. Lost Lake Salt Marsh Restoration Evaluation & Impact Assessment. Guilford, CT. Performed the environmental evaluations for CTDOT and CTDEEP relative to reconstruction of a highway bridge and removal of tidal flow restriction for the purposes of salt marsh restoration in 60± acre flooded former saltmarsh. Evaluations included an inventory of subaqueous soils, existing flora/fauna biodiversity, including documentation of existing salt marsh fringe areas, as well as assessment of potential for successful saltmarsh restoration.

Principal and Lead Environmental Scientist, Wetland Permitting for I-84 Reconstruction, Waterbury, Connecticut. Managed and lead scientific team in wetland and watercourse delineation & evaluation for a 3.5 mile section of I-84. Identified, evaluated, and assessed potential impacts to natural resource elements included wetlands functions & values, aquatic resources (streams and rivers), water quality, and habitat corridors. Work involved evaluation and mitigation of impacts associated with 11 bridge crossings, prior dam removal, and river realignment along portions of the Mad River and Beaver Pond Brook including 3± acres of wetland mitigation design. Permits were prepared and successfully completed with CT DEEP and the Army Corps of Engineers.

Principal and Lead Wetlands Scientist, James Pond Parcel Wetlands Delineation and Assessment, Exeter, RI. Wetland scientist project leaders, delineating a 1000± estate parcel in Exeter Rhode Island with 65,000± LF of wetland boundary. Identified different wetland and waterbody ecotypes. Prepared field maps, dataforms, and assisted in the conduct of an ecological habitat assessment, identifying wetland functions and values.

RESUME

Paul G. Davis, Ph.D, PWS, CPSS

Principal Environmental Scientist

Principal Environmental Scientist. Connecticut Department of Transportation, Wetland Mitigation Site Monitoring – Brookfield, Connecticut. As part of the CT DOT on-call wetlands contract with the Office of Environmental Planning, Dr. Davis implemented the multi-year mitigation site monitoring and invasive species control efforts for these 6 different wetland and upland habitat mitigation sites.

Principal Environmental Scientist. Connecticut Department of Transportation, Wetland Mitigation Site Monitoring – Avon, Connecticut. As part of the CT DOT on-call wetlands contract with the Office of Environmental Planning, Dr. Davis lead the multi-year mitigation site monitoring and invasive species control efforts for this wetland mitigation sites.

Principal Environmental Scientist, Casino & Resort Environmental Design, Assessment & Permitting. Everett, MA. Natural resource analysis, mitigation design and MEPA permitting for the proposed casino and resort located in Everett MA along the tidal Mystic River. Conducted natural resource inventories and prepared sections for MEPA documentation (Expanded ENF) in support of project development, assessment of impacts associated with shoreline development and dredging, including Living Shoreline mitigation (saltmarsh and coastal bank restoration), and oyster and soft-shell clam restoration, and Essential Fish Habitat (EFH) Assessment.

Principal-in-Charge and Principal Environmental Scientist, Harriman-West Airport Runway Reconstruction. NEPA/MEPA Environmental Assessment and Wetlands Variance Permitting, Wetland Mitigation Design, Construction Observation, North Adams and Williamstown, Massachusetts. Natural resource analysis, mitigation design and permitting for the municipal airport in North Adams, MA. Prepared natural resource inventories and prepared sections for NEPA/MEPA documentation in support of runway, taxiway, and infrastructure reconstruction. For runway safety areas impacts of 1.5± acres of wetland requiring MA DEP wetland variance, designed and provided construction and 5-year monitoring for a 3± acre wetland mitigation area with 1200 LF of stream and a cascade feature. Developed, permitted and monitored comprehensive vegetation management plan for airport in two towns, including multiple acres of wetland.

Principal-in-Charge and Principal Environmental Scientist, Westfield-Barnes Municipal Airport, Runway Reconstruction, NEPA/MEPA Compliance, Vegetation Management Plan, and Rare Species Master Plan, Westfield, Massachusetts. Natural resource analysis, mitigation design and permitting for the municipal airport in Westfield, MA, which is also home to the National Guard. Prepared natural resource inventories and prepared sections for NEPA/MEPA documentation in support of runway and taxiway reconstruction, new terminal building. Developed, permitted and monitored comprehensive vegetation management plan for airport including multiple acres of wetland and rare species habitat impact. Implemented Conservation and Management Plan for airport for rare species. Critical issues addressed impacts to rare species (lepidopterans and grasshopper sparrow). Overseeing surveys and preparing Master Plan approach for rare species habitat for benefit of airport future projects.

Project Environmental Scientist, UConn Marine Science and Technology Center, Avery Point Campus, Groton, Connecticut. Lead natural resource scientist for CEPA Environmental Assessment/FONSI and DEP permitting for new marine science building on Avery Point campus of UConn. Evaluated coastal wetlands and other natural resources and identified impacts. Designed coastal wetland replacement site to mitigate unavoidable impacts. Prepared Coastal Consistency Review and CT DEP/OLISP coastal wetland application. Provided construction observation for replacement coastal wetlands.

Project Scientist, Downtown Mansfield Master Plan and UConn Graduate Student Housing EIE, Storrs, Connecticut. Lead environmental evaluation team in support of this EIE for joint usage of property on the fringe of UConn's main campus. Project involved commercial development and 400 units of student housing. Key natural resource issues included vernal pools, rare species (Cooper's Hawk) and stormwater runoff.

Lead Wetlands Scientist, Western Connecticut State University, Wetlands Mitigation Design and Implementation, Danbury, Connecticut. Evaluated wetlands fill violation presumed by DEP to exceed 5 acres and determined by aerial photograph interpretation and soil borings that impacts were significantly less. Assisted WCSU and DEP in agreeing to consent decree for restoration of 2.5± acres of wetlands. Designed wetland restoration and provided compliance monitoring.

Principal-in-Charge, George Harlow Field Airport Runway Reconstruction, NEPA/MEPA Compliance and Wetland/Rare Species Permitting, Marshfield, Massachusetts. Overview of natural resource analysis, mitigation design and permitting for the reconstruction of the

Paul G. Davis, Ph.D, PWS, CPSS

Principal Environmental Scientist

runway at this Coastal Zone municipal airport in Marshfield, MA. Critical issues addressed impacts to rare species (eastern box turtle), modifications to the vegetation management plan, wetlands, water quality and coastal zone consistency associated with the Airport Master Plan Update that included runway extensions and new Part 77/TERPS surfaces.

Principal-in-Charge and Principal Environmental Scientist, New Bedford Regional Airport, Vegetation Management Plan for Runway Reconstruction, New Bedford, Massachusetts. Overview of natural resource analysis for the vegetation management plan at this regional airport, including on- and off-airport properties in the communities of New Bedford and Dartmouth. Critical issues addressed impacts to rare species (eastern box turtle), modifications to the vegetation management plan, wetlands, water quality and coastal zone consistency associated with the Airport Master Plan Update that included runway extensions and new Part 77/TERPS surfaces.

Principal Environmental Scientist, Removal of Upper Roberts Meadow Dam and Trout Stream Restoration, Northampton, Massachusetts. In support of the proposed removal of this dam segmenting a high quality trout stream, performed environmental analysis of the pond and stream habitats, prepared a mitigation strategy and plan, and prepared MEPA documentation and wetland permitting information. Conducted public meetings and seminar presentation in support of project.

Principal Environmental Scientist, Water Resource Management Study for 18 Lakes and Ponds in Springfield, Massachusetts. For the City of Springfield Parks and Recreation Department, GZA undertook a three year study to provide a summary and update of the biological and limnological conditions of 27 lakes and ponds within the City limits, assessing the biological conditions, state of eutrophication, sources of pollution and contamination, and making long-term and short-term management recommendations for the City as part of their recreational priorities.

Principal Environmental Scientist, Aquatic Plant Management in Springfield Park Ponds, Springfield, Massachusetts. Lead the environmental evaluation team in the analysis and permitting for aquatic plant management of five lakes and ponds within Forest Park in Springfield, MA. Herbicide treatment was determined to be a necessary part of the management plan and permits were obtained through DEP in support of this project. Annual monitoring and permit compliance is performed on this project since 2000, including permit renewals and documentation of vegetative changes to the aquatic and limnetic communities.

Principal-in-Charge. Turners Municipal Airport, Runway Reconstruction. NEPA/MEPA Compliance and Rare Species Permitting, Turners Falls, Massachusetts. Overview of natural resource analysis, mitigation design and permitting for the reconstruction of the runway at the municipal airport in Turners Falls, MA. Critical issues addressed impacts to rare species (lepidopterans and grasshopper sparrow). Facilitated rare moth and butterfly habitat enhancement program by initiating greenhouse rearing of host plants from endemic seed stock. Local vocational high school engaged to grow host plants and assist in planting at the airport. Designed and implemented vegetation management plan for airport to protect airspace and enhance biodiversity habitat features.

Principal Environmental Scientist. Sikorsky Memorial Airport, Rare Species Investigations for Airport Reconstruction Permitting. Stratford, Connecticut. Managed and lead scientific team in rare species habitat analysis leading to the design and implementation of a moth blacklight trapping study during 2013 for several species of rare moths potentially present at this airport with the CT Coastal Zone. Study included habitat assessment for mudflat tiger beetle and designed avoidance methodology for construction of a runway safety area at the airport.

Principal Environmental Scientist, I-84 Environmental Impact Statement, Waterbury to Danbury, Connecticut. Managed and lead scientific team in evaluation of natural resources in support of the NEPA EIS and draft permit applications for proposed widening of 34 miles of highway through seven municipalities. Identified, evaluated, and assessed potential impacts to natural resource elements included wetlands functions & values, aquatic resources (streams and rivers), water quality, habitat corridors, biodiversity, and endangered species.

Principal Environmental Scientist. Coastal Wetland Permitting for Bronx Terminal Market Place, Riverfront Park, New York City, New York. As part of the construction and permitting of the new Yankee Stadium, there was a requirement for the creation of a new waterfront park along the Bronx River at a former terminal market place. GZA assessed the coastal wetland resources and designed mitigation measures for the project. NYSDEC & ACOE Joint Permit Applications were prepared for the coastal wetlands, including a DEC Tidal Wetland Permit. An Essential Fish

Paul G. Davis, Ph.D, PWS, CPSS

Principal Environmental Scientist

Habitat Determination was made for the project, and NPDES-SPDES Permitting was performed with the preparation of a stormwater NOI & SWPPP.

Project Manager and Principal Environmental Scientist. Reconstruction of Fort Washington Park, New York, New York. Performed the environmental evaluations under CEQR relative to the PlaNYC Master Plan improvements for the 160 acre Fort Washington Park located along the Hudson River, under the George Washington Bridge. GZA environmental scientists, as coastal resource and permitting specialists to Stantec, completed botanical surveys for invasive species and normal flora within the parkland, as well as assessed wildlife and aquatic habitat. Hazardous materials assessments were conducted throughout the park facilities. Based upon the proposed work under the Master Plan, GZA assessed the environmental permitting requirements and mitigation measures at the Federal, State, and City levels that would be needed or helpful in achieving the goals of the park improvements.

Project Manager and Principal Environmental Scientist. Reconstruction of Route 148 over Great Brook, Chester, Connecticut. Delineation and evaluation of wetlands and brook habitat in this coastal environment and assessed potential impacts in association with proposed reconstruction and expansion of the highway bridge. Prepared Attachment M forms for CT DEEP OLISP application in support of bridge reconstruction.

Project Manager and Principal Environmental Scientist. Reconstruction of Route 1 over Stony Brook and Quanoduck Cove, Stonington, Connecticut. Delineation and evaluation of wetlands and brook habitat in this coastal environment, including addressing Submerged Aquatic Vegetation and assessed potential impacts in association with proposed reconstruction and expansion of the highway bridge. Prepared Attachment M forms for CT DEEP OLISP application in support of bridge reconstruction.

Principal-in-Charge and Principal Environmental Scientist, Boire Field Airport, Vegetation Management Plan and Wetland Permitting for Runway Reconstruction. Nashua, New Hampshire. Natural resource analysis, mitigation design and permitting for the municipal airport in Nashua, NH. Prepared natural resource inventories and prepared sections for NEPA Environmental Assessment in support of runway extension, taxiway, and infrastructure reconstruction. The new runway impacts over 10 acres of low quality wetlands, partially in protected aquifer and conservation land. Evaluated over 500 acres as part of site selection for offsite wetland mitigation. Evaluated rare species and habitat for herpetiles and plants. Wetland permitting at local, State and Federal levels for wetland impacts associated with runway reconstruction and vegetation management plan.

Principal Environmental Scientist, Extension of Route 72, Plainville and Bristol, Connecticut. Delineated and evaluated wetlands, streams and natural resources in corridor of this new highway alignment. Performed environmental constraints analysis for a preliminary design report, including delineation of assessment of wetland resources, identification of surface and groundwater resources, identification of significant habitat and potential endangered or threatened species, potential socio-economic and/or historic impacts, and estimation of wetland resource impacts. Subsequently, prepared contract wetland mitigation plans for 4± acres of new wetlands and 700± of stream restoration to offset wetland and stream impacts. Prepared all DEP and Corps of Engineers permit applications; Inlands/Wetlands and Watercourse Permit and 401 Water Quality Certification from CDEP as well as the Section 404 Corps of Engineers Permit and presented public testimony in support of these applications.

Principal Environmental Scientist, Infrastructure Improvements/Rentschler Field Development EIE, East Hartford, Connecticut. Role of lead natural resource scientist for a $0.7 million EIE for the UCONN stadium and subsequent $1 million EIE involving transportation and land development impacts associated with a $5 billion Master Plan for the former United Technologies Corporation 750-acre airfield. Lead scientific team to evaluate impacts to wetland, water and rare species resources, and to design mitigation approaches and strategies to support ultimate approval for these developments. Designed on-site wetland replacement sites for stadium parking construction. Designed and permitted 200± acre off-site grassland habitat mitigation for grasshopper sparrow for stadium, and subsequently designed sequential temporary on-site and permanent off-site grassland mitigation approach for 500± acres of grassland habitat to support the remaining site development. Off-site mitigation became keystone piece of 5000 acre state-wide grassland habitat preservation.

Project Manager and Lead Environmental Scientist, Route 66 Environmental Assessment (EA), Middlefield, Connecticut. Conducted field evaluations of natural and cultural resources for NEPA/CEPA EA along 2-mile corridor

Paul G. Davis, Ph.D, PWS, CPSS

Principal Environmental Scientist

within Higby Reservoir public water supply watershed,. Designed wetland mitigation plan to replace 1.7 acres of freshwater wetland lost due to highway construction. Conducted noise evaluation and air quality modeling. Prepared Environmental Assessment/FONSI through draft and final stages.

Project Manager and Principal Environmental Scientist, Reconstruction of Interstate 91 Border Crossing to Canada. Derby Line, Vermont. Provided wetlands, habitat and water resource analysis for the proposed reconstruction of this gateway facility between Canada and the United States. GZA developed a conceptual design for day-lighting 1500 LF of stream and development of riparian wetland habitat as part of the mitigation for the project that impacts 2± acres of wetlands. Permitting at the State and Federal levels for the wetlands and mitigation are in progress.

Principal Environmental Scientist. Management of Williston Pond, Easthampton, Massachusetts. Lead the environmental evaluation team in the analysis and permitting for management of Williston Pond in Easthampton, MA. A detailed pond management study was performed developing recommendation for long-term and short-term pond management. Permits were obtained for annual herbicide treatment, as well as developing and permitting a pond dredging plan for the long-term benefit of the pond. Construction monitoring and permit compliance, 2010.

Project Environmental Scientist, Restoration of Nashawannuck Pond, Easthampton, Massachusetts. Lead project team of scientists in assessing trophic and biological status of Nashawannuck Pond, in Easthampton, MA. Designed mitigation strategies for dredging and restoration of Nashawannuck Pond. Conducted base investigations and prepared preliminary designs for the aquatic habitat restoration program in compliance with U.S. Army Corps of Engineers criteria for their Section 206 funding program. Prepared a detailed project report and Environmental Assessment under NEPA. Construction 2009-2010.

Project Environmental Scientist, Restoration of Milford Pond, Milford, Massachusetts. Lead project team of scientists in assessing trophic and biological status of 120 acre Milford Pond, in Milford, MA. Designed mitigation strategies for dredging and restoration of Milford Pond. Assessed rare waterfowl habitat and conducted bird surveys. Conducted base investigations and prepared preliminary designs for the aquatic habitat restoration program in compliance with U.S. Army Corps of Engineers criteria for their Section 206 funding program. Prepared a detailed project report and Environmental Assessment under NEPA.

Project Environmental Scientist, Walden Pond Limnological Evaluation, Concord, Massachusetts. Lead scientific team on first comprehensive limnological investigation of Walden Pond since Henry David Thoreau's original study published in 1854. In-lake and laboratory chemical, physical, and biological studies on the trophic level and ecological status of Walden Pond over the course of 150 years showed that the pond had not changed appreciably, but there were warning signals that its oligotrophic status was being threatened. Management recommendations included waterfowl control, septic system monitoring the implementation of storm water BMPs draining proximal land surfaces and a public education program. A subsequent closing of Walden Pond due to elevated bacterial levels in the swimming beach area prompted a follow-up investigation by GZA in the peak recreational swimming season demonstrating cause as related to unusually heavy releases of white pine pollen that accumulated on the swimming beach.

Principal Environmental Scientist, Barre Biomass Energy Facility, Natural Resource Constraints Analysis. Barre, Massachusetts. Evaluated the natural resource permitting feasibility for this biomass energy facility located at the confluence of two rivers in Barre, MA. Delineated and assessed wetlands, assessed habitat for protected wood turtle, and assessed the impacts of withdrawal on nearby wetlands and streams. GZA proposed wetland and rare species habitat mitigation and discussed favorably with regulatory community. Groundwater extraction rate for cooling water was shown to have potential impacts on low flow conditions of a nearby stream and groundwater levels beneath nearby wetlands, and devised mitigation strategies to achieve permitting. GZA ultimately determined that the site would not support yield of the groundwater and the client elected to not pursue the site further.

Project Environmental Scientist, Routes 82 & 85, Southeastern Connecticut. Delineated and evaluated wetlands, streams and natural resources in corridor for this highway reconstruction. Performed environmental constraints analysis for a preliminary design report, including significant habitat for anadromous fish and potential endangered or threatened species. Subsequently, prepared wetland mitigation plans for 3± acres of new wetlands and 300± ft of relocated stream channel to offset wetland and stream impacts. Prepared all DEP and Corps of Engineers

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permit applications; Inlands/Wetlands and Watercourse Permit and 401 Water Quality Certification from CDEP as well as the Section 404 Corps of Engineers Permit and presented testimony in support of these applications.

Senior Environmental Scientist, Bradley International Airport Environmental Report, Windsor Locks, Connecticut. Delineated and evaluated wetlands, streams and natural resources in proximity of EPA mandated remote deicing facility and a new terminal building in support of the reconstruction of the airport. Identified significant habitat for aquatic species and grassland birds, including endangered or threatened species. Subsequently, prepared wetland mitigation plans for 2± acres of new wetlands to offset wetland impacts. Prepared all DEP and Corps of Engineers permit applications; Inlands/Wetlands and Watercourse Permit and 401 Water Quality Certification from CDEP as well as the Section 404 Corps of Engineers Permit and presented testimony in support of these applications..

Presentations & Publications

Purinton, T., S. Woods & P.G. Davis. 2016. How to Create and Sustain a State-based Ecological Restoration Division: The Massachusetts Model. Society of Ecological Restoration webinar, 05-17-2016.

P.G. Davis, C. Cox, J.P. Guarente. 2016. Using Multi-Disciplinary Science & Engineering in Regional Restoration Design & Implementation: Third Herring Pond Dam Removal and Brook Restoration Case Study. National Conference on Ecological Restoration. Coral Springs, FL., April 20, 2016.

Walder, B., P.Davis, T.Purinton, S.Woods. 2016. Creating and Fostering a State-based Ecological Restoration Initiative. National Conference on Ecological Restoration. Coral Springs, FL., April 20, 2016.

Davis, Paul G., Ph.D. 2016. Emerging Land Use Regulations & the Northern Long-Eared Bat. Society of Women Environmental Professionals, Invited Presentation. Hartford, CT. February 17, 2016.

Davis, Paul G., Ph.D. 2015. Hazardous Algal Blooms – Cyanobacteria 4. Session Moderator. North American of Lake Management Society. Saratoga Springs, NY. November 2015.

P. Davis and M. Simoneaux. 2015. A Changing Biosphere & Evolving Ecological Regulations. What's New in Massachusetts. The Harvard Club, Boston, MA. Invited Presentation, October 12, 2015

Simoneaux, M. and P. Davis. 2015. Building Resiliency Design in Coastal Wetland Restoration Projects. Annual Meeting 2015, Society of Wetlands Scientists. Providence, RI. May 31 – June 4, 2015.

Riberdy, S., P. Davis, E. Haugh, & D. Nitzsche. 2015. Nashua Municipal Airport Runway Expansion: Wetlands and Rare Species Permitting, Mitigation and Construction Observations. GZA Technical Excellence Conference, Norwood, MA. 2015. Practice Excellence Award, First Place, Natural Resources & Permitting and Sustainability.

Lecco, Stephen, P. Davis, S. Riberdy, D. Boudreau, K. Collins. 2014. Under the Gun – The Search for a New Firearms Training Facility in Connecticut. GZA Technical Excellence Conference, Norwood, MA. 2014 Practice Excellence Award, First Place, Natural Resources and Sustainability.

Davis, Paul G. 2013. Recipient of GZA GeoEnvironmental Inc. Shareholder's Grant. Support for 9 Haitian students and 1 instructor at American University of the Caribbean and instructor to attend international conference on Sustainable Agriculture.

Davis, Paul G. (with Lisa Lesperance-FAA, Katie Servis, MassDOT-Aeronautics Div., Armand Dufresne, Gale Assoc.) 2013. Environmental Issues & Trends Affecting Airports. 2013 Annual Massachusetts Airport Management Association (MAMA) Conference, September 25, 2013.

Riberdy, Steven, S. Lecco, & Paul G. Davis, Ph.D. 2013. Wetland, Turtle & Tree Impact Mitigation & Permitting for Runway Extension at Marshfield Airport. Marshfield, MA. GZA Technical Excellence Conference, Norwood, MA. 2013 Practice Excellence Award, Second Place, Water & Natural Resources and Sustainability.

Davis, Paul G. 2013. Soil Microbiology Applications in the Haitian Environment and Agronomy. 1-credit Seminar and Laboratory Course. American University of the Caribbean, Les Cayes Haiti. January 14-18, 2013.

Davis, Paul. G. D. Nitzsche, C. Quinlan, & S. Roy. 2012. Tilting at Windmills: Environmental Permitting of Brodie Mountain Wind Farm, Hancock, MA. GZA Technical Excellence Conference, Norwood, MA. 2012 Practice Excellence Award, Second Place, Water & Natural Resources and Sustainability.

Schlett, Wendy & Davis, P.G. Sustainable Mine Reclamation – Current & Future Trends. Reclamation: A Natural Choice. Stone, Sand & Gravel Review. September/October 2011.

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Davis, Paul. G., Ph.D., Erin Gillen Haugh, Stephen Roy, William Deluca, Daniel Nitzsche, & Steven Riberdy. 2011. Moths, Birds & Runway Extension: Rare Species Analysis, permitting, & Management at Turners Municipal Airport. GZA Technical Excellence Conference, Norwood, MA. 2011 Practice Excellence Award, First Place, Water & Natural Resources and Sustainability.

Davis, Paul G., Ph.D., Erin Gillen, Dan Nitzsche, & Steve Riberdy. 2010. Wildlife and Rare Species Management at Massachusetts General Aviation Airports: 3 Case Studies. Northeastern Transportation & Wildlife Conference. Amherst, MA. September 15, 2010

Davis, Paul G., Ph.D. & Wendy Schlett. 2010. "Ecological Restoration Opportunities and Trends in Large Aggregate Mining Areas". Michigan Aggregates Association, 50th Annual Meeting. Petoskey, MI. July 2010.

Davis, Paul G., Ph.D. 2009. "Watershed Exports II – Development and Water Quality Change" Session Chair. North American of Lake Management Society. Hartford, CT. October 2009.

Davis, Paul G., Ph.D. 2009. "Management Approaches I – Best Management Practices in the Watershed" Session Chair. North American of Lake Management Society. Hartford, CT. October 2009.

Davis, Paul G., Ph.D. 2009. "Construction and Implementation of Simple Sand Filtration System for Water Purification". One-day instructional seminar, Legliz Bon Berger, Nan Doti, Haiti. July, 2009.

Davis, Paul G., Ph.D. 2009. "Global Warming – Changes in Climatology". Seminar presentation at American University of the Caribbean, Les Cayes, Haiti. April 2009.

Davis, Paul G., Ph.D. 2008. "Culturing Fish with Low Resources: the Progress and Challenges of Aquaculture for the Poor in Developing Nations." International symposium participant. Marine Biological Laboratory, Woods Hole, Massachusetts. April 5th, 2008

Davis, Paul G., Ph.D. 2007. "Application of Tilapia and Queen Conch Aquaculture to Haiti". Two-day seminar presentation at American University of the Caribbean, Les Cayes, Haiti. April 2007.

Davis, Paul G., Ph.D. 2006. "Introduction to Marine Ecology". One-credit undergraduate short course. American University of the Caribbean, Les Cayes, Haiti. October, 2006.

Davis, Paul G., Ph.D. 2005. "Dredging of Lakes for Aquatic Weed Control: Does it Work?". Presentation at Northeast Aquatic Plant Management Society, January 2005.

Davis, Paul G., Ph.D. 2003. "Watershed Management." Session Moderator. North American Lakes Management Society. Annual Meeting, November, 2003.

Davis, Paul G., Ph.D. 2000. "Successes and Failures in Wetland Replacement. Developing a Blueprint for Success-5 Case Studies." Seminar presentation to Town of Enfield, CT. October, 2000.

Davis, Paul G., Ph.D. 1996. "Wetland Functions & Values in the North East". Massachusetts Association of Conservation Commissions. Fall Conference, Westfield College, Westfield, MA. November 2, 1996.

Davis, Paul G., Ph.D. 1996. Stormwater Management Technologies: Why, Where, What, When & How". North American Lake Management Society, New England Chapter. Conference, June 21-22, 1996. Ashland, MA.

Davis, Paul G., Ph.D. 1996. "A History of Cedar Swamp Pond, Review of Past Studies, and Approach for Restoration" Presentation to Charles River Watershed Association annual meeting. Milford, MA. March 1996.

Davis, P.G., S.M. Miller, C. Carranza. 1995. Analysis of Nutrient Contributions to Walden Pond, Concord, MA. Davis, Paul G., Ph.D. 1995. Presentation at North American Lakes Management Society Annual Meeting. Banff, Canada. November, 1995.

Davis, P.G., E. Stamman, D.A. Segar. 1987. A preliminary epidemiological assessment of the potential for diarrhetic shellfish poisoning in the northeast United States. NOAA Techn. Memo. NOS OMA 34. pp. 1-18.

Davis, P.G. and W.G. Conner. 1986. Federal Action Plan for ocean dumping research on municipal and industrial wastes. Sixth International Ocean Disposal Symposium. Pacific Grove, California. April, 1986.

Caron, D.A., P.G. Davis, L.P. Madin and J. McN. Sieburth. 1986. Enrichment of microbial populations in macroaggregates (marine snow) from surface waters of the North Atlantic. J. Mar. Res. 44:543-565.

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geographic, vertical, seasonal and diel distributions. Mar. Ecol. Progr. Ser. 21:15-26.

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Segar, D.A., P.G. Davis, and E. Stamman. 1984. Monitoring of disposal at the North Atlantic deepwater municipal sludge dump site. Proceedings 5th International Ocean Disposal Symposium, Corvallis, Oregon. September 1984.

Segar, D.A., E. Stamman, and P.G. Davis. 1984. Beneficial use of municipal sludge in the ocean. Proceedings. Oceans'84, Washington, D.C., September 1984. Marine Technology Society.

Davis, P.G. and D.A. Caron. 1984. American Association for the Advancement of Science Symposium, "The Significance of Procaryotic and Eucaryotic Microbes in Planktonic Food Webs", New York, NY. May 1984.

Estep, K.W., P.G. Davis, P.E. Hargraves, and J.McN. Sieburth. 1984. Chloroplast containing microflagellates in natural populations of North Atlantic Nanoplankton, their identification and distribution: including a description of five new species of Chrysochromulina (Prymnesiophyceae). Protistologica 20: 613-634

Davis, P.G. and V.P. Olivieri. 1984. Assessment of the microbiological hazards to human health associated with the ocean disposal of sewage sludge in the New York Bight apex. Oceans'84, Marine Technology Society/IEEE Ocean Engineering Society. Washington, D.C. Conference Record. pp. 278-284.

Davis, P.G. and J. McN. Sieburth. 1984. Estuarine and oceanic microflagellate predation of actively growing bacteria: estimation by frequency of dividing-divided bacteria. Mar. Ecol. Progr. Ser. 19:237-246.

Segar, D.A., P.G. Davis, and E. Stamman. 1984. A global comparison of contamination in populated estuaries and coastal waters. Oceans'84, Marine Technology Society/IEEE Ocean Engineering Society. Washington, D.C. Conference Record. pp. 284-289.

Davis, P.G. and J.McN. Sieburth. 1984. Differentiation and characterization of individual phototrophic and heterotrophic microflagellates by sequential epifluorescence and electron microscopy. Trans. Amer. Micros. Soc. 103:221-227.

Segar, D.A. and P.G. Davis. 1984. Contamination of populated estuaries and adjacent coastal ocean: a global review. NOAA Techn. Memo. NOS OMA 11. 120 pp.

Small, E.B., B. Neun, D. Caron, and P. Davis. 1983. Ciliates associated with Gulf Stream 'snow'. 36th Annual Meeting Soc. Protozool. Abst. 58.

Johnson, K.M., P.G. Davis, and J.McN. Sieburth. 1983. Diel variation of TCO2 in the upper layer of oceanic waters reflects microbial composition variation, and possible methane cycling. Mar. Biol. 77:1-10.

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Davis, P.G., and J. McN. Sieburth. 1982. Differentiation of phototrophic and heterotrophic nanoplankton populations in marine waters by epifluorescence microscopy. Annales Inst. Oceanogr. 52(S):249-260.

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Davis, P.G. and H. Hara. 1979. Coastal Zone Management in the United States. Marine Parks Journal 46:13-16. (Japanese)
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Davis, P.G., R.F. Heffernan, and J.McN. Sieburth. 1978. Heterotrophic microbial populations in estuarine microcosms: Influence of season and water-accommodated hydrocarbons. Centennial Meeting, American Microscopical Society (Dec. 26-30, 1978). Trans. Amer. Micros. Soc. 98(1):152.

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RESUME

Bryan A. Carignan, E.I.T

Water Resources Specialist

Summary of Experience

Mr. Carignan is a Water Resources Engineer in the Dams and Water Resources Group with a background in Civil Engineering and hydrology/hydraulics starting in September, 2013. His responsibilities on projects include extreme flood analysis, analysis of storm surge and wind driven waves, dam repair assessment and design, and hydrologic and hydraulic modeling, and hydropower feasibility analysis. He has field experience in dam inspections, surveying stream reaches, and stream restoration projects. He has course experience in stormwater management design, fluid mechanics, geo-environmental engineering, statistical hydrology, stream restoration, and ecohydrology. He is proficient in AutoCAD, FLO-2D, ArcGIS, HEC-HMS, HEC-RAS, and SLOSH.

Relevant Project Experience

Project Engineer, Ottauquechee Hydropower Project Inspection, North Hartland, VT. GZA was retained to perform certain engineering investigations and analyses for a FERC authorized project in North Hartland, VT. Mr. Carignan analyzed hydropower production records and compared them to hypothetical production estimates that GZA developed in order to assess hydropower performance.

Project Engineer, Flood Hazard Reevaluation, Coastal Site in New England. Mr. Carignan was a contributing Water Resources Engineer, coastal modeler and hydrologist for external flood hazard re-evaluation of a nuclear power plant site in New England. The external flood reevaluation was performed in response to NRC's 10 CFR part 50, Section 50.54 (f) request for information issued March 12, 2012, and includes evaluation of the Probable Maximum Flood (PMF), Probable Maximum Precipitation (PMP), Local Intense Precipitation (LIP), Probable Maximum Hurricane, Probable Maximum Surge, Seiche, and Tsunami, Combined Events Analysis, Associated Effects Analysis and Error/Uncertainty Analysis.

Mr. Carignan's role on this project included the development of synthetic extra-tropical storm tracks and wind/pressure fields from historical data using ArcGIS in order to simulate the Probable Maximum Wind Storm (PMWS) at the sites, use of NOAA SLOSH, and the development of FLO-2D two-dimensional hydrodynamic models to simulate the LIP at the site. Other aspects of the project in which Mr. Carignan was involved in include wave runup analyses to determine the total combined effect flood elevation, verifying the validity of coastal models, upstream dam failures analyses, development of the Probable Maximum Precipitation, channel migration analysis, and ice effect assessments.

Project Engineer, Flood Hazard Reevaluation, Riverine Site in Illinois. Mr. Carignan was a contributing Water Resources Engineer and hydrologist for external flood hazard re-evaluation of a nuclear power plant site in Illinois. The external flood reevaluation was performed in response to NRC's 10 CFR part 50, Section 50.54 (f) request for information issued March 12, 2012, and includes evaluation of the Probable Maximum Flood (PMF), Probable Maximum Precipitation (PMP), Dam Failures Analysis, Ice Jams Analysis, Local Intense Precipitation (LIP), Probable Maximum Surge, Seiche, and Tsunami, Combined Events Analysis, Associated Effects Analysis and Error/Uncertainty Analysis.

Education
M.S., 2013, Civil Engineering, University of New Hampshire
B.S., 2010, Civil Engineering, University of New Hampshire

Registrations & Certificates
2009, New Hampshire, Engineer-In-Training (E.I.T.)

Affiliations
- American Society of Civil Engineers (ASCE)
- Boston Society of Civil Engineers Section (BSCES)

Areas of Specialization
- Hydraulic Engineering
- Surface Water Hydrology
- Water Resource Systems Analysis
- Geographic Information Systems (GIS)

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Water Resources Specialist

Mr. Carignan's role on this project included the development of FLO-2D two-dimensional hydrodynamic models to simulate the LIP at the site and the development of riverine hydrologic and hydraulic models using HEC-HMS and HEC-RAS to evaluate the design basis flood at the sites. Other aspects of this project in which Mr. Carignan was involved in include wave runup analyses to determine the total combined effect flood elevation, upstream dam failures analyses, development of the Probable Maximum Precipitation, channel migration analysis, and ice effect assessments.

The flood re-evaluations were performed in accordance with current regulatory guidelines including: NRC Standard Review Plan, NUREG-0800, revised March 2007; NRC Office of Standards Development, Regulatory Guides RG 1.102 – Flood Protection for Nuclear Power Plants, Revision 1, dated September 1976 and RG 1.59 – Design Basis Floods for Nuclear Power Plants, Revision 2, dated August 1977; NUREG/CR-7046 "Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America", publication date November 2011; NUREG/CD-6966 "Tsunami Hazard Assessment at Nuclear Power Plant Sites in the United States of America", Final Report; and American National Standard for Determining Design Basis Flooding at Power Reactor Sites (ANSI/ANS 2.8-1992).

Project Engineer, Muddy River Flood Damage Reduction and Environmental Restoration. Mr. Carignan was a contributing Water Resources Engineer on the water diversion and control plan for the Muddy River Flood Damage Reduction & Environmental Restoration project for the U.S. Army Corps of Engineers. Mr. Carignan utilized ArcGIS, HEC-GeoRAS and HEC-RAS in order to model existing and proposed channel conditions to determine channel and culvert capacity during different construction phases. Project responsibilities also included an initial pump feasibility study.

Prior Experience

Climate Change and Snow in the Northeast. Mr. Carignan defended his thesis on the effects of climate change on snow, specifically snow water equivalent (SWE), in July, 2013. His work included the use of the North American Regional Climate Change Assessment Program (NARCCAP) model output. The models were evaluated for performance in New England compared to observed data. Using the best performing models in New England, climate scenarios from 1971-2000 to 2041-2070 were statistically compared for changes in the timing and magnitude of peak SWE, the winter start and end dates, and the monthly SWE averages.

Graduate Assistant within the Environmental Research Group – University of New Hampshire. Mr. Carignan was a graduate assistant as part of the UNH Environmental Research Group (ERG) throughout his graduate career. His responsibilities included working as a teaching assistant for a junior level fluid mechanics class and working under the NASA grant "EPSCoR CAN: Passive Microwave Detection of Snowmelt and Runoff" to further develop the use of remote sensing as a tool for snowmelt runoff flooding predictions; working closely with the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL).

RESUME

Christine H. Stonier, P.E.

Water Resources Engineer

Summary of Experience

Ms. Stonier is an Assistant Project Manager in the Dams and Water Resources Group with a background in Civil and Water Resources Engineering including hydropower development. Her responsibilities on projects include hydrologic and hydraulic analyses, dam inspection reporting, spillway capacity analysis and permitting associated with dams and hydroelectric projects. She is proficient using AutoCAD, GIS, HEC-HMS, HEC-RAS, SMPDBRK, FLO2D and Visual Basic and Matlab programming.

Relevant Project Experience

Project Engineer, Crane & Co. Hydroelectric Project, Dalton, MA. GZA was awarded a contract to conduct hydroelectric feasibility study to assess the potential of restoring hydroelectric generation at the Byron Weston Dam No. 2 in Dalton, Massachusetts. GZA's assessment showed that hydroelectric generation at this site was technically and financially feasible. GZA was awarded a second contract to design a hydroelectric plant at the site. Ms. Stonier is involved in preparing the contract documents and specifications for the construction of the hydroelectric generation plant. Ms. Stonier built a three dimensional model of the proposed powerhouse in AutoCad to aid in design process.

Project Engineer, MWRA CVA to Hatchery Pipeline Hydropower Feasibility Study & Preliminary Design Report, MA. GZA assessed the feasibility of integrating hydroelectric facilities into a proposed water pipeline from the MWRA's Chicopee Valley Aqueduct to the Massachusetts Division of Fisheries and Wildlife's McLaughlin Fish Hatchery. Ms. Stonier's activities included preparing concept drawings for the feasibility study, and preparing the Preliminary Design Report.

Project Engineer, New Jersey Water Supply Authority Feasibility Studies, Clinton, NJ. The NJWSA was interested in assessing the feasibility of hydropower generation at two reservoirs owned by the NHWSA and at ten locations on the Delaware and Raritan Canal. Ms. Stonier assisted in the feasibility analysis for the locations along the Delaware and Raritan Canal. Ms. Stonier's activities included assessing the financial feasibility, preparing concept drawings and writing the feasibility report.

Project Engineer, Manville Dam Hydroelectric Feasibility Study, Cumberland RI. The Valley Affordable Housing Association received a grant from the Rhode Island Economic Development Corporation to study the potential for developing a hydroelectric project at the Manville Dam in Cumberland, RI. Ms. Stonier assisted in the preparation of a FERC Preliminary Permit.

Project Engineer, Dam Safety Modifications for Five MWRA Operated Water Supply Dams, MA. GZA's design services included permitting, preparation of contract documents for repairs and upgrades, and assistance in evaluating bids for five dams operated by the MWRA. During the design phase Ms. Stonier's responsibilities included permit preparation of the Notice of Intent for Town of Weston and the Chapter 253 Dam Safety Permit Application for two of the dams. In addition, Ms. Stonier prepared contract drawings, cost estimates and reviewed specifications for the project. During construction Ms. Stonier responded to Contractor submittals and Requests for Information.

Education
B.S., 2008, Civil Engineering, Northeastern University
M.S., 2010, Environmental and Water Resource Engineering, Tufts University

Registrations & Certificates
Professional Engineer – 2014,Massachusetts, #50880

Affiliations
- American Society of Civil Engineers
- Association of State Dam Safety Officials

Areas of Specialization
- Dam Engineering
- Civil Engineering
- Computer Modeling
- Surface Water Hydrology
- Water Resource System Analysis
- Hydropower Development

Christine H. Stonier, P.E.

Water Resources Engineer

Project Engineer, Permitting of Repairs to Stiles Reservoir Dam, Massachusetts- 2010. GZA was awarded a contract to design modifications to Stiles Reservoir Dam and to assist the Stiles Lake Water District in obtaining necessary permits or exclusions. Ms. Stonier assisted the District in addressing the following agencies/obtaining the following permits: Massachusetts Department of Environmental Projection/ 401 Water Quality Certification, Army Corps of Engineers/ 404 General Permit, and the Town of Leicester Conservation Commission/ Notice of Intent.

Project Engineer, City of Leominster Owned Phase I Dam Inspections, Various Locations- MA. GZA was awarded a contract from the City of Leominster to performed Phase I Dam Inspections for six of the City owned dams. Ms. Stonier was the project engineer for the inspection team of the dams, and was the primary author of the dam inspection/evaluation reports.

Hydrologist, Aquarion Water Company of Connecticut detailed spillway adequacy Analysis, NY. GZA was awarded a contract to conduct detailed spillway adequacy analyses for five of Aquarion Water Company's dams. Ms. Stonier conducted hydrologic and hydraulic modeling of rainfall-runoff processes to evaluate the overtopping potential for of two of the dams located in New York State.

Project Engineer, Engineering Services for 5 NYCDEP dams, NY. GZA performed engineering assessments for 5 New York City Department of Environmental Protection Dams in New York. These dams include: Hillview Reservoir Dam, Jerome Park Reservoir Dam, Central Park Reservoir Dam, Silver Lake Reservoir Dam and Ridgewood Reservoir Dam. Ms. Stonier prepared the Inspection Maintenance & Operations Plans (I&M Plan) that provide information regarding pertinent dam data, operations and maintenance procedures of the dam and its appurtenant structures, and a schedule for monitoring, visual dam inspections, and maintenance activities.

Co-op, Blackstone Valley Visitors Center Hydroelectric Feasibility Study, Worcester, MA. Ms. Stonier assisted in performing a feasibility study to investigate the potential for developing a hydropower project to be constructed as part of the visitors center being constructed on the Blackstone River.

Co-op, Dodgeville Hydropower Pre-feasibility Study, Attleboro, MA. GZA was awarded a contract to perform a pre-feasibility study on the practicability of hydropower generation at Dodgeville Pond Dam in Attleboro, Massachusetts. Ms. Stonier assisted in preparing a Massachusetts Technology Collaborative grant application.

RESUME

Daniel J. Boudreau, Jr.

GIS Coordinator

Summary of Experience

Mr. Boudreau has extensive experience in all aspects of geospatial technology. He brings over twenty-three years of combined CAD and GIS experience in data management, data development/conversion, spatial analysis, cartographic design as well as field data collection for asset management and environmental assessment. Prior to joining GZA, Mr. Boudreau served as a Senior GIS Analyst and GIS Manager at Vanasse Hangen Brustlin, Inc. for eleven years.

Since joining GZA in July of 2012 Mr. Boudreau has served as GIS Coordinator overseeing the deployment of GZA's ArcGIS Server, development of the central data repository and development/deployment of GIS web and mobile applications for both internal and external clients.

Education
B.S., 2001, GIS and Cartography
Salem State College, Salem MA
Presenting Data and Information
Edward Tufte – Boston, MA, 2001

Registrations & Certificates
Certified Geographic Information Systems Professional (GISP), 2005

Areas of Specialization
- Geographic Information Systems (GIS)
- Database Development
- Spatial Analysis
- CAD/GIS Integration
- Cartographic Design and Production
- 3D modeling and Data Visualization

Relevant Project Experience

Review of Existing FEMA Flood Insurance Rate Maps/Study, and Preparation Letter of Map Revision, Town of Hingham, Massachusetts. In 2013, the Town of Hingham, MA retained GZA to provide a technical review of the current FEMA Flood Insurance Rate Maps (FIRM). The primary goals of the project were to determine if the existing FIRM accurately reflect the 100-year flood conditions within the Town and whether or not the 2012 FEMA coastal and inland flood mapping and study analyses were completed in accordance with FEMA study guidelines and mapping requirements. Also evaluated whether more refined storm surge modeling and analyses could reduce the predicted base flood elevation. Initial review of the 2012 coastal study analyses and flood zone delineations revealed discrepancies in the wave input data and flood zone delineations. Developed new wind, water level and wave data for the performance of new coastal analyses and remapping the coastal areas of the Town. The coastal analyses and revised FIRMS were completed in ArcGIS to support the submission of a Letter of Map Revision (LOMR) to FEMA for the modification the 2012 FIRMs.

DESPP Firearms Training Facility Siting Study/EIE – Statewide- Connecticut. GZA was selected by the Connecticut Department of Construction Services to perform a Siting Study and Environmental Impact Evaluation for a proposed new Firearms Training Facility for the State Department of Emergency Services and Public Protection (DESPP). The existing facility has been plagued by frequent and intense flooding as it is located in the Farmington River Flood Zone. Evaluated a site owned and managed by the Connecticut Department of Energy and Environmental Protection (DEEP) that contains rare wildlife. Conducted herpetile, Lepidoptera (moth), insect and plant surveys at the site in close coordination with the DEEP Natural Diversity Data Base. DESPP was unsuccessful in securing a shared firing range site on the site due to wildlife and land use concerns as well as strong public opposition. Therefore, DCS and DESPP enlisted GZA to conduct a statewide alternatives analysis of all land that is potentially suitable for this use.

Developed a comprehensive siting criteria matrix and scoring system that takes into account land use, ownership, socioeconomic and environmental resource factors. These criteria were then applied to properties in the State using ArcView GIS as the

Daniel J. Boudreau, Jr.
GIS Coordinator

platform. GZA is in the process of developing a shortlist of candidate sites that will be evaluated in greater detail during the Connecticut Environmental Policy Act process.

GZA developed a secure web-based GIS application that can be used by DCS and DESPP staff to help narrow the list of potential sites that will be reviewed in further detail in the Environmental Impact Evaluation.

DESPP Firearms Training Facility Siting Study/EIE – Statewide- Connecticut. Developed a comprehensive siting criteria matrix and scoring system that takes into account land use, ownership, socioeconomic and environmental resource factors. These criteria were then applied to properties in the State using ArcGIS and an iterative model to rank the sites. The results and factors were presented and managed via a GIS Web Application facilitating collaboration with stakeholders.

EDO Corporation, Kellogg Deering NPL Site, Norwalk, Connecticut. Developed a geodatabase and a GIS web application allowing users to query and view wells and sampling data in support of a Quality Assurance Project Plan (QAPP) for Operable Unit Number 2 of the Kellogg-Deering National Priority List Site (the Site) in Norwalk, Connecticut which was originally submitted to and approved by the United States Environmental Protection Agency (EPA) in March, 1993.

Experience Prior to GZA

T.F. Green Airport (PVD) Drainage Master Plan Update, RIAC Warwick, Rhode Island. Developed a geodatabase comprised of spatial data collected in the field by surveyors of over 900 drainage structures and associated pipes, that met the requirements of Part I.B.4g of the RIAC RIPDES Permit. The geospatial drainage data included all information collected in the field, including linked images highlighting existing structure condition, created as a networked system and were used for hydrologic and hydraulic analysis, and modeling in XP SWMM as well as the development of a revised Master Plan. Geospatial data was provided to the airport for inclusion in existing geospatial infrastructure at the close of the project.

ALDEN

GREGORY S. ALLEN, P.E.

Director, Environmental and Engineering Services

Mr. Allen is Director of Environmental and Engineering Services at Alden and manages a staff of engineers and scientists. Mr. Allen has over 15 years of experience conducting feasibility, design, laboratory and field services related to hydropower projects. Mr. Allen has managed and overseen numerous projects to evaluate and test new turbine technologies, complete resource assessments for site potential, measure flow rates to understand plant performance, and restore historic spawning habitat for anadromous and riverine fish. Mr. Allen has participated in many agency meetings and supported FERC licensing activities at numerous projects.

EXPERTISE

- Hydropower feasibility studies
- Upstream and downstream fish passage evaluations and design
- Turbine fish passage survival analysis
- Hydraulic and hydrologic analyses
- Dam removal analyses
- Engineering Economics
- Detailed structural and civil designs

PROJECT EXPERIENCE

Fish and Aquatic Resource Study for Ludington Pumped Storage Project (2015 to present) – Project Manager to conduct a FERC required Fish and Aquatic Resource Study. The study includes a thorough review of potential fish protections technologies and operational measures to reduce fish entrainment. Mr. Allen coordinated technical activities, participated in agency consultations and presented results of the study to resource agencies, stakeholders and FERC.

FERC Preliminary Permit Application for McNary Advanced Hydropower Project(2015 to present) – Project Manager for Alden's support of a preliminary permit application for Advanced Hydropower's new hydropower development (FERC Project No. 14697-000) proposed for McNary Dam. Mr Allen prepared the initial design and description of the proposed project features.

Economic and Engineering Evaluation of Water Power Conduit Technologies, Electric Power Research Institute (December 2015) – Mr. Allen oversaw, managed and provided guidance for a waterpower technology evaluation for the Electric Power Research Institute. The project included a thorough review of available waterpower conduit technologies, a market assessment of key technology manufacturers, public policy and regulatory review in the US and abroad, and an overview of existing project costs, and performance data.

Hadley Falls Hydroelectric Project (2007 to present) – Project Manager and fish passage engineer for various projects related to the design of downstream passage facilities for endangered shortnose sturgeon at Hadley Falls Station on the Connecticut River. Alden's scope included numerous CFD modeling efforts of various bar rack configurations for downstream passage and alternatives to improve hydraulic conditions at the entrance to the upstream fish passage facilities. Mr. Allen provided fish passage and hydraulic design consultations with resource agencies and client. He was the design engineer of a new fish friendly bypass weir for downstream passage (installed in 2012) which included hydraulic and structural design, preparation of bid documents and inspections.

Scotland Hydro Fish Passage Project, Windham, CT – Project Manager for the design of upstream and downstream fish passage facilities at Scotland Hydro Electric Project on the Shetucket River. The project includes design of a fish lift to pass American shad and herring upstream and downstream passage bypasses for American shad, herring and American eels. The fish lift design is unique, in providing an exit sluice rather than an exit flume which has significantly reduced the overall installation costs.

Cumberland Mills Dam Fish Passage Project, Westbrook, ME – Provided expert testimony and design services for fish passage issues at the Cumberland Mills Dam located on the Presumpscott River in Westbrook, Maine. The site is within a mill complex with the river channel splitting around an island with a dam either side of the island. Mr. Allen developed preliminary and hydraulic design for a single Denil fish ladder in one channel and directed CFD modeling of various design features. This project required close collaboration and consensus with multiple stakeholders, including Federal and State agencies, NGOs and state and client attorneys.

Saccarappa Fish Passage Project, Westbrook, ME – Fish passage engineer to evaluate fish passage feasibility at SAPPI's Saccarappa Hydroelectric project on the Presumpscott River in Westbrook, Maine. The site includes a powerhouse and a bypass reach with an island and two sets of falls that are important assets to the community of Westbrook. Various upstream fish passage options were evaluated which included: dam removal, nature-like bypass channels, and fish ladders. In addition, final hydraulic design of a fish ladder over the lower falls was provided. Mr. Allen continues to provide fish passage design consultations with the resource agencies, NGOs and client.

Shawmut Hydroelectric Project, Shawmut, ME – Fish passage engineer to evaluate downstream passage feasibility at FPL's Shawmut Hydroelectric project on the Kennebec River in Shawmut, Maine. Greg, working with project team members, developed various downstream passage alternatives for Atlantic salmon. He provided fish passage and hydraulic design consultations with resource agencies and the client.

EDUCATION

B.S., University of Massachusetts, 1998, Civil Engineering

Fish Passage Training Course. May 18-21, 2010. Hadley, MA. Sponsored by the Northeast Regional Office of the U.S. Fish and Wildlife Service.

Engineering Innovative Fish Passage Course. October 21-24, 2002. Waterville Valley, NH. Sponsored by the University of Wisconsin – Madison, College of Engineering. 3 CEU

REGISTRATION

Registered Professional Engineer in Maine, Massachusetts, New York and Connecticut.

PROFESSIONAL ACTIVITIES

National Hydropower Association, Research and Development Committee Chair
Associate Member, American Society of Civil Engineers (ASCE)
Member, Association of State Dam Safety Officials (ASDSO)
Tau Beta Pi Engineering National Honor Society
Chi Epsilon Civil Engineering National Honor Society

SELECTED PUBLICATIONS/PRESENTATIONS

An approach to Predicting Fish Survival for Advanced Technology Turbines, with Hecker, G.E. Hydro Review. November 2005.

ALDEN

STEPHEN V. AMARAL
Principal Fisheries Biologist

EXPERIENCE SUMMARY

Mr. Amaral has extensive experience in the assessment and resolution of aquatic resource issues at all types of water intakes. This experience has been developed over the past 25 years through the management and performance of laboratory, field, and desktop studies designed to investigate the effects of intakes and to develop solutions for mitigating any identified impacts. Mr. Amaral's capabilities are focused primarily on evaluations of aquatic resource impacts for hydroelectric project relicensing and for meeting Clean Water Act (CWA) Section 316(b) requirements. Specific expertise and experience includes:

- Laboratory and field evaluations of fish passage and protection technologies;
- Design and performance of water quality and instream flow studies;
- Field Sampling techniques for fisheries applications;
- Literature-based estimates of turbine entrainment and survival at hydro projects;
- Assessment and resolution of resource impacts for hydropower licensing and cooling water intake permitting;
- Preparation of FERC licensing documents, including PADs, study plans, and license applications; and
- Expert witness for issues related to the application and biological effectiveness of fish passage and protection technologies and entrainment of fish at water intakes.

SELECTED PROJECTS

FERC Relicensing of Small Hydro Project in Rhode Island (current project) – Project manager for the relicensing of the Central Falls Hydroelectric Project on the Blackstone River in Rhode Island. Responsible for preparation of NOI, PAD, and license application, as well as strategic planning, agency consultation, and study plan development.

Fish Bypass Efficiency Study – Project manager for the evaluation of a downstream fish bypass installed at the Ball Mountain Hydroelectric Project located on the West River in Vermont. The bypass efficiency study is a FERC license requirement for the project. This study is in progress and will include a field evaluation of bypass efficiency with two species of trout, data analysis, preparation of draft and final reports, addressint state and federal agency comments, and submitting the study report to FERC.

Water Quality Monitoring Study – Project manager for water quality monitoring studies conducted at the Ball Mountain and Townshend hydroelectric projects located on the West River in Vermont. Studies were completed as part of a FERC license requirement for each project. Prepared draft and final reports, addressed state and federal agency comments, and made final submittal of the study report to FERC.

Preparation of FERC-Required Study Plans – Prepared downstream passage and water quality monitoring study plans for the Ball Mountain and Townshend hydroelectric projects located on the West River in Vermont. Coordinated agency consultation for the development of each study plan and made final submittal to FERC for the project owner (Eagle Creek Renewable Energy).

Preparation of Aquatic Resource Impacts for FERC Environmental Assessments – As a subcontractor to FERC, evaluated and drafted aquatic resource impact sections for environmental assessments (EA) prepared for the relicensing of three hydro projects in Vermont and one in Connecticut.

Instream Flow Studies for Small Hydro Projects – Project manager for instream flow studies conducted at two small hydro projects in Connecticut and Massachusetts. Prepared FERC-approved study plans, collected field data, and estimated habitat availability for target fish species and life stages at several bypass reach flow rates. Provided recommendations for minimum flow releases that were accepted by state and federal resource agencies.

Estimation of Downstream Passage Survival for Atlantic Salmon at 15 Penobscot River Hydroelectric Projects – Lead investigator for desktop study that provided NMFS with estimates of downstream passage survival for endangered Atlantic salmon at 15 hydro projects on the Penobscot River in Maine. For each project, estimates of bypass efficiency, spillway and bypass survival, and turbine passage survival were developed to calculate total project survival rates of smolts and kelts. NMFS is using the information from this study in a population model that will allow them to determine acceptable take limits at each project and the need for fish passage measures.

Turbine Entrainment and Survival Study Plans for FERC Relicensing– Prepared study plans for turbine entrainment and survival evaluations conducted at the St. Anthony Falls (Minnesota) and Wissota (Wisconsin) hydroelectric projects. These studies were conducted as required for the relicensing of each project.

Evaluation of Entrainment and Mortality and the Effectiveness of Downstream Fish Passage Technologies for a Proposed Hydro Project – Prepared technical documents that estimated turbine and spillway mortality rates for a proposed hydro project in Alberta, Canada. Also estimated the potential effectiveness of downstream fish passage systems for selected species. Served as an expert witness at a government hearing for determining the environmental and social impacts of the proposed project. Provided testimony on turbine and spillway mortality and effectiveness of proposed downstream fish passage technologies.

EDUCATION

B.S., University of Massachusetts, 1989, Fisheries Biology
M.S., University of Massachusetts, 1996, Fisheries Biology

ADDITIONAL TRAINING

DIDSON Basic Training Course – Multibeam Sonar, 2007
River Morphology and Restoration, AFS Continuing Education Workshop, 2004
Using Hydroacoustics for Fisheries Assessments, Hydroacoustic Technology, Inc., 1993
Bioenergetics Modeling, Massachusetts Cooperative Fish and Wildlife Research Unit, 1992
Radio Telemetry Techniques for Fisheries Application, Lotek Engineering, 1992

PROFESSIONAL ACTIVITIES

Member, American Fisheries Society
Editor, Proceedings of the Fourth Fisheries Bioengineering Symposium
Faculty, Hydro Basics Course, Hydropower and Natural Resource Stewardship, Hydro Training Institute
Board of Directors, Hydro Research Foundation

SELECTED PUBLICATIONS AND PRESENTATIONS

Hydropower and Natural Resource Stewardship:Instream Flows and Fish Passage, presented each year at HydroVision Conference as part of the Hydro Training Institute's Hydro Basics Course.

Evaluation of Behavior and Survival of Fish Exposed to an Axial-Flow Hydrokinetic Turbine, Lead author, North American Journal of Fisheries Management, 2015.

Fish Passage in the U.S.: Latest Developments and Approaches, presented at the Forum on Hydropower 2014, Canadian Hydro Association.

Turbines and Fish: The Status of Fish-Friendly Hydropower Turbines, presented at the Workshop on Fish Migration and Water Resources-Challenges and Solutions in Biel, Swizterland, 2014.

Upstream Fish Passage in the Northeast: Are We Moving in the Right Direction, presented at HydroVision International 2013.

Estimation of Total Project Survival for Atlantic Salmon Passing Downstream at Penobscot River Hydro Projects, presented at the 2012 International Conference on Engineering and Ecohydrology for Fish Passage.

Fish Protection Technologies: The US Experience, co-author, In: Operational and Environmental Consequences of Large Industrial Cooling Water Systems, S Rajagopal et al. (eds.), Springer Science and Business Media, LLC., 2012.

Determining the Best Methods for Reducing Fish Mortality, co-author, Hydro Review, Pennwell Corporation, September 2011.

Development and Application of a Fish-Friendly Turbine, lead author, Hydropower & Dams, Issue 4, 2010.

Advances in Fisheries Bioengineering, editor (with D. Mathur and E. P. Taft), American Fisheries Society Symposium 61, 2008.

Biological Evaluation of Angled Bar Racks and Louvers for Guiding Silver American Eels, lead author, Biology, Management, and Protection of Catadromous Eels, American Fisheries Society Symposium 33, 2003.

Biological Evaluation of Angled Bar Racks and Louvers for Guiding Lake and Shortnose Sturgeon, lead author, Biology, Management, and Protection of North American Sturgeon, American Fisheries Society Symposium 28, 2002.

ALDEN

WILLIAM FAY
Engineer

PRESENT POSITION

Mr. Fay is responsible for general physical and hydraulic engineering in association with the design, construction, and testing of physical hydraulic models. Mr. Fay is also involved with projects associated with hydroelectric power generation utilizing his years of field experience.

EXPERTISE

- Regulatory Compliance, Licensing, and Permitting for Hydroelectric Power Plants in the United States
- Hydroelectric Power Plant Economics and Feasibility Analysis
- Hydroelectric Power Plant Civil and Mechanical Design
- Hydroelectric Power Plant Civil Works and Mechanical System Maintenance and Repair
- Hydroelectric Power Plant Operations Streamlining and Organization
- Hydroelectric Power Plant Construction Management/Oversight
- Dam Safety Inspections and Downstream Hazard Analysis
- Dam Safety Repair Design and Construction Management

PROJECT EXPERIENCE

Mr. Fay has over 9 years of engineering, permitting, and hands on experience associated with hydroelectric power generation and dams. Selected projects include:

FERC Licenses and Exemptions: Indian River Hydroelectric, Vermont Tissue Hydroelectric, Woronoco Hydroelectric, and Tannery Pond Hydroelectric.

FERC Compliance and Dam Safety: Golden Pond Hydroelectric, Glenn Falls Hydroelectric, Tannery Pond Hydroelectric, Salisbury Hydroelectric, Wappingers Falls Hydroelectric, LP Athol Hydroelectric, Woronoco Hydroelectric, Collins Hydroelectric, and Indian River Hydroelectric.

Recent Hydroelectric Feasibility Studies: New Mills Hydroelectric, Sparhawk Mills, Linwood Mills, Tannery Pond Hydroelectric, Hope Mills, Golden Pond Hydroelectric, Vermont Tissue Hydroelectric, and Claverack Creek Hydroelectric. Comprehensive feasibility studies for resuming and upgrading hydropower generation, including onsite engineering surveys, onsite mechanical/civil works inspections, power production modeling, proforma business modeling and sensitivity analysis for several preferred alternatives.

Dredging Design and Permitting: Indian River Hydroelectric, Tannery Pond Hydroelectric, Vermont Tissue Hydroelectric, and Golden Pond Hydroelectric. Prepared and filed US Army CORPS 404 dredge and fill permits and associated state level permitting for construction and repair of hydroelectric power plants.

Dam Breach Studies: Hilchey Pond Dam, South Village Pond Dam, Wappingers Falls Hydroelectric, and Salisbury Hydroelectric. Dam Breach studies utilizing BOSS Dam break routing model including onsite survey of transects, differential survey of critical elevations, NWS hydrology computations, computerized breach simulations and inundation mapping.

Recent Dam Safety Studies: Gavco Pond Dam, Thorndike Lower Dam, Thayer Pond Dam, Williams Pond Dam, Patril Hollow Dam, Lower Burrage Pond Dam, and Hilchey Pond Dam. Assisted in the onsite inspection and preparation of the dam inspection reports.

Low Impact Hydro Institute Applications: Prepared LIHI applications for Collins Hydroelectric, Indian River Hydroelectric, Woronoco Hydroelectric, and Turners Falls Hydroelectric.

Golden Pond Hydro Dam Repair Design, for French River Land Company, Repair Design including CAD Drawings, 401 Dredge Permit and Dam Repair Permit for flood damaged dam.

Golden Pond Hydroelectric Rehabilitation: Complete mechanical, electrical, and civil works modifications and repairs to resume generation at an inoperative hydropower plant.

Tannery Pond HEP Grant: Prepared a grant application for $450,000 of construction financing to replace two hydrogenerator sets and update electrical controls.

Tannery Pond HEP Rehabilitation: Winchendon, MA, for French River Land Company, Administered CEC grant award. Designed and rebuilt two hydrogenerator sets and installed updated electrical controls.

Recent Hydroelectric Mechanical Repairs: Tannery Pond Hydroelectric, LP Athol Hydroelectric, Golden Pond Hydroelectric, Brockway Mills Hydroelectric, Kingsfalls Hydroelectric, Valatie Falls Hydroelectric, and Vermont Tissue Hydroelectric.

EDUCATION

B.S., Worcester Polytechnic, 2010, Civil Engineering

Various courses on engineering design including wood, steel, and concrete construction, construction management, mechanical engineering design, biomedical engineering design, advanced technical Spanish, and graduating projects focused on hydroelectric and hydrokinetic power generation.

REGISTRATION

Engineer in Training (2010), Massachusetts

YMCA (2007) and PADI (2012) SCUBA Diving Certification

SELECTED PUBLICATIONS/PRESENTATIONS

WPI, IQP, "Hydrokinetic Energy in Massachusetts", Prepared and published an Interactive Qualifying Project (IQP) that to identify the resources available to generate hydrokinetic power in Massachusetts Rivers. Published April 14th, 2010.

WPI, MQP, "Lake Anastaquntook Dam Replacement Study, Co prepared and Co published a Major Qualifying Project (MQP) that analyzes the stability and safety of the Lake Anasagunticook Dam on Whitney Brook in Canton, Maine and investigates alternative designs for repair and replacement of the existing dam. Published April 24th, 2008.

Raymond A. Wingert, P.E.

Northeast Regional Manager

EDUCATION
B.S., Civil Engineering, Oregon State University, 1981

REGISTRATIONS
Professional Engineer:
MA (No. 46973), MI (No. 6201056900), NH (No. 6131), PA (No. 083350)

SPECIALIZED TRAINING AND CERTIFICATIONS
Colorado State University, Instream Flow Incremental Methodology:

- IF200 Designing and Negotiating Studies Using IFIM
- IF310 Using the Computer Based Physical Habitat Simulation System (PHABSIM)

PROFESSIONAL MEMBERSHIPS
American Society of Civil Engineers

Association of State Dam Safety Officials

INDUSTRY TENURE
35 years

PUBLICATIONS
Wingert, R, Trotter, B, Schlorke, V *"Design Flood Determination for the Victoria Dam Spillway Improvement Project,"* presented at the 2014 USSD Annual Meeting and Conference

"Dambreak Flood Analyses and Emergency Action Plan: West Branch and Main Stem of the Penobscot River," presented at Waterpower '95.

Mr. Wingert has over 35 years of experience in the civil engineering evaluation, licensing support, construction, design, and operation of hydroelectric projects with emphasis on hydraulics and hydrology. Mr. Wingert has conducted H&H evaluations for Federal (FERC Part 12) and state dam safety and hazard evaluations for more than 100 dams nationwide. He also has experience in hydro equipment assessment and selection, development of hydrology, and model simulation of project operation for estimating long-term future energy production for project capacity upgrades, life extension, and relicensing. He has conducted civil facility condition and operations assessments and evaluation of energy production for due diligence for hydroelectric project/system acquisition. Mr. Wingert has also performed as owner's Project Manager for capital improvement projects and owner's representative for hydroelectric project construction; and has been an expert witness for tax valuation proceedings.

Mr. Wingert has extensive experience in the evaluation and modeling of river and lake systems, including development of hydro system operations management plans within the FERC licensing process using HDR's CHEOPS™ computer model. The development of these plans included assessment of existing and proposed conditions including energy production and other project benefits, and impacts on resources. He has prepared FERC license documents and local and state permit documents; has conducted licensing consultation with natural resource agencies; and has served as a technical advisor for stakeholder groups.

Mr. Wingert's civil/hydraulic design experience includes site development, erosion and sedimentation control, principal water retaining structures, water intake and conveyance facilities, spillways and gates, and fish-passage facilities. He has experience in the modeling and analysis of operations and water management for hydro systems, including development of water management plans. Mr. Wingert's experience in hydrologic analysis includes determination of site-specific Probable Maximum Precipitation and Probable Maximum Floods with the development of rainfall-runoff and hydraulic channel routing models. Other hydrologic and hydraulic analyses include determination of water budget, development of synthetic flow data, river channel erosion and sedimentation, spillway and outlet hydraulic capacity, flood studies, flood-frequency analysis, and river channel and lake routing.

RELEVANT EXPERIENCE

School Street Hydroelectric Project, Brookfield, New York
Project Manager for licensing and permitting, engineering, and construction for significant improvements to the hydroelectric project including dam and gatehouse rehabilitation, power canal excavation, and construction of fish passage facilities. Work included on-site project management of work including budget and schedule for all work.

Baldwin Hydroelectric Project, Baldwin Hydroelectric Corporation
Prepared federal and state licensing and permit documents including design documents in compliance with FERC license articles. Mr. Wingert prepared the NPDES permit, the New Hampshire Wetland Board Permit and Site Specific Permit applications, and the Erosion and Sedimentation Control Plan for the

project. Mr. Wingert prepared contract documents for the first phase of construction.

Star Falls Hydroelectric Project, National Hydro Corporation
Mr. Wingert performed preliminary feasibility assessments, prepared preliminary environmental reports, and initiated agency consultation for the licensing of the proposed 30 MW hydro project on the Snake River near Twin Falls, Idaho.

Gregg's Falls Hydroelectric Project, National Hydro Corporation, Goffstown, New Hampshire
Prepared FERC license exemption application for station upgrade to 4 MW. Conducted licensing consultations with natural resource agencies. Responsible for assessment of environmental impacts and development of mitigation including riverine fishery studies to determine minimum instream flow releases and development of downstream fish passage facilities to meet objectives of State and Federal anadromous fish (American shad and Atlantic salmon) restoration plans. Developed and coordinated rehabilitation and upgrade of existing facilities, including dam and powerhouse repairs, runner replacement, equipment procurement, and downstream fish passage facilities.

Gardner Falls Project, Powerhouse Repairs, Essential Power, Massachusetts
Project Manager for the detailed engineering, design, evaluation and construction support for stabilization and repair of a 1913 vintage powerhouse seriously undermined by a draft tube collapse.

Hydro Operations Model Simulation, Confidential Hydroelectric Project, Washington
Mr. Wingert was the lead engineer responsible for development of HDR's CHEOPS™ computer model to simulate operation of a hydroelectric project in Washington with over 1,700 MW in generating capacity. The model was developed to determine the project plan for relicensing, including capital improvements, changes in project operation, and measures to protect, mitigate, and enhance (PMEs) resources. The model was used to evaluate the benefits and impacts associated with a complex array of alternatives for turbine-generator upgrades, PMEs, and operation constraints. Mr. Wingert was the lead writer and technical support in the preparation of Exhibits A and B of the draft license application recently submitted to FERC for the project.

Victoria Dam Spillway Remediation, Upper Peninsula Power Company, Michigan
Served as Project Engineer for hydraulic evaluations and risk assessments conducted to establish the acceptable project design flood for Spillway Remediation for this FERC regulated project. Alternative concepts for accommodating extreme floods were developed including raising non-overflow structures and increasing gated spillway capacity. Dam failure and hazard analysis were conducted to successfully reduce the required design flood from the full Probable Maximum Flood (PMF) to approximately 50% of the PMF. Mr. Wingert acted as Lead Hydraulic Engineer for the design of the spillway remediation.

Rob Mitchell

Environmental & Regulatory Manager

EDUCATION
MA, Geography (Environmental Issues), 1988, San Francisco State University

BA, Communications (Minor - Geography), 1979, Syracuse University

PROFESSIONAL MEMBERSHIPS
American Planning Association

American Wind Energy Association

National Wind Coordinating Committee - Wind-Wildlife Working Group

Massachusetts Executive Office of Environmental Affairs (EOEA) : Windpower and Wildlife Assessment Working Group - appointed consultant member of inter-agency stakeholder workgroup

Massachusetts Water Resources Commission (formerly Alternate Member)

INDUSTRY TENURE
30 years

Mr. Mitchell is a Project Manager with over 30 years of experience managing and conducting environmental studies, permitting, agency consultation, site selection, facility layout and environmental compliance to support utility and energy developments. His primary focus has been on renewable energy development, particularly windpower and hydroelectric project relicensing and compliance. He has been involved in managing, scoping and conducting multi-disciplinary studies in the areas of environmental impact review, resource protection master planning, water resources management, land use management, recreational and scenic resources planning, environmental permitting and agency/community consultation. Primary clients have included government agencies, energy companies, water resource managers and paper companies. These projects each required extensive agency coordination and proactive citizen consultation to develop environmental protection solutions that were approved at the local, state and federal level. He has also organized and led several advisory committees and workshop groups in order to ensure close consultation with public agencies and interested parties and create a forum for cooperative development of new projects and resource management plans.

Prior to joining HDR, Mr. Mitchell worked as a professional environmental and permitting consultant for 22 years focusing on comprehensive project management services, environmental study planning, strategy and management services to support the development and upgrade of various energy and transportation facilities. He also was a Senior Planner and subsequently the Director of Program Planning for the Massachusetts Metropolitan District Commission's Division of Watershed Management for 4 years before becoming a consultant.

RELEVANT EXPERIENCE

Connecticut River Basin Integrated Licensing Process Support, Five Hydroelectric Projects on Connecticut River, Federal Energy Regulatory Commission (FERC)
Project Manager for relicensing support services for FERC, involving review of relicensing documents, and assistance with study plan analysis and study plan determinations for five hydroelectric projects on the Connecticut River in Vermont, New Hampshire and Massachusetts. These projects include the Wilder, Bellows Falls and Vernon projects, managed by TransCanada, and the Northfield Mountain pumped storage project and Turners Falls project, managed by FirstLight Power Resources/GDF Suez. All project licenses expire in 2017 and are being relicensed through an integrated licensing process. Support to FERC involves review of applicant-filed relicensing documents (Pre-Application Documents, proposed study plans, responses to agency and stakeholder comments) and drafting of FERC documents (notices of deficiencies, study scoping documents, study plan determinations).

Housatonic Railroad Bridge Repair Permitting, Massachusetts Department of Transportation – Rail Program
Supervisor for the permitting of 12 railroad bridge repair projects on the Housatonic Railroad in western Massachusetts. The project included site review and preparation of proposed repair drawings and permit application materials for filing

with Massachusetts Department of Environmental Protection, U.S. Army Corps of Engineers and Massachusetts Natural Heritage Program. Regulatory approvals include Section 401 Water Quality Certification, Section 10 and 404 wetlands/waterways permit and compliance with Massachusetts Environmental Species Act. Repairs are scheduled to occur in 2016.

Third Party NEPA Consultant for Connecticut Expansion Project Natural Gas Pipeline, FERC
Project Manager supporting FERC staff to develop a NEPA-based Environmental Assessment for Tennessee Gas' proposed natural gas pipeline project in parts of New York, Massachusetts and Connecticut. Duties included review and assessment of Tennessee Gas' resource reports and information filings and development of additional information requests to provide sufficient information for NEPA review. Drafted Environmental Assessment document for FERC filing and coordinated with FERC resource leads and project manager to maintain process schedule and track agency and stakeholder consultation on proposed pipeline project.

Connecticut River Riverbank Management Master Plan, Berlin, Northeast Utilities, Inc., Connecticut
Lead Environmental Planner for development of comprehensive riverbank management master plan submitted to the FERC and the Massachusetts Environmental Protection Act Unit. Organized and led a stakeholder workshop group of federal, state, local and non-government organization representatives which met monthly throughout a 18-month planning process. Emphasis was on compiling and consolidating an extensive environmental and land use GIS database to support the investigation of riverbank erosion causes and assist in the prioritization of riverbank repair methods and repair sites.

Hoosac Windpower Project, enXco, Inc., Florida/Monroe, Massachusetts
Environmental Manager responsible for scoping, scheduling and managing all environmental resource investigations and impact assessments associated with proposed 30 MW wind power facility in the Berkshire Mountains. Selected and managed team of resource specialists to conduct wildlife, avian, natural community and cultural resource studies. Conducted land use, recreation and visual impact assessments for proposed project. Responsibilities also included preparation of federal, state and local permit applications, consultation with agency and stakeholder groups, preparation of information for project website and presentation of project study results at permit hearings. The Massachusetts Environmental Protection Act Environmental Certificate, Federal Aviation Administration marking and lighting and local development permits were secured and the project was completed and on line in January 2012.

FERC Hydroelectric Project Relicensing Studies (Bangor Hydro-Electric Company, PPL Maine, Niagara Mohawk Power Corporation, Washington Water Power, Grant County Public Utility District No. 2, AmerenUE)
Project Manager or study lead for various natural resource, recreation, visual, land use and socioeconomic studies to support FERC relicensing efforts. Included development of study plans and management or implementation of various studies in Maine, Missouri, Washington, Idaho and Montana and extensive stakeholder consultation. Responsibilities also included preparation of several project relicensing documents in support of three-stage FERC hydroelectric project consultation process.

Cate F. Russell

Regulatory Specialist

EDUCATION
B.S. Environmental Science, University of Massachusetts, Amherst, Massachusetts, 2002

INDUSTRY TENURE
12 years

Cate Russell is a regulatory specialist with a combined 12 years of experience in Federal Energy Regulatory Commission (FERC) licensing and compliance, environmental permitting and compliance, environmental assessment and remediation, and due diligence reviews for real estate transactions.

For the past seven years, Ms. Russell has worked for HDR as a Regulatory Specialist performing work for clients in the energy sector including hydroelectric and electric transmission facilities. Ms. Russell has supported and/or led the development of numerous permit/license applications to the U.S. Army Corps of Engineers (USACE) and FERC, as well as state agencies in Maine, Massachusetts, New York, Pennsylvania, Maryland, Minnesota, and West Virginia. Ms. Russell has experience with environmental, regulatory, and dam safety compliance for hydroelectric facilities including preparation of Pre-Application Documents, Study Plans, License Applications, License Amendment Applications, Emergency Action Plans (EAPs), Public Safety Plans, Dam Safety Surveillance and Monitoring Plans/Reports (DSSMP/DSSMR), Supporting Technical Information Documents, Spill Prevention, Control and Countermeasure (SPCC) Plans, and National Pollutant Discharge Elimination System (NPDES) permits. Ms. Russell has supported the development of feasibility studies for proposed energy projects such as a 1,000 MW submarine cable project and liquid natural gas storage and pipeline projects.

RELEVANT EXPERIENCE

Hadley Falls Hydroelectric Facility, City of Holyoke Gas and Electric, Connecticut River, Massachusetts
The client evaluated the design and installation of downstream fish passage facilities at their hydroelectric project. Ms. Russell supported the development of the required permit applications for the construction of the fish passage facilities by federal, state, and local agencies including the USACE, Massachusetts Department of Environmental Protection, Massachusetts Department of Fish and Game, the Massachusetts Environmental Policy Act Office, and the Holyoke Conservation Commission.

Stewarts Bridge Hydroelectric Facility, Erie Boulevard Hydropower, Sacandaga River, New York
Ms. Russell supported the preparation and submittal of the Joint USACE/New York State Department of Environmental Conservation permit application as well as the FERC Non-Capacity License Amendment Application associated with the proposed installation of a new turbine-generator unit and associated powerhouse at the Stewarts Bridge Hydroelectric Project. HDR approached the amendment application in such a way to receive a waiver for the three-stage consultation process; thereby saving time and money for the client. Additionally, the amendment application was submitted to FERC with uniform support from the regulatory agencies and interested NGOs.

Keowee Toxaway Hydroelectric Facility, Duke Energy Carolinas, LLC (Duke Energy), Keowee River, South Carolina
The Keowee Toxaway Hydroelectric Project consists of two developments: the 157.5 MW Keowee Development and the 710.1 MW Jocassee Development. The

existing FERC License for the Project expires in 2016 and Duke Energy is currently in the process of obtaining a new license under FERC's Integrated Licensing Process (ILP). Ms. Russell is currently serving as HDR's Project Manager for supporting Duke Energy with the development of numerous FERC-required licensing documents.

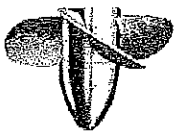
Yadkin Pee Dee Hydroelectric Facility, Duke Energy Progress, LLC, Pee Dee River, North Carolina
The Yadkin Pee Dee Hydroelectric Project consists of two developments: the Tillery Development and the Blewett Falls Development. The Project received a new license from the FERC on April 1, 2015, requiring Duke Energy to develop a Recreation Flow Release Plan for the Tillery Development. Ms. Russell is currently serving as HDR's Project Manager to support Duke Energy with development of the FERC-required Recreation Flow Release Plan, which will be based on the results of a Recreation Flow Release Study. Ms. Russell assisted Duke Energy with the Study Plan, performance of the Study, Study Report, and associated stakeholder consultation for a Recreation Flow Release Study at the Project.

Lower Saint Anthony Falls Hydroelectric Project, SAF Hydroelectric, LLC, Minneapolis, Minnesota
The LSAF Project is owned and operated by SAF Hydroelectric, LLC, a subsidiary of Brookfield Renewable Energy Group. Ms. Russell assisted the licensee with a Non-Capacity License Amendment Application to FERC to modify the Project Boundary on the Exhibit G drawings to reflect as-built conditions and remove lands not necessary for the operation and maintenance of the Project.

York Haven Hydroelectric Project, York Haven Power Company, LLC, Pennsylvania
The York Haven Hydroelectric Project on the Susquehanna River in Pennsylvania is currently in the process of obtaining a new license under ILP. Ms. Russell assisted in the development of the Pre-Application Document during the relicensing process for the York Haven Project.

Sherman Island Hydroelectric Facility, Erie Boulevard Hydropower, Hudson River, New York
In support of proposed site work requiring excavation and fill within the Hudson River, Ms. Russell developed the permit application package, including the Joint USACE/New York State Department of Environmental Conservation Application, to obtain various state and federal permits. During development of the permit application, Ms. Russell participated in a site meeting with the client and USACE staff to discuss potential impacts to wetlands at the site, wetland functions and values, and mitigation plans, as necessary.

Maine Power Express Project, Transmission Developers, Inc., New England
Ms. Russell served as the Technical Lead during permitting activities associated with a proposed 200-mile submerged electric transmission cable in the Atlantic Ocean. The proposed project was subject to federal, state and local jurisdictions. Ms. Russell served as the primary author of a feasibility analysis that identified known sensitive resources and physical constraints, analyzed existing federal, state, and local regulatory requirements, and identified a proposed route for the transmission cable and associated facilities. Ms. Russell also provided regulatory support in permit application planning and preparation for the required state and federal permit requirements.



Hydropower Consulting Specialists

Celeste N. Fay

President, HCS

Ms. Fay has a variety of experience in hydropower engineering including:

- Feasibility studies (upgrade, new development), hydropower design
- Hydrologic and hydraulic evaluation
- Dam safety
- Turbine performance testing
- FERC licensing and compliance
- Fish passage
- Turbine selection and procurement

Her experience as a small hydro owner provides a unique knowledge of items such as financing, power purchase agreements, renewable energy certificates, water rights and other non-engineering hydro considerations. In addition, she has hands-on maintenance and repair experience of dams and hydropower equipment. Separate from her efforts at HCS, Ms. Fay works for Gravity Renewables, Inc. as a staff engineer.

Experience - the following provides a selection of projects

Wyre Wynd Hydroelectric Project, Jewett City, CT – Ms. Fay recently assisted the Wyre Wynd hydroelectric project through the pre-consultation phase of relicensing of the Wyre Wynd project. This information provided sufficient information for the Owner to commence strategic planning which is currently underway.

Byron Weston Hydropower (Crane Paper)– Ms. Fay was part of a project team working to develop the Byron Weston Hydroelectric project located in Western, MA. The project included the repowering of a former hydropower project to generate electricity for an on-site paper factory. Ms. Fay was involved in the preliminary through final FERC application. In addition she participated in various design phases including the H&H, turbine selection and turbine procurement process. Efforts included several stages of consultation, mailings, Agency consultation, draft/final document preparation, exhibit drawings and system design.

Chittenden Falls Hydropower, Stockport, NY – Ms. Fay is currently the lead engineer working on the Chittenden Falls Hydropower Relicensing Project in New York. She is responsible for all regulatory and technical aspects of the relicensing. Details of the relicensing are confidential.

Woronoco Hydropower, Woronoco, MA – Ms. Fay provided assistance during the relicensing process for the Project including participating in the mussel field study and document assembly. Ms. Fay was a mechanic working with a team to disassemble two 450 kW horizontal double camel back Francis units. She assisted in the machine shop fabricating new distributor cases and rehabilitating runners. Other tasks included reinforcing one of the pressure cases with grout, replacing antiquated governors with hydraulic power packs and dam repairs.

Ludington Pumped Storage Hydro Barrier Net Evaluation (Consumers Energy) – Ms. Fay was the lead engineer analyzing the effect of increasing pumping and generation flows on the structural integrity of a large barrier net designed to protect fish from entrainment in a large pumped storage hydro project. Responsibilities included using flow predictions made from CFD simulations to predict potential issues with the effectiveness of the fish protection technology.

LIHI Reviewer – At Alden, Ms. Fay worked for the Low Impact Hydropower Institute (LIHI) as an independent reviewer of certification applications. Responsibilities included identification of missing information, project compliance review and comparing project data to LIHI criteria.

LIHI Applications – With FES, Ms. Fay worked with a team of engineers to assist hydropower owners with the development of their LIHI applications. This included the development and assembly of required information and conformance to the LIHI criteria.

4145 Church Street, PO Box 193
Thorndike, MA 01079

hydroconsultingspecialists@gmail.com
413-262-9466

Alden Turbine Inquiries (various) – The Alden fish friendly turbine was developed in part by Alden and is currently licensed by Voith for manufacturing. Ms. Fay has been responsible for developing turbine sizing and fish survival estimates in response to turbine inquiries received by Alden since about 2013.

Atlantic Salmon Turbine Passage Survival Estimation on the Penobscot River (NMFS) – Ms. Fay was the lead engineer on a desktop analysis that estimated overall project survival of smolts and kelts passing through each of 65 turbines installed at 15 Penobscot River dams. Responsibilities included predicting blade strike probability and subsequent mortality using laboratory-generated test data. Estimates of turbine passage survival associated with strike were developed for each turbine in an interactive model. http://www.aldenlab.com/Portals/0/White%20&%20Tech%20Papers/Estimating%20total%20passage%20survival%20for%20fish%20migrating%20downstream%20at%20hydropower%20projects-amaral.pdf

Water Quality Study Plan (Eagle Creek) – Ms. Fay was the project manager and lead engineer to develop a pre and post operations water quality monitoring plan for a project in VT. This included identifying instrumentation, installation location and data collection frequency as well as inspection and maintenance plans.

Fish Passage Conceptual Design (Nova Scotia Power) – Ms. Fay worked with a team of engineers to develop conceptual upstream and downstream fish passage designs for a series of interdependent reservoirs at a hydropower project in Nova Scotia.

DOE Sponsored Model Turbine Performance Testing (Confidential Client) – Ms. Fay was the lead engineer working with a team of civil and mechanical engineers as well as technicians and construction staff to design a hydraulic loop for turbine testing. Head, flow, power and speed data for the new turbine concept were measured using a variety of instrumentation and the data analyzed to estimate unit efficiency.

Turbine Troubleshooting (PSEG) – Ms. Fay worked with another engineer providing PSEG advice on resolving a flow induced vibration issue observed in a new minimum flow turbine that was installed. Various resonance modes were evaluated and guidance provided on how to work with the manufacturer to find a resolution.

Due Diligence (Confidential Client) – Ms. Fay was the lead engineer for a due diligence inspection of a project in northern New England on behalf of a potential purchaser. Focus was on the civil structures including the dam, powerhouse, water control features, hydraulics, tailrace, and site access. Cost estimates were also developed.

Northfield Mountain Data Acquisition for Relicensing (First Light) – Ms. Fay was the senior engineer participating in a field effort to collect velocity data in the upper reservoir at Northfield Mountain. The field effort first focused on using instrumentation to traverse the reservoir while in its pumping and then during its generation mode. This data was later used as part of a CFD model focusing on sedimentation.

In-Conduit Hydropower Feasibility Study (Mass. Water Resources Authority) – Ms. Fay worked with a team to evaluate MWRA's Chicopee Valley Aqueduct for hydropower potential. The study was limited to technical evaluation in support of a grant application.

NYSERDA Market Analysis (NYSERDA) – Ms. Fay was the lead engineer to complete a market analysis that reviewed powered and non-powered dams in the State of New York to identify the market potential for an Alden fish friendly turbine. https://www.nyserda.ny.gov/-/media/Files/Publications/Research/Clean-Power-Innovation/Alden-Turbine-Market-Analysis-NYS.pdf

In-Conduit Hydropower Feasibility Study (City of Northampton) – Ms. Fay worked with a team to evaluate the City of Northampton's water supply system for hydropower potential. The study included reviewing head and power data, identifying installation locations, requesting turbine quotations, development of cost estimates, estimating value of energy, financial evaluation, and environmental evaluation.

Dam Safety Inspections – Ms. Fay has been a staff engineer on numerous dam safety inspections for various public and private dams located throughout New England. She participated in a FERC Part 12 inspection as well as a three day FERC training session in 2013 on Risk Informed Decision Making in DC.

MassCEC Application Reviews – Alden is contracted with the MassCEC to review applications for funding in its Commonwealth Hydropower program. Ms. Fay has served as the lead engineer for review of these applications, identifying potential issues and providing technical recommendations on a potential project.

Hydropower Feasibility Study North and South Round Valley Reservoir (New Jersey Water Supply Authority) – Ms. Fay worked with a team to develop a hydropower feasibility study at the North and South Round Valley Reservoir Dams in New Jersey. The evaluation included preliminary layouts, cost estimates, proformas, and, environmental assessments.

Starrett Hydropower Project (L. S. Starrett) – Ms. Fay was part of a project team that redeveloped the south side hydropower facilities at the L. S. Starrett manufacturing facility on the Millers River in Athol, MA. Ms. Fay's tasks included final turbine procurement and design review, powerhouse design, conceptual fish passage design and powerhouse construction oversight.

Turners Falls Equipment Evaluation (Esleeck) – Ms. Fay was the lead technical engineer estimating the power generation of potential equipment upgrades at the independently owned Esleeck hydropower generation on the Turners Falls Canal in MA.

(see www.frenchriverland.com)

Work History

Hydropower Consulting Specialists, LLC – President April 2015 to Present
Gravity Renewables, Inc – January 2016 to Present
Three Fays Power, LLC – Hydropower Owner - Present
Thorndike Energy, LLC – Hydropower Owner - Present
Alden Research Laboratory – Senior Engineer - April 2011 to April 2015
French River Land – Manager - 2005 to Present
GZA GeoEnvironmental – Project Engineer - October 2008 to April 2011
Fay Engineering Services, Thorndike, Ma– Assistant Engineer – May 2006 to October 2008
Swift River Hydro Operations, Wilbraham, Ma – Hydropower Mechanic – May 2003 to May 2006 (part/full time)

Education, Awards, Professional Activities

B.S., Worcester Polytechnic Institute, 2008 Civil Engineering
Inaugural Women with Hydrovision Award, Penwell, 2014
Hydro Research Foundation Mentor

Selected Publications/Presentations

T. Hogan, C. Fay, S. Beck, T. Pankratz, S. Lattemann. *"Impingement Mortality and Entrainment (IM&e) Reduction Guidance Document for Existing Seawater Intakes"*. N.p.: WateReuse Research Foundation, 2014. Print. ISBN 1934183997

C. Fay, G. Allen, P.E., R. Tuttle. *"Luddington Pumped Storage Plant Upgrades - Potential Impacts to Barrier Net and Fisheries"*, Presented Hydrovision. July 2014.

C. Fay, J. Kirejczyk, Ph.D. *Hydropower Development: "New Projects and Existing Project Upgrades"*. EUCI. October 2013.

C. Fay, G. Allen, P.E. *"Hydropower Potential Projects – Recovering Energy & Reducing Costs"*. Environmental Business Council of New England, Renewable Energy Program. October 2012

C. Fay. *"The Business of Small Hydropower"*. Environmental Business Council of New England Renewable Energy Program – Small Hydropower in New England. October 2012

C. Fay, G. Hecker, P.E., S. Amaral. *"Estimation of Turbine Passage Survival for Atlantic Salmon Entrained at Penobscot River Hydroelectric Projects"*, National Conference on Engineering and Ecohydrology for Fish Passage, University of Massachusetts Amherst. June 2012.

C. Cox, P.E., C. Fay, *"Fundamentals of Hydraulic Turbines"*, EUCI, March 28, 2011.

C. Fay, W. Fay, *"Small Hydro Renaissance"*. International Water Power and Dam Construction, July 2010.

WILLIAM K. FAY
189 River Road
Ware, MA 01082
1-413-427-2665

CONSULTING PE: HYDROELECTRIC PLANTS & DAMS

Inspections • Design • Construction • Rehabilitation • Operation • Maintenance

REGISTRATIONS
Registered Professional Engineer: New Hampshire, Massachusetts, Vermont, New York, Washington
Certified by FERC: Part 12 Inspections of Earthen and Gravity Dams

PROFESSIONAL EXPERIENCE

Principal Engineer, Hydropower Consulting Specialists, Thorndike, MA 2015-Present

DBA Fay Engineering Services, Ware, MA 1988-Present
Complete design of Ruger Lower Hydroelectric Project, Newport, N. H., including a new dam, Fish Ladder design for Lisbon Falls Hydro, Lisbon, N. H., Dam safety analyses for Pioneer Hydro, Ware, Ma., New dam for Lower Village HEP, New powerhouses for Miniwatt Inc., Fallon Hydro Inc., and Southern New Hampshire Hydro Inc. Many small dam inspections, e.g., Lost Lake Dam, Wills Brook Dam, Chateaugay Chasm Dam, Badger Pond Dam, Carolina Mill Dam. Fresh Water Pumping station for Greenville Steam Co. VITA Engineer in Jamba, Angola.

Supervisor of Mechanical Engineers, Tacoma Power, Tacoma, WA 2013-2016

President, Swift River Hydro Operations Co., Inc., Wilbraham, MA 2001-2013
Oversaw the formation and operation of an in-house machine shop ,as well as the day to day management of 16 employees. Provided customers with runner replacements, Kaplan turbine rebuilds, generator overhauls, main shaft replacements, pressure case and draft tube replacements, fish & eel passage design and installation. FERC work included recreation plans, as-built drawings, licensing, and annual inspections.

Vice President, D. Hobbs Contracting, Hamilton, MA 1993-2001,
Designed repairs and supervised construction of the Schmidt Dam, Harvard, MA. and Lake Wickabog Dam, West Brookfield, MA. Ran BOSS Dambrk model for Lake Wickabog. Dam was declassified as result of modeling and report. FERC Part 12 Inspection of Wappingers Falls Project, FERC 3065-NY. Central Hudson Gas & Electric annual inspections of Walkill and Salisbury HEP. Responsible charge of design and construction of the Lower Thorndike HEP. In charge of the rehabilitation of the Valley Paper Hydro Project, Design of the Tannery Pond HEP, Inspection of 60 dams for the Commonwealth of Massachusetts, Department of Environmental Management, Dam Safety Section with published reports. Responsible charge of design and construction supervision on over 25 HEP projects in Northeast area. Dam reconstruction plans for Paradise Lake, Monson, MA., Lake Wickabog Dam, N. Brookfield, MA., Mary Schmidt Dam, Harvard, MA., Georgia Pacific Dam, Thompson, N.Y.

Chief Engineer,Swift River/Hafslund Co, Hamilton, MA. 1984-1988
Designs for the Errol, Lower Dam, East Outlet, Brassua, Wappinger's Falls, and Riverside hydroelectric stations including conceptual drawings, detailed computerized energy studies, bid documents, and performance testing. Detailed hydrologic investigations of Brassua, Moosehead, Umbagog and Richardson Lakes for Central Maine Power Company including annual hydrographs, flow duration curves, headwater elevation curves, and mass curves for 70 years of record. Dam safety and stability analysis for

a high hazard dam in Ware, Ma.. Complete design of a 75 kw unit in Jeffersonville, N.Y. including hydrologic, hydraulic, structural design and drawings.

EARLY CAREER HIGHLIGHTS
Served as **Chief Engineer** and **Project Engineer** for numerous hydroelectric feasibility studies; FERC ownership exemptions/licenses, rehabilitation of hydroelectric stations, and programming for hydrologic and hydraulic designs.(1980 84: Hoyle, Tanner & Assoc., Inc/ Ware River Power Co.) • **Research & Development** designing nozzle test facility, determining cause of excessive oscillator startup pressures, designing nonstandard flow meter calibration equipment, using Doppler sonic and hot wire anemometers (1978-80: Lodding Engineering Co/ Alden Hydraulic Research/ Morgan Construction Company)

TECHNICAL SKILLS
Programming: AUTOCAD, MS (Word, Excel, Power Point), Frontpage1, WHAMO, SWASE, REAME DAMBRK, HEC 2, HEC

PROFESSIONAL ASSOCIATIONS
American Society of Civil Engineers
American Society of Mechanical Engineers
New England Association for Dam Safety

EDUCATION
MSME Worcester Polytechnic Institute (WPI), Worcester, MA, 1982
BSME Lehigh University, Bethlehem, PA, 1978.

PROFESSIONAL DEVELOPMENT
Dam Break Analyses, NWS, Marlboro, MA, 1991
Hydraulic Turbine Testing, EPRI, York, PA, 1987.
HEC 2 Course, Rice University, Houston, TX, 1986.
Numerous PDH courses to maintain licenses

PAPERS
Master's Thesis: A Study to Determine Some of the Fluid Flow Characteristics of a Cross Flow Type Hydraulic Turbine. Presented at ASME winter convention,1985, New Orleans.
60 Dam Safety Reports: Massachusetts DEM Dam Safety Program. Selected as future model reports for the Dam Safety Program. 1998
Numerous studies including business plans, proformas, detailed power production studies, dam stability analyses, dam break studies, project budgets and project schedules.

Proactive by Design

Section 5.

Hourly Rates

HOURLY RATES

Following are Schedules of Fees and Hourly Rates for GZA and the following subcontractors:

- Alden Research Laboratory, Inc. – Fisheries Support
- HDR, Inc. - Regulatory Support
- Heritage Surveys, Inc. – Topographic and Boundary Surveys

Hourly Rates for all personnel from Hydropower Consulting Specialists are $100/hour.

GZA's Schedule of Fees provided with this Statement of Qualifications package is consistent with the rate schedule currently in use, without modification since 2014, under GZA's ongoing "Agreement for On-Call Engineering Services", with the City of Springfield, City Contract No. 20140969, dated April 10, 2014, as extended. For any work subsequent to City RFQ # 16-190, GZA proposes to utilize these same hourly rates, without increase, during the first year of any contract resulting from City RFQ # 16-190. Consistent with the currently-approved rate schedule under City Contract No. 20140969, GZA requests and proposes a 5% markup on subcontractors. Additionally, GZA proposes to honor the hourly rates provided in the following Schedule of Fees throughout the first year of our contract, and will limit any adjustments in the second or third years to any increases in the Consumer Price Index City Average – All Urban Consumers.

GZA GEOENVIRONMENTAL, INC.
SCHEDULE OF FEES
CITY OF SPRINGFIELD
Professional Design Services for the Implementation of the HUD NDRC Grant
RFQ # 16-190

TO ACCOMPANY GZA'S QUALIFICATIONS PACKAGE DATED JUNE 29, 2016 GZA FILE NO. 15.P000031.17

LABOR	***Per Hour***
Senior Principal Engineer / Scientist	$260
Principal Engineer / Scientist	$240
Associate Principal Engineer / Scientist	$220
Senior Consultant	$200
Senior Project Engineer / Scientist	$175
Senior Designer/Landscape Architect	$160
Project Engineer / Scientist	$150
Assistant Project Engineer / Scientist	$125
Staff Engineer / Scientist I	$105
Staff Engineer / Scientist II	$95
Technician I	$85
Technician II	$80
Senior CAD/Technical Designer	$120
CAD/Technical Designer	$110
Technical/Administrative Support	$75
Outside Services and Subcontractors	Cost Plus 5%**
Expenses	Cost

The above rates for technical and support personnel will be charged for actual time worked on the project, including time required for travel from company office to job or meeting site and return. For work requiring out-of-town overnight stay, the minimum charge for work on the project will be eight (8) hours per day.

*The above-listed rates are valid for the calendar year in which the work is performed. GZA will modify this rate schedule on an annual basis per the contract-specific cost of living adjustment procedure (see notes below**).*

EXPENSES

- *Laboratory service, rental of specialized field or monitoring equipment and vehicle charges based on GZA standard unit prices*
- *Transportation, lodging and subsistence for out-of-town travel*
- *Printing, reproduction, plotting, and wide-format scanning*
- *Express mail and shipping charges*
- *Project-specific computer hardware and software*

APPLICABILITY

This Schedule of Fees is appropriate for use with:
City RFQ # 16-190

** *NOTES: This Schedule of Fees is consistent with the rate schedule currently in use, without modification since 2014, under GZA's ongoing "Agreement for On-Call Engineering Services", with the City of Springfield, City Contract No. 20140969, dated April 10, 2014, as extended. For any work subsequent to City RFQ # 16-190, GZA proposes to utilize these same hourly rates, without increase, during the first year of any contract resulting from City RFQ # 16-190. Consistent with the currently-approved rate schedule under City Contract No. 20140969, GZA requests and proposes a 5% markup on subcontractors. Additionally, GZA proposes to honor the hourly rates provided in this Schedule of Fees throughout the first year of our contract, and will limit any adjustments in the second or third years to any increases in the Consumer Price Index City Average – All Urban Consumers.*

Alden Research Laboratory, Inc.

Billing Rate Schedule

Effective May 1, 2016 - April 30, 2017

Personnel Categories:	Rates per hour
PRINCIPALS and DIRECTORS	$ 170.00 to $ 290.00
ENGINEERS/SCIENTISTS	$ 85.00 to $ 195.00
LABORATORY SUPERVISOR	$ 125.00 to $ 160.00
TECHNICIANS	$ 50.00 to $ 110.00
SKILLED CRAFTS	$ 90.00 to $ 125.00
SEMI-SKILLED CRAFTS	$ 65.00 to $ 80.00
ADMINISTRATIVE	$ 65.00 to $ 95.00
EXPERT TESTIMONY	$ 195.00 to $ 335.00

Note: Annual increases expected on above rates effective May 1st in subsequent years.

Additional Items:

Materials and subcontractors costs are subject to procurement, processing and handling fees.

Rental rates for space, tanks, flumes instruments, etc. will be quoted as applicable.

HDR

HYDROPOWER
STANDARD HOURLY RATE SHEET FOR 2016
(in US Dollars)

Accounting Asst Sr	$60.00	-	$70.00
Accounting Business Manager	$210.00	-	$240.00
Receptionist Clerk	$50.00	-	$60.00
Admin Asst Word Processor	$50.00	-	$90.00
Exec Sec Coordinator	$60.00	-	$110.00
CADD Technician Civil 3	$110.00	-	$130.00
CADD Technician Electrical 1	$50.00	-	$110.00
CADD Technician Electrical 2	$80.00	-	$120.00
CADD Technician Electrical 3	$120.00	-	$140.00
CADD Technician General 1	$50.00	-	$60.00
CADD Technician General 3	$80.00	-	$160.00
CADD Technician General 4	$130.00	-	$170.00
EIT Coordinator Civil	$80.00	-	$130.00
Engineer Civil	$110.00	-	$170.00
Engineer Civil Sr	$140.00	-	$260.00
Environmental EIT	$80.00	-	$90.00
Environmental Engineer	$150.00	-	$180.00
Environmental Engineer Sr	$180.00	-	$210.00
EIT Electrical	$80.00	-	$120.00
Engineer Electrical	$100.00	-	$200.00
Engineer Electrical Sr	$140.00	-	$260.00
EIT Mechanical	$110.00	-	$130.00
Engineer Mechanical	$90.00	-	$180.00
Engineer Mechanical Sr	$170.00	-	$290.00
Engineer Soils	$80.00	-	$150.00
Engineer Soils Sr	$150.00	-	$220.00
EIT Structural	$80.00	-	$100.00
Engineer Structural	$120.00	-	$160.00
Engineer Structural Sr	$160.00	-	$250.00
EIT Water Resources	$70.00	-	$120.00
Engineer Water Resources	$80.00	-	$130.00
Engineer Water Resources Sr	$180.00	-	$200.00
Human Resources Specialist Sr	$120.00	-	$140.00
Management Consultant Sr	$160.00	-	$290.00
Section Manager/Team Leader	$120.00	-	$270.00
National Technical Director	$280.00	-	$300.00

Note: All rates are subject to adjustment on January 1 of each year.

HDR

HYDROPOWER
STANDARD HOURLY RATE SHEET FOR 2016
(in US Dollars)

Bus Unit Mgr/Managing Principal	$230.00	-	$290.00
Managing Principal	$250.00	-	$300.00
Marketing Coordinator	$70.00	-	$80.00
Marketing Coordinator Sr	$100.00	-	$120.00
Marketing Services Manager	$150.00	-	$170.00
Project Controller	$70.00	-	$120.00
Project Manager Engineer Asst	$110.00	-	$130.00
Project Manager Engineer	$180.00	-	$210.00
Project Manager Engineer Sr	$170.00	-	$250.00
Project Manager General	$140.00	-	$250.00
Project Manager General Sr	$200.00	-	$260.00
Environmental Planner 1	$70.00	-	$110.00
Environmental Planner 2	$90.00	-	$160.00
Environmental Planner 3	$150.00	-	$190.00
Program Manager	$170.00	-	$270.00
Technical Editor	$100.00	-	$110.00
Biologist 1	$60.00	-	$110.00
Biologist 2	$90.00	-	$100.00
Biologist 3	$140.00	-	$220.00
Cultural Resource Specialist 1	$80.00	-	$100.00
Cultural Resource Specialist 2	$100.00	-	$120.00
Cultural Resource Specialist 3	$110.00	-	$130.00
Environmental Scientist 1	$70.00	-	$90.00
Environmental Scientist 2	$80.00	-	$170.00
Environmental Scientist 3	$90.00	-	$200.00
GIS Analyst	$90.00	-	$110.00
Senior GIS Analyst	$90.00	-	$150.00
Geologist 2	$70.00	-	$110.00
Geologist 3	$180.00	-	$210.00
Hydrologist 2	$100.00	-	$180.00
Technician General 2	$90.00	-	$100.00
Technician General 4	$150.00	-	$170.00

Note: All rates are subject to adjustment on January 1 of each year.

HERITAGE SURVEYS, INC.

Professional Surveyors and Engineers
241 College Hwy & Clark St, P O Box 1
Southampton, Massachusetts 01073-0001

Bruce A. Coombs, President
Professional Surveyor, MA, CT & VT
E-mail: bruce@heritagesurveys.com

Telephone (413) 527-3600
Facsimile (413) 527-8280
Website: heritagesurveys.com

SCHEDULE OF FEES

EFFECTIVE JULY 1, 2015

Heritage Surveys, Inc established in 1975, provides complete surveying, mapping, and survey-related engineering services to a variety of residential, commercial, industrial, and municipal clients. The firm also works closely with other firms or individuals engaged in the professions of law, architecture, landscape architecture, civil and environmental engineering, forestry, photogrammetry, or similarly aligned professions. A team of experienced professionals can be assembled to handle your project from the planning stage through final design and construction.

The following rates for services include wages and employee benefits, as well as normal overhead or business operating expenses for items such as; office facilities, vehicles, electronic measuring and computer equipment, building and equipment maintenance, administrative services, legal and accounting services, and various types of insurance. Fee cost estimates for a specific scope of services will be provided upon request.

PERSONNEL:

2-Man Survey Party	$130.00 per hour
3-Man Survey Party	$160.00 per hour
Principal	$175.00 per hour
Project Manager	$115.00 per hour
Professional Land Surveyor	$120.00 per hour
Associate Surveyor	$95.00 per hour
Professional Engineer	$150.00 per hour
Associate Engineer	$95.00 per hour
Researcher	$95.00 per hour
CAD Operator	$85.00 per hour
Word Processor	$60.00 per hour
Consultants	Cost plus 15%

EXPENSES:

Mileage	$ .60 per mile
Print paper	$ 1.50 per square foot
Mylar	$ 4.50 per square foot
Other project related expenses such as stakes, monuments, postage, etc.	Cost plus 15%

GZA

Proactive by Design

Section 6.

Quality Assurance Plan

QUALITY ASSURANCE PLAN

To deliver consistently high-quality products and services to our clients, GZA infuses quality into all aspects of our operations. This is evidenced through our 85% repeat business rate and through our corporate commitment to continuous improvement and customer satisfaction. The goal of the quality assurance and control program is to ensure that the work is performed with the highest level of technical accuracy and soundness. It is the responsibility of the assigned project staff to implement the QA/QC plan for every phase of the work process.

As part of our Quality Control program, the Principal-in-Charge conducts or assigns a Project Reviewer who is trained in the appropriate technical qualifications to coordinate the independent review of the project at critical milestones and to provide technical input at the planning stage and at critical points as the project develops. Efforts revolve about design reviews, project scheduling, allocation of appropriate team personnel and fiscal oversight.

The Project Reviewer is competent in the appropriate disciplines and is independent from the day-to-day operation of the project. The reviewer concentrates on the technical approach, correctness and loss prevention. The Project Reviewer also plays a major role in controlling the quality of services by reviewing major concepts, approaches, conclusions, and recommendations before they are transmitted to the client.

Our Quality Control procedures are used to independently check and review documents, plans, cost estimates, and supporting data in their final format before they are released.
Documents and supporting data include reports (either formal or informal), written project programs (design basis or criteria), design analyses (design computations and design sketches), drawings, project or procurement manuals (specifications), cost estimates, schedules, operation manuals, and equipment maintenance manuals. Components of our quality control program include training of staff, written standard operating procedures, written technical guidelines, and calibration requirements for equipment.

The QA/QC program includes internal and external technical training of staff members. GZA maintains and upgrades quality control procedures to implement and control geotechnical and environmental investigation, design, and laboratory testing. We use a structured approach to quality management, those closest to the work are responsible for quality control of their work, while the quality control manager verifies adherence to company and client quality control procedures. This ensures that personnel performing the work build quality into the project.
Project-specific Quality Control plans are developed to handle unique projects. For reports that are written primarily for public consumption, an additional level of review is provided by a professional who has little or no knowledge of the project. The purpose of this is to ensure that, in addition to technical accuracy, the document is written in a clear and concise manner that is easily understood by the public. For projects with large amounts of spatial data (GIS-driven), additional QA/QC procedures are implemented.

Following are two related documents, namely the Corporate Quality Control Plan and the guidelines for Review of Personnel Work Products. Both offer insight into how GZA approaches QA/QC and the importance of these policies to the successful development of projects for our clients.

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Approved:	R.M. Simon	
Sponsoring Function:	Quality Assurance	
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CORPORATE QUALITY CONTROL PLAN

1.00 SCOPE

This Corporate Quality Control Plan ("CQCP") applies to GZA GeoEnvironmental Technologies, Inc. ("GZA") and all operating companies of GZA. There are substantial differences in the way in which quality assurance and quality control practices ("QA/QC") can be applied to professional service activities (engineering and design) and as can be applied to construction activities (remedial action, test borings and construction drilling).

This policy is intended to apply a consistent philosophy to all QA/QC practices carried out by GZA. However, because of the differences between execution of professional services and construction services, application of the philosophy is divided along the two types of service lines. Construction is a service that results in a work product in the form of a constructed facility. Scientific or engineering professional service results in a work product in the form of information. In addition, the degree to which this Plan may apply to different projects depends on the project's nature and is to be decided by the professional individual in responsible charge of the service being provided.

2.00 CORPORATE QUALITY CONTROL PHILOSOPHY

GZA's corporate approach to QA/QC is based on two precepts:

1. Each employee is empowered, responsible and accountable for individual work product quality consistent with this corporate philosophy.

2. A separate QC monitoring function is maintained for all work on a project with a direct reporting line to senior management outside the project line management organization.

3.00 QUALITY CONTROL - GENERAL

Quality assurance and quality control will be implemented at all levels within the GZA Corporation. The Chief Executive Officer of the Corporation will be the Chief Quality Officer. Implementation of QA/QC will take place at each corporate and operating unit level.

3.10 Definitions

- *Quality Assurance ("QA")* - Activities undertaken to cause a service, work product or constructed facility to meet the intended or specified requirements.

- *Quality Control ("QC")* - Activities undertaken to verify that the QA activities have been carried out and that the ultimate work product meets intended specifications.

3.20 Quality Organization

Each GZA operating Company will develop a Company Quality Assurance/ Quality Control Organization. The Organization will incorporate the following elements:

1. The Company Quality Control System Manager ("CQCM") for each operating company of GZA is responsible overall for GZA's compliance with quality requirements in all company endeavors. The CQCM will report directly to the GZEA Chief Executive Officer with respect to quality matters. The CQCM will be the operating Company President. The President may delegate the authority for this function, but responsibility for work product quality always remains with the Company President.

2. For each project undertaken by GZA, there will be a Project Manager ("PM") (the Principal-in-Charge for professional service efforts or the construction Project Manager) who is responsible for incorporation of appropriate quality assurance and control procedures in the execution of each project.

3. For each project undertaken by GZA, there will be a Project Quality Control System Manager ("PQCM") who will verify (QC) that the proper QA efforts have been implemented in the project and who may take part in final testing or assessment of project performance. The PQCM serves in a consulting role to the Project Manager but reports directly to the CQCM in matters relating to Quality. *The PQCM has specific delegated authority from the CQCM to stop work on a project if, after attempts to resolve identified problems with the Project Manager, he or she believes that the Project Quality Control Plan is being overlooked or believes that the quality level achieved is significantly below industry or professional standards or fails to meet Client requirements.*

4. The CQCM may appoint Technical Service Leads ("TSL"), Lead Technical Specialists ("LTS") or Program Managers in specific technical areas. Their function will be to establish technical standards for a segment of the Company's technical work. In this role, they will resolve discrepancies with respect to technical quality performance that may be reported by the Project Managers or the PQCM's. The TSL's, LTS's and Program Managers serve a consulting role for the Project Managers but have a QC support and reporting responsibility to the CQCM.

3.30 Project Control Program Procedures

1. Project Quality Plans: Project Quality Plans will be prepared for projects generally to describe a QA/QC program consistent with contract documents and the nature of the work to be performed, including applicable codes, standards and regulations. Elements typically considered in preparing a Project Quality Plan are:

   - the quality-related activities to be performed by GZA according to the contract scope of work;
   - the need for special controls over QA/QC activities;
   - the criticality of the work to the operability, reliability, and maintainability of a facility;
   - the cost of repair or replacement of an item or system;
   - the consequences of a failure to the safety of operating personnel or the public;
   - the consequences of an unplanned shutdown or loss of use of a facility or a portion thereof;
   - the consequences of delays, replacement costs increases, or other effects on facility operations.

2. Plan Implementation: The major components of a Project Quality Plan are described briefly below.

   - Project organization charts including names, position descriptions, and responsibility matrices will define project quality organization, delineate authorities, reporting relationships, and responsibilities for project activities. Further, such documents will identify both the quality-attaining (QA) functions and the independent quality control (QC) functions.

- Operating procedures, instructions, and directives will be identified, prepared, and implemented to provide adequate control over quality-related activities. Operating procedures will attain a level of control consistent with the importance of the task in fulfilling quality performance requirements.

- Audits and surveillance of project activities will be conducted at regular intervals by the PQCM to verify implementation of the Project Quality Control Plan and to evaluate its effectiveness. Audit results will be reported to the Project Manager and the Company Quality Control Manager.

- Corrective action for out-of-control conditions identified by surveillance, audit, inspection, or monitoring will be documented and reported by the Project Manager to the Project Quality Control Manager, the Technical Program Manager, and the Company Quality Control Manager. The responsible manager will immediately prepare an action plan stating the cause of the condition, the action taken or planned to preclude recurrence, and the date when the condition will be fully corrected. Quality Control personnel will review the action plan, verify its implementation, and evaluate its effectiveness following correction.

- Training, qualifications, and special skills needed to yield specified performance, and special qualifications and certifications for particular project applications, will be identified in the Project Quality Control Plan, including the required form(s); method of data collection, review and authentication.

- The means for retention, storage, and distribution of quality control reports to GZA project management, to quality control personnel, and to the Client.

4.00 QUALITY CONTROL FOR CONSTRUCTION PROJECTS

The QA/QC program for construction activities encompasses five elements:

1. Thorough planning and specification of project and activity goals.

2. Initiation of quality standards.

3. Identification of and compliance with project specifications and appropriate regulatory requirements and procedures,

4. Continuous application of QC measures to identify out-of-tolerance occurrences near the time they transpire.

5. Establishment of control systems to confirm that deficiencies have been identified, evaluated and corrected.

4.10 Implementation

4.1.1 Project Quality Planning

1. Each Project Manager will develop a Project Quality Plan in accordance with Section 3.3 above.

2. The Project Manager will establish an independent QC organization as part of the development of each construction Project Quality Plan. The primary focus of the QC organization will be to provide senior GZA management with frequent evaluation of the QA/QC program, specifically whether the program can distinguish project quality objectives as to demonstrate the standards of performance required to preclude out-of-control and non-compliant situations (*i.e.* compliance with specifications).

3. Each project task will have a pre-determined degree of QA/QC necessary to attain the level of accuracy and precision to demonstrate compliance of the work product with specifica-

tions. For example, field and analytical procedures will conform to predetermined industrial standards of performance developed to ensure specified levels of quality. Standard Operating Procedures ("SOP's") will be developed for appropriate project tasks. The SOP's will be made available to all GZA and subcontractor personnel performing the work as well as QC personnel prior to initiation of critical activities. The Project Manager or his designee will conduct a pre-task planning meeting prior to task initiation to confirm clear, consistent communication of SOP's and task objectives.

4.1.2. Project Quality Assurance

The following summarizes QA/QC procedures for construction/work areas that will constitute the majority of the activities required to service remediation construction contracts:

1. Construction Process: Construction processes including those of materials handling/storage, rigging, fabrication, installation, and construction will be performed according to written work plans, procedures, or instructions. Special processes such as welding, heat treatment, and nondestructive examination will be performed according to approved procedures by qualified personnel. In addition, work plans, procedures, or instructions for the control of construction and installation will provide for hold-points, in-process monitoring, or witnessing as a means of verifying quality conformance. Work plans, procedures or instructions will also provide or reference the project or industry acceptance criteria for determining satisfactory work completion and conformance to quality requirements.

2. Control of Materials:

   a. Source Traceability: Materials, parts, components, and assemblies (including partially fabricated materials) will be identified by unique number (e.g., part number, heat/log number, serial number) on the item itself or on documents traceable to the item; such identification must be maintained throughout fabrication, installation, assembly and construction to ensure use of the correct items.

   b. Storage: Materials, parts, components, subassemblies and other items will be stored and handled to preclude damage, deterioration, or degradation. Consideration will be given to the need for special environments, handling or rigging equipment, segregation, periodic examination or inspection, periodic activation or test; and protection from the elements. These considerations will extend to items stored in place, partially completed installations, and construction in progress. In addition, procedures will be implemented for maintaining inventory records, disbursement logs, lists, or other evidence of use of items and incorporation of materials into the work.

3. Inspection: All construction work will be subject to inspection provided for or approved by the Project Manager and the Project Quality Control Manager. Inspection will include preconstruction, in-process, and post-construction inspection. The inspections will be used to verify compliance with design documents, and will be conducted by qualified personnel in accordance with inspection requirements set forth in the Project Quality Control Plan prepared for that purpose from design documents. Inspection results will be documented to provide traceability of the item inspected to design documents. Inspection data will be recorded as specified in the inspection plan and will include identification of the inspector, inspection date, and item acceptability. If the inspection follows a non-compliance test, the report will cross-reference the earlier inspection report.

4. Test Control: Proof tests, pre-operational tests, or other tests used to demonstrate that items perform their intended function will be specified, performed in accordance with written procedures, and results documented and evaluated to demonstrate that project requirements are met. Specific tests will be required during construction to verify that conditions and materials of work in the ground or otherwise covered have been constructed and/or installed according to specification prior to their burial or

covering. Physical testing will be based on industry standards (*e.g.* ASTM, API, *etc.*) methods when employed and will be required for the following construction activities: Excavation, backfill, concrete, equipment, piping, electrical, instrumentation and control, and as required by applicable codes and regulations.

5. Inspection and Test Status: Items subject to inspection or test will be identified and the results indicated. Status indicators, such as tags, markings, stamps, routing cards, etc., will be affixed to the equipment as appropriate. Items which fail inspection or test will be segregated, if practical; valves, switches, *etc.* will be tagged or marked to show status (open/closed; on/off, *etc.*).

6. Nonconforming Items: Items that fail to pass inspection or test will be documented on a Non-conformance Report ("NR") and marked, tagged, segregated, or otherwise indicated to prevent use prior to disposition. Non-conformances will be reviewed by cognizant design personnel and dispositioned: use as-is, repair, rework, or reject. NR's will be logged and tracked to achieve resolution in a timely manner. Non-conformances will be reinspected, as applicable, to verify that the condition has been satisfactorily corrected.

7. Inspection and Test Equipment: Measuring devices, gages, and test equipment will be uniquely identified, calibrated, marked, or tagged to show calibration status, and recalibrated at specific intervals to maintain integrity of the device. Project Quality Control procedures will specify the inspection and test equipment to be calibrated, the control measures to be employed, and the steps to be followed in recalibrating the equipment. Calibration and calibration records will, when possible, be traceable to nationally recognized standards; if none exists, the calibration basis will be documented. Each item will be marked or otherwise traceable to calibration records for the item; identification will provide calibration status and re-calibration due-dates, as appropriate. Out-of-calibration items will be marked, removed from service, repaired or replaced; inspections or tests completed with out-of-calibration equipment must be reinspected, tested, or otherwise verified.

8. Procurement/Supplier QC:

- *Procurement Documents:* Documents used to procure materials, parts, components, and services will be developed and reviewed to determine that design criteria, performance standards, service conditions, quality standards, applicable codes and standards, regulatory requirements, or other data concerning quality are included or referenced in such documents.

- *Source Selection:* Suppliers or subcontractors of services, materials, parts, components, or equipment will be selected through a quality based source evaluation by the Project Manager and key task leaders with support from the Program Manager and Project Quality Control Manager. Supplier evaluation will consider such factors as supplier's quality history, technical ability to supply the item, financial soundness, quality assurance/quality control system in place, facility survey, industry reports, and other factors as appropriate to the criticality of the item.

- *Source Surveillance:* Purchase orders or contracts, subcontracts, or other purchase agreements will provide for source surveillance by project QC personnel to an extent appropriate for the importance or criticality of the item to project performance quality. Periodic inspections, testing, witnessing, and program audits may be used to control and verify supplier and subcontractor performance.

- *Documentation/Certifications:* Suppliers and subcontractors will furnish documentary evidence or certifications attesting that the quality of an item conforms to performance specifications.

- *Packaging/Shipping:* Purchase orders or contracts will identify the need for special packaging and shipping required by types of items, sizes, or special environments.

- *Receiving Inspection:* Materials, components, parts, equipment, and supplies will be inspected on receipt to verify conformance with procurement documents. The following QC steps include: receiving package inspection will be provided in addition to site inspection and surveillance. Nonconforming items will be tagged, marked, segregated, or otherwise identified to prevent use. Non-conformances, including missing documentation, will be reported to the supplier and the shipper, if required. Disposition will be in accordance with an engineering evaluation.

- *Health and Safety Monitoring* will be performed to assess compliance with OSHA and the site-specific and Company Health and Safety Plan, including personnel protection, engineering control measures, real time monitoring, and decontamination procedures.

- *Field Sampling:* QC samples will be collected by GZA and submitted as blind samples to the laboratory to assess analytical accuracy and precision, and possible field or laboratory contamination. QC samples will include raw material for construction (e.g., clay, concrete, steel, etc.) and duplicate, rinsate/blank, spikes, and reference samples for chemical parameters.

- *Laboratory Data Management:* QC will include GZA's assessment or verification of laboratory data for accuracy, precision, and completeness before submitting them to others. The GZA Laboratory Manager will serve as the Program Data Coordinator. He will be responsible for assembling the data packages and coordinating with the Project Manager to produce adequate data review and validation.

- *Preventive Maintenance and Calibration Schedules* will be established for instruments and equipment used to collect field and laboratory data. A preventive maintenance plan will be developed and implemented to allow for periodic instrument checks for problems that occur frequently. Procedures for preventive maintenance are contained in the manual for each instrument under the sections for maintenance/troubleshooting. Equipment for all SOP's will detail the required calibration/maintenance instructions. Equipment failing to achieve the appropriate calibration will be tagged and removed from service and replaced or repaired.

4.1.3 Auditing Program

1. *Field audits* will occur in conjunction with construction activities to monitor protocols used in the field, to demonstrate that the integrity of samples collected in support of the project has not been impaired, and to verify that construction activities (*e.g.*, well installation, excavation, cap construction, treatment system installation, *etc.*) were conducted in accordance with design specifications. Field audits will occur at a minimum of once per construction activity or sampling task. Checklists specifically relevant to the event will be developed to verify that field activities are performed in conjunction with existing SOP's. A report of the findings and deficiencies will be distributed to the appropriate project and senior management personnel upon completion of the audit.

   Construction activities will be evaluated for compliance to design specifications, written work plans, and SOP's. Construction QC monitoring activities will include evaluation of processes, control of materials, inspection, and testing (based on ASTM or other requirements), as well as final review of as-built drawings and post-construction documentation for compliance with project specifications.

2. *Laboratory audits* will be conducted to determine whether the laboratory is following established protocols. The laboratory will be audited during the time of actual sample processing to verify adherence to protocols defined by the QA/QC program. The audits will verify that specified standards and procedures have been followed; records have been generated, filed and maintained; documents are protected and retrievable; and results of QC sample analyses have been assessed.

4.1.4 Corrective Action

Requirements for corrective action will be implemented in response to deficiencies encountered during system audits or failures to adhere to the Project Quality Plan. To confirm that remedial construction activities are performed to meet specifications, the Project Quality Control Manager will maintain authority for critical tasks identified in the Project Quality Plan. For these activities, the PQCM will require immediate response, including detailed reports to document identified problems, investigations, actions taken, and subsequent resolutions. Steps comprising a closed-loop corrective action system will include: detecting and defining the problem; assigning responsibility for investigating the problem; investigating and determining the cause of the problem; assigning responsibility for problem resolution; and verifying that the problem has been corrected.

4.1.5 Subcontractor QC Programs

1. Quality Plan: Each potential subcontractor will be required to submit its own Corporate Quality Control Plan ("QCP") for review by GZA prior to award of work. The subcontractor must have an independent QC organization capable of verifying that the subcontractor or supplier can attain project quality objectives and the standards of excellence required to minimize out-of-control situations. At a minimum, the basic objectives of the subcontractor QC program will be: achieve GZA quality requirements; generate data and/or services documented to achieve Project requirements; and evaluate internal QC systems to detect and correct out-of-control occurrences.

   The subcontractor QCP will identify QC criteria and will specify routine procedures to assess project goals of accuracy, precision, and completeness required to achieve project objectives for data quality and performance. The subcontractor QCP will delineate the extent to which activities are controlled; the authority and responsibility of the project team; the role of QC staff and their relationship to corporate entities supporting the project; and the applicable industrial codes, standards, or regulations required to perform project activities.

2. Communication of Objectives: GZA subcontractor services will be adequately defined prior to commencement of work. The Project Manager will be responsible for initiating communication between the subcontractor and the appropriate management level within GZA. Once communication has been established, the appropriate technical support staff will be responsible for directly communicating with the subcontractor and for providing frequent reports concerning performance and quality management to the Project Manager.

3. Subcontractor QA/QC Reporting: Subcontract QC reports will be submitted monthly, summarizing the internal QC measures that have been implemented. At a minimum, the reports will provide information attesting to the following:

   - Records, logs, and data generation activities have been adequately documented, and information has been achieved and is retrievable;

- Appropriate QC criteria have been provided to ensure the reliability of project systems;
- Conditions requiring corrective actions have been identified, documented, and the appropriate corrective action has been performed; and
- Periodic audits have been conducted to verify acceptable subcontractor performance.

4. The Project Quality Control Manager will evaluate the monthly QC reports to verify compliance with contract QC agreements established with the subcontractor. The subcontractor will be apprised of the findings and will be required to initiate corrective action, if applicable.

5. *Identified Subcontractor Non-compliances.* QA/QC problems identified by the subcontractor during monitoring, surveillance, audits, or by other means will be documented and promptly reported to the responsible subcontractor management staff, the Project Quality Control Manager, and the Contractor Quality Control System Manager. Responsible personnel will take prompt action to determine the cause of an out-of-control situation; will take appropriate corrective action measures; and will identify steps to preclude recurrence of the situation.

6. *Auditing:* GZA will monitor subcontractor performance through surveillance and periodic auditing to determine whether subcontractor activities are in compliance with the project-specific QCP. These audits are performed to verify that actual practice agrees with written instructions; that QC measures have been implemented to achieve delivery of quality services; that QC records have been adequately filed and maintained; and that documents are protected and retrievable.

   Upon completion of the audit, a formal report will be distributed to the subcontractor QC Manager, Project Manager, Program Manager, and Contractor Quality Control Manager. Deficiencies encountered and recommendations for corrective action, including time frame, will be provided in the audit report. The Project Manager will reevaluate the subcontract status when the subcontractor consistently fails to achieve the level of quality defined in the subcontract QC program and in the conditions specified in the task order agreement.

5.00 QUALITY CONTROL FOR PROFESSIONAL SERVICE PROJECTS AND TASKS

The QA/QC program for professional service activities encompasses five elements:

1. Thorough planning and specification of project and activity goals.
2. Initiation of quality standards.
3. Identification of and compliance with appropriate regulatory requirements and procedures.
4. Continuous application of QC measures to identify out-of-tolerance occurrences near the time they transpire.
5. Establishment of control systems to confirm that deficiencies have been identified, evaluated and corrected.

Professional service projects differ from construction projects in that the quality standards for the service are defined, in addition to meeting Client requirements, as the ordinary standard of care and skill of qualified professionals practicing in the same technical field near the same time and locale. Therefore, quality assurance for professional services can only be carried out by the activities of qualified professionals reviewing the work of other professionals.

5.10 Implementation

5.1.1 Project Quality Planning

1. Each Principal-in-Charge ("PIC") will develop a Project Quality Plan in accordance with Section 3.3 above. The plan will indicate the name of the Project Manager(s), Reviewer/Consultant ("R/C") and Outside Consultants, if any.

2. The Reviewer/Consultant will serve as the Project Quality Control Manager (PQCM). The primary focus of the Reviewer/Consultant will be to provide senior GZA management with regular evaluation of the QA/QC program, specifically whether the program can distinguish project quality consistent with the ordinary standard of care of the profession and whether that level of care and skill is achieved in delivering the project services.

3. Each project task will have a pre-determined degree of QA/QC necessary to attain the level of accuracy and precision to demonstrate compliance with the professional standard of care. For example, field and analytical procedures will conform to predetermined standards of performance developed to achieve the professional standard of care. Standard Operating Procedures ("SOP's") are or will be developed for appropriate project tasks. The SOP's will be made available to all GZA and subcontractor personnel performing the work as well as QC personnel prior to initiation of critical activities.

5.1.2. Project Quality Assurance

Professional project quality assurance is based on review of one professional's work by a another professional of comparable training and experience. The Reviewer/Consultant serving as the PQCM is the key individual for project quality assurance. The objective of the quality assurance plan is to reduce errors and the propagation of errors into later phases of the work by having professional work checked at strategic stages in the work process.

1. The Principal-in-Charge and the Project Manager or his designee will conduct a pre-task planning meeting prior to each task initiation to confirm clear, consistent communication of task objectives and SOP's. The R/C may also take part in this meeting.

2. Quality will be assured by periodic review of the project status (completed tasks) and plans for the ensuing tasks. This meeting will include at least the PIC, R/C and the Project Manager. Project review meetings will take place at the following stages at least:

   - Development of Scope (Proposal stage)
   - Following field and laboratory data collection
   - At development of study conclusions (before writing report)
   - Written report draft.

   Reviews will be carried out generally according to Guideline 06-0200: Guidelines for Review of Professional Work Product.

3. Calculations will be documented and checked according to Guideline 06-0001: Technical Calculations. Computer calculations will be documented and checked according to Guideline 06-0005: Automated Calculations - Spreadsheets and Scientific Programs.

4. Technical Reports will be prepared according to contract specifications and generally according to Guideline 06-0100: Technical Reports.

5. Where the PIC and R/C have differing opinions on professional approach to a project, the matter will be referred to the Company Strategic Service Group Leader or other person assigned responsibility for Quality Assurance in a particular technical specialty. The Reviewer/Consultant has authority to halt delivery of professional work product (reports, specifications, *etc.*) to a Client if he or she believes that the work product does not meet Client requirements or does not represent the ordinary standard of professional care and skill.

5.1.3. Professional Project Quality Control

Quality control is tracked by signatures. Calculations, laboratory reports, exploration logs, drawings and other instruments of professional service will generally be signed or identified by the originator name and the name of the person who checked the work. The Project Manager and PIC can control that these QA steps have been carried out by reviewing the signatures.

At least the PIC and the R/C must sign professional reports as evidence that the required project quality assurance processes have been completed.

6.00 PREPARED BY:

This Plan was prepared by J. DeStefano and R.M. Simon. For questions, comments or recommended changes to this document, contact the Executive Vice President for Professional Practice.

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Date:	February 1, 1996
Supersedes:	Draft of 11/1/94
Approved:	R. M. Simon
Sponsoring Function:	Technical Practice
Page:	1 of 3

GUIDELINES FOR REVIEW OF PROFESSIONAL WORK PRODUCT

A. INTRODUCTION

1. For over 30 years, GZA has had a report review policy as a basic element of our professional quality assurance program. Through the years this has been expanded to include all technical correspondence that expresses professional opinions and recommendations. With time the procedure has become more formalized. Our reports generally reflect a considerable amount of judgment. It is important that our reports, to the extent practical, reflect the cumulative experience of an office. In addition, reviews should improve the appearance and writing quality of our professional work product which is often taken by Clients and other readers as a direct reflection of the technical quality of the professional work. Therefore it is important that any professional work product be given an appropriate review before it is sent to our client or other outside reader in draft or final form.

2. A PROFESSIONAL WORK PRODUCT IS DEFINED AS ANY DOCUMENT WHICH EXPRESSES A TECHNICAL OPINION, PRESENTS INTERPRETATIONS OR CONCLUSIONS, OR PROVIDES RECOMMENDATIONS. THESE INCLUDE PROPOSALS, REPORTS, LETTERS, MEMORANDA, SPECIFICATIONS, DRAWINGS AND EXPERT REPORTS OR TESTIMONY. Letters and memoranda which transmit solely factual information are excluded from the review requirements of this policy.

B. PURPOSE

The purpose of this policy is:

1. To provide guidance in reviewing technical work product
2. To define responsibilities for reviewing
3. To maintain consistent quality work product in all offices

C. SCOPE

1. This policy applies to GZA, GZAR and GZANY.

D. ASSOCIATED DOCUMENTS

1. Policy No. 06-0020 - Technical Reports; Loss Prevention
2. Policy No. 08-1010 - Corporate Quality Control Plan

E. BACKGROUND

1. When a Project Manager (PM) and Principal-in-Charge (PIC) are intimately involved in staying within budget and meeting the Client's schedule, associated pressures may cause them to overlook some broad technical issue, regulatory requirement or loss prevention factor. That is why it is important to have an independent review of the work product by an objective, experienced technical person. This function is generally provided by the in-house Consultant/Reviewer ("C/R"). As a control to verify that the work product is independently reviewed, the C/R must either sign the document or sign a file copy on a approved form before the work product is sent to the Client.

2. The intent of the independent review is to assure that our work product is technically correct, meets contract requirements and that appropriate wording is included to identify risks and uncertainties, limit claims and avoid misunderstanding by the Client.

F. GUIDELINES

1. All reports and technical correspondence requiring a principal's signature , *i.e.* professional work product, must be reviewed by a Consultant/Reviewer (C/R) before they are sent to the Client in draft or final form. These include any document which expresses a technical opinion, presents interpretations or conclusions, or provides recommendations, such as proposals, reports, letters, memoranda, specifications, drawings and expert reports or testimony.

2. The C/R, selected by the project PIC, must have technical expertise and experience in the appropriate field. The C/R should be identified at the start of the project and informed of his/her responsibility. If the specific expertise is not available in the office where the work is being performed, then an appropriate person from another office or an outside consultant must be utilized as the C/R. Where the scope of the study crosses several technical fields, it may be necessary to involve more than one C/R.

3. The C/R should be a senior staff member (to the extent that it is reasonable and practical, Associate Principal or above). In limited situations, where this is not possible, the C/R shall be approved by a technical group leader. In all cases, the C/R must be qualified in the specific technical area under analysis through academic training and/or experience.

4. The C/R should participate from the proposal stage of the project to provide input and direction. Ideally the C/R should have already acquired a thorough understanding of the project decisions and conclusions at the time he/she actually reads the final work product draft.

5. The C/R should concentrate on technical approach, accepted standard of care, and loss prevention. It remains the responsibility of the PM and PIC to ensure that computations have been checked, that work product format, organization and grammar are in accordance with GZA standards, and that the work product adequately addresses the entire scope of work stated in the contract.

6. In general, the PIC and C/R will work together to resolve differences in opinion, with the final work product reflecting the consensus of the PM, PIC, and C/R. In the rare instance when the PIC and C/R cannot reach agreement, the PIC and C/R shall seek the help of a Principal or Senior Principal in the firm to resolve the issue. The Technical Service Lead or Strategic Service Group may be the appropriate person to resolve professional differences of opinion.

7. The PIC and C/R must sign the work product before it is sent to the Client. It is unacceptable to have another senior staff member sign for the C/R unless it is clear to the alternative signer that the reviewer has completed his/her review.

8. No written record of the C/R comments shall be maintained in GZA's files. ALL DRAFT COPIES AND COMMENTS MUST BE DISCARDED AS SOON AS THEY ARE NO LONGER NEEDED FOR FINAL WORK PRODUCT DEVELOPMENT. The PM's is responsible to see that written documentation of completed reviews is maintained in project files only in the form of the C/R's signature on the work product or on a cover sheet. While comments on drafts are part of the ordinary work

product development, do not retain review comments. Comments by technical reviewers can easily be misrepresented by others. All comments must be resolved before the work product is finalized. THEREFORE, DISCARD ALL REVIEW COMMENT NOTES AND DRAFT COPIES ONCE THE DOCUMENT IS FINALIZED. SAVE ONLY THE FINAL COPY.

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G. RESPONSIBILITIES

1. The PIC is responsible to the Client for providing a quality work product, which is protective of GZA's short- and long-term interests, and being sure the technical work product is reviewed by the C/R.

2. The PM is responsible to the PIC for seeing that all steps necessary to assure the quality of our work product.

These steps include:

- verifying that all calculations have been independently checked;
- proofreading the final text (spelling and format check);
- checking figures for final revisions;
- checking the assembled work product originals, including text, figures, tables, logs, laboratory test reports, and signing the reproduction form; and
- checking each assembled copy of the work product to ensure that printing is clear and clean, all pages are included in proper order, and all signatures are applied.

This does not mean that the PM must perform all these steps, but the PM must verify that those s/he delegates have made the required checks.

H. PREPARED BY:

This document was prepared by N. A. Campagna. Refer questions, comments or recommendations for changes to the Executive Vice President for Professional Practice.

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Number:	Vol. 04	No. 0200
Date:	February 1, 1996	
Supersedes:	Draft of 11/1/94	
Approved:	R. M. Simon	
Sponsoring Function:	Technical Practice	
Page:	1 of 3	

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H. PREPARED BY:

This document was prepared by N. A. Campagna. Refer questions, comments or recommendations for changes to the Executive Vice President for Professional Practice.

Proactive by Design

Section 7.

Affirmative Action Plan

SECTION 7 AFFIRMATIVE ACTION PLAN

GZA's corporate Affirmative Action Policy, February 16, 2015, is included in this section.

GZA prohibits discrimination in employment on the basis of race, color, religion, creed, citizenship status, marital status, national origin, sex, sexual orientation, Vietnam Era Veteran status, age, and disability.

AFFIRMATIVE ACTION PROGRAM
GZA GEOENVIRONMENTAL, INC.

INTRODUCTION

All information in this Plan, including salary information, total level of employment, and other statistical data, is confidential, and may not be released to any third party without the consent of GZA GeoEnvironmental, Inc.

The terms "underutilization" and "goals" are used only to comply with Affirmative Action regulations and are not an admission of any illegal or discriminatory activity.

REVIEW OF PERSONNEL PROCESSES

GZA reviews annually its personnel processes to determine whether its present procedures assure careful, thorough and systematic consideration of the qualifications of known qualified individuals with disabilities and qualified protected veterans. This review covers all procedures related to the filling of job vacancies either by hire or by promotion, as well as all training opportunities offered or made available to employees.

In determining the qualifications of veterans, GZA limits its consideration of a qualified protected veteran's military record, including discharge papers, to only that portion of the record, which is relevant to the specific job qualifications for which the veteran is being considered.

Based upon GZA's review of its personnel processes, GZA will modify the personnel processes when necessary, and will include the development of new procedures in this Affirmative Action Program to ensure equal employment opportunity. To date, no modifications have been necessary.

REASONABLE ACCOMMODATION TO PHYSICAL AND MENTAL LIMITATIONS

The Company recognizes its obligation and does make a reasonable accommodation to the physical and mental limitations of an applicant or employee unless the Company is able to demonstrate that such an accommodation would impose an undue hardship on the conduct of its business. In determining the extent of the Company's accommodation obligations, the following factors, among others, are considered:

(1) business necessity, and

(2) financial cost and expenses.

EXTERNAL DISSEMINATION OF POLICY, OUTREACH, AND POSITIVE RECRUITMENT

A. INTERNAL DISSEMINATION

1. The GZA GeoEnvironmental, Inc. Manual Contains our Affirmative Action/Equal Opportunity Compliance Program Policy Statement.

2. GZA GeoEnvironmental, Inc. publicizes the Program through applicable internal publications, including memos to employees.

3. Periodic meetings are held with executive and supervisory personnel to explain the intent of the Program, and the responsibility of each Company employee for effective implementation.

4. Supervisory Personnel hold staff meetings to further implement and explain the Program to all other employees.

5. As a part of the GZA GeoEnvironmental, Inc. introduction procedure, each new employee is handed a copy of the Policy Statement, and after review by the new employee, an opportunity to ask questions is provided.

6. Notices are posted about EEO programs, progress reports, etc.

7. The Policy Statement covering our Affirmative Action/Equal Opportunity Compliance Program, is posted on the Company bulletin board.

8. The Policy is discussed in Management Training Programs.

9. Articles (and pictures) regarding accomplishments of employees who are qualified individuals with disabilities and qualified protected veterans shall be included in Company and/or facility publications.

10. Existence of the program is communicated to employees and such elements of the program made available to employees to know of and avail themselves of its benefits.

B. EXTERNAL DISSEMINATION

1. GZA GeoEnvironmental, Inc. recruiting sources are informed about our EEO policy, and are requested to actively recruit and refer Minority and Female applicants for all positions listed.

2. All employment advertising includes reference to our EEO policy.

3. The EEO clause is included in purchase orders and subcontracts.

4. Minority and Female organizations, community agencies, community leaders, secondary schools and colleges are notified of Company policy.

5. Subcontractors, vendors and suppliers are notified of Company policy requesting appropriate action on their part.

RESPONSIBILITY FOR IMPLEMENTATION OF AAP

A. Ms. Kathleen A. Murphy, Human Resources Director, is responsible for the Affirmative Action/Equal Employment Compliance Program. In matters involving Equal Employment Opportunity, the Director of Human Resources reports directly to the Chief Executive Officer. The responsibilities, with the full support of top management, include, but are not necessarily limited to:

1. Establishing measurable and attainable goals regarding employment of Minorities and Females.

2. Developing policy statements, affirmative action programs, internal and external communication techniques.

   a. To ensure the Policy Statement and Program achieve compliance with the with the following applicable federal and state laws, regulations, executive orders and together with the E.E.O. contract provisions contained in Department of Small Businesses Service/Division of Labor Services awarded contracts constitute a complete affirmative action program:

      1) Civil Rights Act of 1964 as amended

      2) Presidential Executive Order 11246 as amended

      3) Title 23 U.S.C. 140

      4) Title 49 C.F.R. Part 23

      5) Governor's Executive Orders #3 and #17

      6) The Americans with Disabilities Act of 1990

      7) Public Act No. 91-58

      8) Civil Rights Act of 1991

3. Assisting in the identification of problem areas.

4. Assisting management in arriving at solutions to problems.

5. Annually designing and implementing audit and reporting systems that will measure the effectiveness of the Program indicating the need for remedial action, and determining the degree to which the Program's goals and objectives have been attained.

6. Serving as liaison between the Company and enforcement agencies.

7. Serving as liaison between the Company and minority organizations, women's organizations, and community action groups concerned with employment opportunities for Minorities and Females.

TRAINING TO ENSURE AAP IMPLEMENTATION

To establish availability factors for this Plan year, local, state, and national data was used as a starting point, modified by the appropriate factors, according to federal guidelines. The Company believes these figures to be an accurate and true reflection of its current status.

To determine whether Minorities or Females are being underutilized in any Job Group, all of the following factors have been considered:

1. The Minority population and Females seeking employment in the labor area surrounding the facility.

2. The size of the Minority and Female unemployment force in the labor area surrounding the facility.

3. The percentage of the Minority and Female work force as compared with the total work force in the immediate labor area.

4. The general availability of Minorities and Females having requisite skills in the immediate labor area.

5. The availability of Minorities and Females having requisite skills in an area in which the Company can reasonably recruit includes the State of Connecticut.

6. The availability of promotable and transferable Minorities and Females within the Company is considered for all Job Groups which are filled by current employees.

7. The existence of training institutions capable of training persons in the requisite skills is important for several Job Groups.

8. The degree of training which the Company is reasonably able to undertake as a means of making all job classes available to Minorities and Females is considered in determining promotable and transferable candidates and uses the same data as Factor 6.

enforcing laws administered by OFCCP, or enforcing the Americans with Disabilities Act may be informed.

6. If you are a qualified special disabled veteran it would assist us if you tell us about (i) any special methods, skills, and procedures which qualify you for positions that you might not otherwise be able to do because of your disability so that you will be considered for any positions of that kind, and (ii) the accommodations which we could make which would enable you to perform the job properly and safely, including special equipment, changes in the physical layout of the job, elimination of certain duties relating to the job, provision of personal assistance services or other accommodations. This information will assist us in placing you in an appropriate position in making accommodations for your disability.

7. A written copy of this Affirmative Action Program is available for inspection by any employee or applicant for employment, during normal business hours, in the Administration Department. Interested persons should contact Kathleen Murphy, Human Resources Director, at (781) 278-3837 for assistance.

ORGANIZATIONAL PROFILE
41 C.F.R & 60-2.11

As required by 41 C.F.R. § 60-2.11, GZA has prepared an organizational profile for this establishment as part of its affirmative action program. The organizational profile is a depiction of the staffing pattern within this establishment. The profile provides an overview of the workforce at the establishment that may be used to assist in identifying organizational units where women or minorities are underrepresented or concentrated.

GZA has elected to prepare a workforce analysis to satisfy the organizational profile requirement of 41 C.F.R. § 60-2.11(a).
Pursuant to the requirements of 41 C.F.R. § 60-2.11(c), the workforce analysis is a listing of each job title as it appears in applicable collective bargaining agreements or payroll records, ranked from the highest paid to the lowest paid within each department or other similar organizational unit including departmental or unit supervision. If there are separate work units or lines of progression within a department, Company has prepared a separate list for each such work unit, or line, including unit supervisors. If and where there are lines of progression, Company has indicated the order of jobs in the line through which an employee could move to the top of the line. If and where there are no formal progression lines or usual promotional sequences, job titles are listed by department, job families, or disciplines, in order of wage rates or salary ranges. For each job title, the total number of incumbents, the total number of male and female incumbents, and the total number of male and female incumbents in each of the minority subgroups have been provided. The wage rate or salary range for each job title will be provided upon request. All job titles, including all managerial job titles, are listed.

For purposes of this affirmative action program, an organizational unit is defined primarily as any discrete component of Company's corporate structure at which there is a level of supervision responsible and accountable for establishing the employment terms and conditions (e.g., selection, compensation, etc.) of the employees therein. In addition, this establishment's organizational units also may include discrete components of the establishment's structure that are monitored separately for cost, accounting, payroll, or other operational purposes.

The establishment's management team reviews the organizational profile at the beginning of each affirmative action program year to determine whether the establishment's staffing patterns indicate potential barriers to equal employment opportunity.

JOB GROUP ANALYSIS REPORT
41 C.F.R. & 60-2.12

PLACEMENT OF INCUMBENTS IN JOB GROUPS
41 C.F.R. § 60-2.13

COMPARING INCUMBENCY TO AVAILABILITY
[41 C.F.R. § 60-2.15]

DESIGNATION FOR RESPONSIBILITY FOR IMPLEMENTATION

Kathleen A. Murphy, Human Resources Director, has overall responsibility for communicating and executing the affirmative action policy and programs. The program will be reviewed and directed with an emphasis on the results achieved. With the cooperation and assistance of appropriate management staff and operating personnel, the responsibilities include:

1. Development of policy statements, affirmative action programs, and internal and external communication techniques to be certain that the policies are being followed, including advising supervisory personnel that

   (a) their work performance is being evaluated on the basis of their affirmative action efforts and results, as well as other criteria, and

   (b) the Company is obligated to prevent harassment of employees placed through affirmative action efforts;

2. Identification of problem areas, in conjunction with line management and known handicapped individuals and disabled veterans, in the implementation of the affirmative action programs, and developing solutions;

3. Designing and implementing audit and reporting systems that measure the effectiveness of the program, indicate any need for remedial action, determine the degree to which the Company's objectives have been attained, and determine whether known handicapped individuals, veterans of the Vietnam Era, and disabled veterans have had the opportunity to participate in all Company sponsored educational, training, recreational, and social activities;

4. Serving as a liaison between the Company and enforcement agencies, as well as between the Company and organizations of, or for, handicapped individuals, veterans of the Vietnam Era, and disabled veterans, and arranging for the active involvement by Company representatives in the community service programs of local organizations of, and for, handicapped individuals, veterans of the Vietnam Era, and disabled veterans;

5. Keeping management informed of the latest developments in the entire affirmative action area; and

6. Arranging for career counseling for all employees, including known handicapped individuals, veterans of the Vietnam Era, and disabled veterans.

5. The Company analyzes its position descriptions to ensure that they accurately reflect position functions. All qualifications and requirements have been analyzed to ensure they are job related.

6. Formal or scored selection procedures would be validated if required by the Uniform Guidelines on Employee Selection Procedures.

7. The Company does not currently use tests as a selection technique with the exception of a typing test to assist in the proper placement of an applicant according to typing speed. If other test forms are ever used, when appropriate, they would be validated by location and work performance and would include Minorities and Females in the sample.

8. The referral ratio of Minorities and Females to the hiring supervisor/manager does not indicate that a significantly higher percentage is being rejected as compared to non-Minority and male applicants.

9. Minorities and Females are not excluded from and are not discouraged from participating in Company sponsored activities or programs.

10. De facto segregation does not exist anywhere in the Company.

11. The analysis of seniority practices at the Company does not disclose any procedure which discriminates against Minorities or Females. Although seniority is one of the factors taken into consideration, the primary factor on all upgrades, promotions, and transfers is the individual's level of experience, skill and performance.

12. Company policy is supported by managers, supervisors, and employees.

13. Minorities and Females are not significantly underrepresented or underutilized in training or career development programs.

14. The effectiveness of EEO programs is evaluated formally.

15. The Company provides reasonable assistance for all relocating employees. Suitable housing is accessible to employees and the availability of housing does not appear to inhibit the recruitment of qualified Minorities.

16. Most of the Company's employees use private transportation to commute to work. Proximity to public transportation routes does not appear to impact the Company's ability to recruit and employ Minorities.

17. The Company does not have labor unions. Subcontractors are notified of their responsibilities.

18. Vendors are informed of their responsibilities.

19. Posters are on display.

DEVELOPMENT AND EXECUTION OF PROGRAMS

1. Approved job descriptions and job specifications, when used by us, are available to all members of management involved in the recruiting, screening, selection, and promotion process. Copies are also available to all recruitment sources, as appropriate.

2. Our manpower selection process, described in Section 5, has been evaluated, and is free from bias in order to aid in the attainment of goals and objectives.

   a. All personnel involved in the recruiting, screening, selection, and promotion process are made aware of our EEO commitments, and are carefully directed to ensure elimination of bias in all personnel actions.

   b. We observe the requirements of the Office of Federal Contract Compliance pertaining to the validation of employee tests, if required.

3. The Company ensures that Minority and Female employees are given equal opportunity for promotion.

   a. The Company maintains personnel records which include the academic, skill, and experience levels of individual employees, including Minority and Female employees.

   b. The Company conducts formal evaluations for each employee and trains its managerial employees on proper techniques for evaluating employee performance.

   c. All job qualifications are job-related. Neither Minorities nor Females are required to possess higher qualifications than other candidates for the position.

   d. When apparently qualified employees, including Minority and Female employees, are passed over for promotion, supervisory personnel must justify their decisions.

   e. Career counseling includes individual consultation, educational reimbursement, and other programs. All employees are eligible to participate in the Company's educational reimbursement plan and in-house courses. Employees are encouraged to participate in programs which are related to their present job and to jobs to which they might reasonably progress.

4. Techniques to improve recruitment and increase the flow of Minority or Female applicants include appropriate contacts with organizations committed to Minorities and Females.

   a. When appropriate, brochures will show Minority and Female employees at their work stations. Employment advertising includes news media accessible to and read by Minorities and Females.

   b. Minorities and Females, as well as all employees, are encouraged to refer qualified applicants. Also, verbal announcements are made in staff meetings.

5. All facilities and Company sponsored social and recreational activities are integrated, which encourages all employees to participate.

ACTION-OREINTED PROGRAMS

The Company is committed to the support of action programs by encouraging supervisory employees, Human Resources Department employees, and Minority and Female employees to participate in programs which encourage the upward mobility, training, and hiring of qualified Minorities and Females.

The Company supports high school, vocational, and college training programs designed to enable Minority and Female graduates of these institutions to compete in the open employment market on a more equitable basis and to become employees at the Company. The Company has an active donations program including such area schools as University of Connecticut, and participates in college career nights through engineering societies (i.e. ASCE, ASFE, ACEC, NSPE).

The Company supports programs developed by organizations concerned with employment opportunities for Minorities and Females, such as the Chamber of Commerce, the SHRM Personnel Association, and other organizations.

D. DISCRIMINATING WAGES

1. Wage schedules are not related to or based on the sex of the employee. Discrimination does not exist where employees of different sexes are paid different wages on jobs which require substantially equal skill, effort and responsibility, and are performed under similar working conditions.

E. AFFIRMATIVE ACTION

1. The Company is taking affirmative action to recruit Females to apply for those jobs where there exists an underutilization of Females.

2. Females are included in all management training programs.

3. No distinctions are made in other training programs. Both sexes have equal access to all training programs.

CONSIDERATION OF MINORITIES AND FEMALES IN THE WORKFORCE

Appropriate consideration is given to Minorities and Females not currently in the workforce with requisite skills who can be recruited through affirmative action measures.

The Company provides part-time work, job sharing, and flexible work schedules.

GZA

Proactive by Design

Section 8.

Section 3 Compliance Plan

SECTION 3 COMPLIANCE PLAN

GZA has completed numerous recent assignments for the City of Springfield subject to Section 3. GZA agrees to abide by the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3), as detailed in the information below:

Section 3 Clause:

A. The work to be performed under a contract subsequent to City of Springfield's RFQ #16-190 will be subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.

B. GZA agrees to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by our execution of a contract, GZA certifies that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.

C. GZA agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

D. GZA agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. GZA will not subcontract with any subcontractor where GZA has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

E. GZA will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.

F. Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

G. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C 450e) also applies to the work to be performed under a contract subsequent to City of Springfield's RFQ #16-190. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to a contract subsequent to City of Springfield's RFQ #16-190 that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).

Exhibit C

GZA

Proactive by Design

GEOTECHNICAL
ENVIRONMENTAL
ECOLOGICAL
WATER
CONSTRUCTION MANAGEMENT

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July 14, 2017 ***revised July 27, 2017***
15.P000031.17 / 15.0166577.00

Peter J. Garvey, Director
City of Springfield - Department of Capital Asset Construction (DCAC)
36 Court Street, Room 312
Springfield, MA 01103

Re: **Follow-Up to Proposal for Professional Consulting Services**
City Bid Number SPG-16-190 for Professional Design Services
Feasibility Study for Hydropower Facility at Watershops Pond Dam
Springfield, MA

Dear Mr. Garvey:

GZA GeoEnvironmental, Inc. (GZA) is pleased to submit to the City of Springfield (the City) this Proposal for Professional Consulting Services to perform a **Feasibility Study** for a potential Hydropower Facility at Watershops Pond Dam in Springfield, Massachusetts (the Project). This Proposal is made pursuant to the following:

- The City's Request for Qualifications (RFQ; City Bid Number SPG-16-190 received June 10, 2016);
- GZA's resulting Statement of Qualifications submitted to the City on June 29, 2016;
- GZA's interview with the City's selection committee on November 10, 2016;
- GZA's Proposal for Professional Consulting Services submitted to the City on January 27, 2017;
- GZA's Follow-up Proposal for Professional Consulting Services submitted to the City on April 11, 2017;
- Follow-up conversation with the City and Pinck & Co. in April and May 2017; and
- The City's request for this Proposal to perform a Feasibility Study in line with the recommended Scope of Services developed by Pinck & Co. and Mott MacDonald dated May 22, 2017.

PROJECT BACKGROUND AND OBJECTIVES

The City's 2015 Phase II application under HUD's NDRC Grant program originally proposed to increase resilience through a portfolio of activities to be carried out in its Urban Watershed Resilience Zone, an economically distressed area along the Connecticut River. The initiative was presented to HUD to provide flood protection, introduce two clean redundant energy sources, create business and job opportunities, provide safe and healthy housing, and engage the community about climate change and environmental stewardship. The proposed activities were demonstrated to include significant co-benefits, including local and regional health benefits, decreased heat island effect, disaster preparedness, climate change mitigation, and recreation opportunities. One of the key components of the City's NDRC application was the re-establishment of hydropower at the Watershops Pond dam.

The achievability of a project to re-power the Watershops Pond Dam was preliminarily assessed in a 2015 report by GZA titled, "Watershops Pond Dam - Preliminary Hydropower Resource Assessment." As a part of that study, GZA worked with the City to conceptualize a new configuration for the Project, which included a new freestanding powerhouse immediately downstream of the dam using the existing outlets to supply the turbine. This configuration could result in a project which is constructed on City-owned property and was estimated to be capable of generating approximately 145 kW of power and 700 MWh of electricity annually. A portion of this electricity could potentially be used at the nearby new Brookings School. The remainder of the energy could be sold to the grid. Although final details are pending implementation details of the 2016 Massachusetts Energy Diversity Act, the City could benefit from the avoided cost of energy consumed from the grid, income from the sale of excess energy, and the sale of renewable energy certificates (RECs).

The Preliminary Hydropower Resource Assessment (GZA, 2015) estimated the Project payback period to be approximately 42 years without financial assistance. With assistance from the NDRC Grant, the Project can be constructed at reduced cost to the City, and is therefore potentially viable. The annual income from the sale of RECs and energy to the grid will offset the annual operations and maintenance costs. At the same time, the Project will assist the City in its endeavors to become more resilient in times of disaster and will foster the City's ongoing efforts to integrate green energy alternatives throughout the City and continue the City's standing as a leading Green City.

Should the Massachusetts Department of Public Utilities require that the City connect the hydroelectric project direct to the local electric grid, the Project will still create increased distributed generation capacity in the area, will offer potential opportunities to increase the local electric grid's resilience to potentially catastrophic disruptions, and will increase the resilience of other critical infrastructure sectors. Additionally, it may be possible for the City to apply to enroll in Eversource's Blackstart service. Blackstart service is necessary to facilitate a stable and orderly restoration of the power system in the event of a partial or complete shutdown of the system, incorporating participating generators interconnected to the transmission or distribution system at strategic locations that can be called upon to re-energize the system. This would require the generator and associated control systems to be selected and configured appropriately.

PROJECT UNDERSTANDING AND SCOPE OF SERVICES

Based on our discussions with the City and our history of assistance with the City's successful Phase II NDRC Grant application submitted in October 2015, GZA understands that the professional services to be provided to the City under this Proposal specifically include completion of a study to determine the feasibility of redevelopment of hydropower at the City's Watershops Pond dam. The proposed scope of services outlined in this proposal includes additional evaluation of the feasibility for development of a hydropower facility at Watershops Pond beyond the conceptual feasibility and cost estimations presented in the Preliminary Hydropower Resource Assessment (GZA, 2015).

Even though the Project is relatively small, the process of advancing it to completion and commissioning is complex due to the nature of hydropower licensing under Federal law and regulations. Virtually all hydropower projects fall under the jurisdiction of the Federal Energy Regulatory Commission (FERC) due to the inherent public interest of the utilization of a natural waterway for the generation of power which will be input into an interstate electrical grid. Therefore, hydropower projects of any size must complete an extensive process of studies and consultations to obtain Federal authorization prior to construction. A project must also receive approval to interconnect with the local electrical distribution system. These steps are in addition to all of the typical tasks necessary to design, permit, contract, and construct a public works project at a dam.

In support of the City's execution of the NDRC Grant, which was awarded in 2016, the City contracted Pinck & Co. to provide owner's project management services to oversee implementation of the NDRC Grant. Pinck & Co.

subcontracted Mott MacDonald, an engineering, management and development consultant, to aid in its review of the Preliminary Hydropower Resource Assessment (GZA, 2016) and GZA's previous proposals to provide professional consulting services for the Project. Following their review of these materials, Pinck & Co. submitted to the City on May 22, 2017, a "Scope for Feasibility Study, Hydropower Facility at Watershops Pond Dam" which outlined a recommended scope of services to perform a financial and engineering study for the feasibility of the Project prior to the City advancing conceptual study of the development. GZA was subsequently provided Pinck & Co.'s scope and has developed the following Scope of Services in response to the City's request. In general, the proposed Scope of Services follows the outline of Pinck & Co.'s scope:

Task 1. Incorporate Recent Dam Investigation Reports

a. Identify Impacts from FERC Criteria

All new hydropower projects require authorization from the Federal Energy Regulatory Commission (FERC). Watershops Pond Dam currently falls under dam safety jurisdiction by the Massachusetts Department of Conservation (MADCR) Office of Dam Safety (ODS) and The Code of Massachusetts Regulations (CMR), specifically, CMR 10.14 – *Dam Safety*. As part of the federal permitting and licensing process, Watershops Pond Dam will fall under FERC jurisdiction and may be subject to additional dam safety criteria under the FERC Dam Safety Program. Under this task, GZA will review FERC dam safety criteria and identify additional modifications or procedures that may impact the operation and maintenance of the dam.

GZA will review differences in design criteria, methodology, and loading conditions. Potential impacts to the dam analysis criteria may include differences in the required factor of safety under load conditions and stability analysis methodology. Additionally, GZA will identify differences in guidelines for the determination of the appropriate inflow design flood (IDF) under FERC requirements. GZA will present the results of the literature review in a table that identifies MADCR ODS criteria, FERC criteria, and the differences in criteria.

b. Preliminary Geotechnical Assessment and Development of Existing Conditions

The Watershops Pond Dam Phase I Inspection Report completed by GZA in January 2016 recommended that a complete structural stability analysis be performed. It is GZA's understanding there are no known recent engineering analyses, as-built drawings, instrumentations, or previous stability analyses for Watershops Pond dam.

Access to the dam to perform subsurface investigations and borings is extremely limited; therefore, costly subsurface explorations are not recommended during the Feasibility Evaluation phase of the Project. Due to the absence of as-built data, field exploration information, laboratory test results, or other similar existing information, GZA will select conservatively-assumed strength characteristics based on typical values, industry standards and guidelines, and our experience with other similar settings. Input data for our stability analyses will be primarily derived based on engineering judgment and dam geometry. GZA will review existing geotechnical information, including the historic USACE 1956 reconstruction drawings, notes from our visual observations performed during the Phase I Inspection (GZA, 2016), and historical photos of the dam with the water level partially drawn down to confirm the geometry of the dam to the plans.

A GZA geologist or geotechnical engineer will perform a site investigation to assess the bedrock outcrops at the toe of the dam. GZA will assess the bedrock for the type of material, obvious fracture patterns, strike and dip, and weathering characteristics. GZA will combine the information collected during the site investigation with a desktop study to develop information on the presumed bedrock foundation conditions. The 1956 reconstruction plans, and GZA site visits in 2015-2016, indicate that the dam foundation appears to be bedrock of Portland arkose sandstone materials.

From this analysis, GZA will develop assumed bedrock strength parameters, including compressive strength, friction angle, etc. for use in the gravity stability analysis.

c. *Stability Analysis*

GZA will perform a stability analysis in accordance with FERC requirements with the understanding that the dam will be required to comply with FERC regulations if the dam becomes licensed as a hydropower facility. FERC outlines the stability load cases that must be analyzed in Chapter 3 of the Engineering Guidelines for Dam Safety. Uplift will be included for all cases, with cracked base conditions if appropriate. GZA will perform the analysis as outlined in Chapters 3 or as mutually agreed upon by the City of Springfield and GZA. GZA will analyze the following load cases using the revised stability model:

- Case I (Usual) – Normal Operating Condition;
- Case II (Unusual) – Flood Discharge Loading;
- Case IIA (Unusual) – Case I + Ice;
- Case III (Extreme) – Case I + Earthquake (as per revised FERC guidance for damage assessment).

GZA will use the methodologies and loading conditions identified in the FERC Engineering Guidelines for Dam Safety. The task is meant to be a conservative, screening-level assessment of overall stability and seepage. If the results of this analysis indicate that minimum factors of safety are not favorable, GZA would most likely recommend that a subsurface exploration and instrumentation program be conducted to provide site-specific subsurface information. If the analyses cannot demonstrate that with typical assumptions, then additional investigations may be warranted to refine parameters. Only after the additional methods have been attempted would the recommendation for physical modifications of the structure be made.

The results of the stability analysis will be detailed within the Feasibility Study report, to be completed in Task 12, and GZA will discuss the recommendations for whether a subsurface investigation should be performed with the City. GZA also notes that as per FERC guidance, there are two separate sets of factors of safety requirements that must be met for analyses with and without cohesion.

d. *Identify and Detail Costs Associated with Dam Updates/Repairs*

The most recent Phase I Dam Inspection / Evaluation report, dated January 27, 2016 and completed by GZA, identifies dam safety deficiencies at Watershops Pond Dam, and outlines minor repair recommendations in *Section 3.4*. Repair recommendations include, but are not limited to, removal of trees, shrubs and brush, repair of safety railing, adding new locks, repair of the operator platform, cleaning and repair of the sluicegates, replacement of the Bascule gate power unit, repair of training walls, and investigation of the former penstocks. Additionally, recommendations for dam improvements may result following completion of the stability analysis performed during Task 1c and the revised hydrologic and hydraulic analysis performed during Task 5. GZA will consider the improvements that may be needed under the separate tasks and incorporate the findings within a new repair plan developed as part of this task. GZA will summarize the required dam repair/updates and detail the costs associates with implementing these updates within a table.

e. *Head and Potential Head for Dam*

In conjunction with Task 5, GZA will perform a hydraulic analysis at the dam to develop a headwater/tailwater stage-discharge curve that will be used to determine the available gross head curve at the dam for a variety of flows. GZA will revise the HEC-RAS model previously developed as part of the Dam Breach Analysis for Watershops Pond dam

performed in 2007 as needed to perform the analysis. GZA will model various flow increments and calculate the headwater at the dam and the tailwater elevations immediately below the dam for each flow condition. GZA will evaluate the tailwater impacts of the downstream flow constrictions (i.e., the culvert under the existing historic building immediately downstream of the dam, the driveway bridge, and the Allen Street bridge) on higher flows, and the resulting impact on available gross head during increasing flows.

Task 2. Develop Preliminary Site Plans and Layout Drawings

a. Site Survey and Layout Drawings

GZA will engage our surveyor subconsultant to develop a topographic survey of the facilities to be modified as part of this Project. In general, this will include the Watershops Pond dam and appurtenant structures adjacent to and in proximity to the dam. The survey will extend downstream to Allen Street and upstream to a distance of approximately 100 feet upstream of the Watershops bridge.

Determining usable access routes for material and equipment will be a key part of a successful project. GZA's survey subconsultant will perform deed and records research to make an opinion on the ownership of the Watershops Pond shoreline and whether the City owns the entire shoreline around Watershops Pond, which may qualify the proposed Project for a 10MW exemption under FERC licensing requirements. GZA will coordinate with the City's Law Department and, if directed by the City, may engage the services of a local attorney providing specialized energy and environmental legal expertise to assist in unique legal aspects of the Project. GZA will also consult with the Springfield Armory Museum and will review their extensive archives for historical information that may be of use in the Project documentation.

The site plans will be developed with the understanding that a future "Exhibit G – Project Boundary Map" will be required as part of the FERC licensing application process. The survey information will be developed and deed research performed in a manner that will facilitate future preparation of an Exhibit G filing. As part of the survey, a minimum of three (3) survey reference points, with coordinates, will be collected for inclusion on the boundary map.

Using the topographic and boundary information as a base, GZA will develop preliminary Site Plans and Layout Drawings which will include Existing Conditions; Erosion Control, Site Access and Staging; 25% Proposed Conditions Plan and Section; General Arrangement drawing(s); and Details.

b. Develop Bathymetry Plan, Cross Sections, and Perform Sediment Investigations

GZA will conduct a bathymetric (underwater) survey of the areas within Watershops Pond from the dam to a distance of approximately 100 feet upstream of the Watershops bridge. In addition, "soft" sediment thicknesses will be measured at stations across the surveyed portion of the pond using a graduated manual probe bar. Each measurement station location will be survey located with a Global Positioning System (GPS) survey unit with sub-meter accuracy.

GZA will prepare a bathymetric plan of the surveyed portions of Watershops Pond, with top of sediment and bottom of sediment contour maps using the collected survey data plotted on the base plan information prepared in Task 2a. GZA will compute the volume of sediments in the vicinity of the dam and upstream areas that may need to be dredged for the proposed alterations to the dam and appurtenant structures.

GZA will conduct a limited watershed "Due Diligence" evaluation to identify potential historic contamination sources in the vicinity of the dam and will discuss those findings with the Massachusetts Department of Environmental Protection (MADEP) in Boston (dredging unit). Consult with MADEP to develop a preliminary sediment sampling plan that will comply with the requirements of 314 CMR 9.00 401 Water Quality Certification (401 WQC) regulations and will be acceptable for a dredge permit application. For the purposes of this proposal, GZA has assumed a total of four

sediment samples will be acquired, which will be field-logged and composited into two (2) samples to be analyses for contaminants by a Massachusetts-certified laboratory in compliance with the 314 CMR 9.00 dredging regulations. GZA will evaluate the test results relative to disposal and reuse characteristics.

Task 3. Develop Preliminary Electrical One Line

In consultation with our sub-consultant, GZA will contact Eversource, the City's public electric utility provider, to discuss interconnection requirements. Subsequently, we will develop an electrical one-line diagram. The one-line diagram will show the main components of the electrical system, how they are connected, and including backup and spare equipment. The diagram will show the power distribution path from the dam to the downstream connections (Brooking School or adjacent electric grid, pending Eversource discussions), and include ratings and sizes of the equipment to be used.

Task 4. Develop Preliminary List of Mechanical and Electrical Equipment

GZA will develop a preliminary list of mechanical and electrical equipment. The Preliminary Hydropower Resource Assessment (GZA, 2015) indicated that a new Kaplan turbine or crossflow unit was the preferred option at the Watershops Pond dam. However, ultimate availability and price of equipment, along with information about available configuration and space within the proposed powerhouse may lead to a reconsideration of this recommendation. GZA will work with turbine suppliers and the City to review the options and make a final selection of the turbine type based on the known variables and considerations for lead time and operational aspects. This task of developing a preliminary list of equipment will be completed in coordination with development of the One-Line Diagram to be completed during Task 3.

Task 5. Perform Updated Hydrologic Analysis

a. Update Probable Maximum Flood Study

The most recent hydrologic analysis for Watershops Pond Dam was performed in 2007 in support of the dam's Emergency Action Plan (BEC, 2007). The EAP included a Hydrologic and Hydraulic analysis and downstream hazard assessment commensurate with the intended purpose and need to develop downstream inundation mapping. Under Massachusetts Dam Safety Regulations at 302 CMR 10.00, the Spillway Design Flood (SDF) for Watershops Pond Dam is the ½ Probable Maximum Flood (½PMF). The EAP-related H&H analysis performed in 2007 estimated the inflow to the pond to be 9,620 cfs with an outflow of approximately 7,100 cfs. The primary spillway capacity was estimated to be 3,700 cfs with the Bascule gate lowered, sluice gates closed and flow to the top of the abutments at El. 158.3. The calculated SDF is significantly greater than the spillway capacity. GZA notes that the most recent Phase I Inspection / Evaluation Report (GZA, 2016) recommended an Incremental Damage Assessment (IDA) be performed to potentially reduce the SDF and facilitate compliance with Dam Safety regulations. This recommendation also applies to potential FERC regulation of the dam.

The 2007 H&H analysis simulated the rainfall/runoff process using the Army Corps of Engineers (USACE) HEC-HMS computer program, which utilized the Soil Conservation Service (SCS) Unit Hydrograph model. However, the model was not calibrated to historic gage data and may overestimate the peak inflow to the dam.

As part of this task, GZA will assess the Watershops Pond Dam's watershed runoff response under various design storms up to and including the PMF. GZA proposes to revise the existing HEC-HMS computerized simulation model of the approximate 32 mi^2 contributing watershed. GZA will use methodology outlined in Chapter 8, Determination of the Probable Maximum Flood, of the FERC Engineering Guidelines for the Evaluation of Hydropower Projects, to develop a new PMF for Watershops Pond Dam. GZA will follow the approach in Chapter 8, which includes development of a

H&H model and subsequent calibration of the model and verification of the model results to existing stream gage records.

GZA will utilize the Snyder's Synthetic Unit Hydrograph methodology for this analysis. Unit hydrographs are the "fingerprint" of a specific watershed's response to one-inch of runoff (i.e. excess precipitation). The Pinck & Co. scope of work specifically recommended using historical data from USGS Gage 01178000 Mill River, in Springfield, MA (which has a short period of record) and USGS Gage 01184490 Broad Brook, in Broad Brook, CT. GZA will use this gage data to construct unit hydrographs. GZA will also review gage data for nearby, similar streams that may be applicable in developing unit hydrographs. As appropriate, we will use historic flood hydrograph data from these and other nearby USGS gages on other watersheds having similar hydrologic characteristics as the Mill River watershed, to develop transposed unit hydrographs for the study area.

The calibration process involves simulating the flood flow hydrograph for a specific flood(s) at specific USGS stream gages within the watershed by developing unit hydrographs or Snyder Unit hydrograph parameters for the subarea watersheds developed with GZA's HEC-HMS model. The simulated hydrograph will be compared to the observed hydrograph, and key hydrologic input parameters will be adjusted to better match observed data. The verification process involves using the calibrated hydrologic input parameters to simulate a separate flood at the same stream gage. The calibration process is successful when an acceptable comparison of simulated versus observed stream flow data (e.g. peak flow rate and/or runoff volume) is achieved during the verification process. The HEC-HMS model will be calibrated to historic/measured flood hydrographs before applying the PMP. This methodology provides technically defensible results which will reduce the likelihood of grossly overestimating the design flood.

The PMF inflow for the Watershops Pond Dam will be developed by GZA using the calibrated HEC-HMS hydrologic model with the probable maximum precipitation (PMP) depth of 33.0 inches, as calculated using HMR-52 during the 2007 H&H analysis. Within the HEC-HMS model, GZA will hydrologically route the SDS inflow through the reservoir and over the spillway to assess its hydraulic adequacy. As appropriate, GZA will apply non-Linearity adjustments to the SDS inflow hydrograph. Please note that a rain on snow-induced SDS is not currently part of our proposed scope of work.

Discharge capacity at the dam will be developed, in part, through a hydraulics analysis performed with using an updated HEC-RAS model (See Task 1e). The original HEC-RAS model developed in 2007 was used to perform inundation mapping for Watershops Pond Dam. This model will be used to help assess the stage-discharge relationship and tailwater depths. These parameters will then be used as inputs for other tasks such as stability analyses and assessment of gross head.

b. Perform Incremental Damage Assessment / Assess Inflow Design Flood

GZA will evaluate the possibility of reducing the magnitude of the SDF using the Inflow Design Flood (IDF) methodology outlined in Chapter 2: Selecting and Accommodating Inflow Design Floods for Dams, of the FERC Engineering Guidelines for the Evaluation of Hydropower Projects. This methodology involves comparison of downstream flooding impacts with and without dam failure. If the consequences of dam failure during a specific design flood are insignificant on top of inundation which would be expected as a result of natural flood flows, then the magnitude of the design flood may be reduced until the incremental affects are consequential. GZA will use this methodology as a means of defensibly establishing a risk-based inflow design flood (IDF) and thereby potentially reducing the effort and cost of spillway rehabilitation.

The IDF analyses are performed iteratively down from the PMF for Watershops Pond Dam. GZA will evaluate the incremental increase in consequences due to dam failure by routing a series of flows assuming 1) the dam remains in place, and 2) the dam fails. In accordance with FERC methodology, the dam failure analysis will be completed assuming

that failure occurs at the peak of the flood hydrograph. GZA will follow the specific guidance and procedures outlined in Appendix II-C of the FERC Guidelines. The incremental increase in downstream, water surface elevation between the with-failure and without-failure conditions will be determined and the amount of damage that could result will be identified. GZA will continue to route varying flows until the incremental rise in flood water downstream indicates adverse consequences; this resultant flow will determine the IDF for the Project. FERC Guidelines typically identify "adverse consequences" as an increase (delta) in water surface elevations during dam failure of 2.0 feet or greater. However, the two-foot increment is not an absolute decision-making point, and therefore, GZA will use engineering judgment in determining the flow for which no adverse consequences result.

GZA will perform the hydraulic analysis used to evaluate the consequences of dam failure using the HEC-RAS model updated during Task 5a. The original HEC-RAS model developed in 2007 was used to perform inundation mapping for Watershops Pond Dam and it is therefore assumed the model extends far enough downstream for this analysis.

GZA will conduct the IDF analysis utilizing the unsteady, dynamic dam break flood module within the latest version of the HEC-RAS program. The results of this analysis will be presented within the Feasibility Report completed as part of Task 12. Model results including peak inflow and discharge rates, results of IHE/IDF analysis, recommended SDS/SDF, freeboard or overtopping depth, and the percent of the recommended SDS/SDF passed will be presented in tabular form and model input parameters will be summarized. The maximum IDF will be the PMF (equal to the SDF), but may likely be substantially less than the PMF.

c. Perform Stream Gage Analysis and Evaluate Climate Change Potential

The Preliminary Hydropower Resource Assessment (GZA, 2015) developed a flow duration curve for Watershops Pond Dam using a surrogate stream gage. USGS Gage 01184490 Broad Brook was selected for use as the surrogate gage. As part of this task, GZA will update the flow duration curve. The updated curve will assess the use of data from other stream gages, specifically including USGS Gage 01178000 Mill River (gage records from 1938-1951). The revised flow duration curve and the headwater / tailwater stage-discharge curve developed during Task 1e, will be used to revise the projected power/energy output for the proposed hydropower facility.

GZA will also review flow trends from USGS Gage 01178000 Mill River (gage records from 1938-1951) and compare to USGS Gage 01184490 Broad Brook (gage records from 1961-Present). GZA will evaluate the suitability of the stream gage data and potential identified flow trends (if any) to extrapolate the gage data approximately 40 years to account for climate change. GZA will develop flow-duration curves for each decade (i.e., 1960s, 1970s, 1980s, etc.) to identify any flow trends at the gage for use in extrapolating future decreases/increases in streamflow at Watershops Pond Dam.

GZA will also perform a literature review to identify studies and / or methodologies for performing hydrologic analyses to account for future climate change. This will include review of information developed by the USGS in cooperation with the New York State Department of Transportation, regarding flood regressions and climate change scenarios to estimate future peak flows. GZA will discuss identified methodologies for evaluating climate change impacts on streamflow with the City and Pinck & Co. to ensure the methodology is appropriate. GZA will incorporate the identified information within the stream gage analysis.

d. Verify Bypass Flow Exemption

GZA will verify the potential Watershop Pond Dam Hydropower Project exemption from bypass flow (i.e. maintaining a conservation flow over the dam separate from flow discharged from the turbine), and provide an updated calculation

if the Project is determined to be not exempt. Verification will be in conjunction with the agency consultation performed in Task 9 (see below).

Task 6. Revise Projected Power and Energy Output

GZA will revise the projected power and energy output detailed in Section 3.5 of the 2015 Resource Assessment. The projected power and energy estimate is dependent on head and turbine efficiency. The recommendation for the proposed turbine will be completed as part of Task 4, and turbine efficiency information at various heads and flows will be obtained from manufacturers. The head information will be developed from the updated hydrologic and hydraulic analyses performed during Task 5c and Task 1e. The flow duration curve describes how flows vary at a site over a typical year and is the basic tool for selecting a design flow for a hydropower facility.

GZA will also revise the projected power and energy output to account for time-weighted adjustments for turndown efficiency. The revised projected power and energy output will be based on preliminary generator selection efficiency and in consideration of the Task 4 recommendations. GZA will identify additional electrical losses for the proposed system based on the preliminary one-line diagram developed as part of Task 3 and include these losses within the projected power output calculations.

Task 7. Perform Interconnection Analysis

GZA will work with its electrical sub-consultant to:

a. Provide information on how the system would operate when the grid is down;

b. Show/explain how the hydropower facility can connect to the Brookings School with or without electrical upgrades at the school;

c. Develop a preliminary transmission route from the hydropower facility to Brookings School;

d. Perform a preliminary investigation of interconnection requirements, including any potential risks; and

e. Review and determine whether the Project qualifies or is appropriate for Eversource's Blackstart Program, and if the Project qualifies, explain how the facility qualifies for the program and what benefits the City may realize from the program participation. Describe what different and/or additional equipment would be needed at the hydropower facility to provide this capability.

The interconnection of the new generation equipment to the serving utility will require an interconnection agreement which typically initiates a system study and the utility specifying protection requirements for the interconnection. An application for interconnection must be submitted and receive approval prior to installing distributed generation. Depending on the size of the proposed system, approvals can take three weeks to several months. GZA will coordinate with Eversource to identify requirements of the interconnection permit and develop the permit application for interconnection, and will build upon the Pre-Application information provided by the City to Eversource in late 2015.

Task 8. Perform Potential Risk Assessment

GZA will perform a potential risk assessment that identifies potential permitting, environmental, engineering, and financial issues that will need to be considered as part of the development of the hydropower project. GZA will outline the potential permitting implications of hydropower development at the Watershops Pond Dam Site, including anticipated wetlands and water quality permitting and licensing under the Federal Energy Regulatory Commission. GZA will also identify unique engineering aspects which might complicate the Project such as Site access, geotechnical

conditions, hydraulic conditions at the dam, etc. This risk assessment will expand upon the information presented in *Section 3* of the Preliminary Hydropower Resource Assessment (GZA, 2015).

GZA will generate a qualitative or quantitative risk register that identifies potential projects risks and the consequences thereof by developing risk categories and descriptions, the impacts or consequences if events occur, the probability or likelihood of the events occurring, risk ratings, and appropriate mitigation efforts.

Task 9. Preliminary Discussions with Regulatory Agencies:

GZA will establish contact with the various regulatory agencies that will have input and regulatory jurisdiction over the Project , which will include, but may not be limited to the following:

a. City of Springfield Conservation Commission;
b. Springfield Historical Commission;
c. Massachusetts Historical Commission and Board of Underwater Archeological Resources;
d. Massachusetts Division of Fisheries and Wildlife;
e. MA Natural Heritage and Endangered Species Program;
f. U.S. National Park Service; and
g. U.S. Fish and Wildlife Service.

The City of Springfield will need to coordinate with regulatory permitting agencies and interested resource agencies and stakeholder groups regarding the proposed project. Coordination and discussions under this task will be in the form of notification and soliciting of input from resource management agencies that will be involved through the regulatory consultation process required by FERC regulations. GZA will initially contact each of the agencies listed above (and additional agencies identified to be stakeholders in the Project) by telephone or electronic mail communication. GZA will provide introductory information regarding the Project to each of the agencies and set up an information meeting inviting each of the agencies, if they are available and willing to attend. During the meeting, GZA will discuss the Project and its attributes and characteristics, and identify components of the Project applicable to each agency. GZA will develop preliminary indications of each agency's issues and potential for environmental study and, to the extent feasible, possible mitigation requirements. Environmental assessments or studies may be necessary to provide complete applications as part of the hydropower Project licensing and permitting. Where possible, the necessary studies will be identified during these preliminary discussions, and GZA will develop an outline and scope of work for performing required studies.

Task 10. Perform Limitations and Alternatives Assessment

GZA will perform an alternatives assessment of the various layouts for implementing hydropower facilities at the Dam. GZA has previously worked with the City to identify the preferred layout for the power generation equipment; however, GZA will reevaluate the configuration layout and potential other scenarios that may be applicable at the dam after completion of the property boundary and ownership research of previous tasks. Review of the Site constraints for the layout and construction will be described and discussed.

Task 11. Develop Cost Estimates

GZA will develop a detailed cost estimate of project components including: permitting, engineering, labor, equipment and construction costs. The cost estimate will identify potential costs through completion of construction to provide a

budgetary estimate to aid in the City's future planning. The cost estimate will include back-up data to support the cost estimates which may include sketches and/or concept plans, previous project data and/or experience, hydropower study or economic reports, and cost estimating programs.

Task 12. Develop Feasibility Study Based on Current Information

GZA will develop a comprehensive Feasibility Study that summarizes the evaluation and analysis performed throughout Tasks 1 through 11, in addition to information previously presented in the Preliminary Hydropower Resource Assessment (GZA, 2015). Financial projections will be adjusted accordingly. In support of the report, GZA will identify any regulations that may have changed since the 2015 assessment, or that are known to be pending or under development.

GZA will submit a draft of the Feasibility Study in electronic (PDF) format, for review by the City and its consultants. GZA will respond to one round of comments, after which the Feasibility Study will be finalized and produced. GZA will provide two (2) bound hard, color copies of the Feasibility Study, along with an electronic copy of the complete study with all attachments and appendices in unlocked, searchable PDF (compatible with Adobe Reader Version 6.0 or later) format.

Task 13. Develop a Project Schedule

GZA will develop a high-level schedule for all phases of the hydropower development Project including permitting, design, construction, and startup/commissioning. The sequence and schedule will include the scope of work necessary to license and construct the proposed project and will incorporate the findings of the Feasibility Study. Timeline development will be discussed with the City and its NDRC Grant implementation team prior to finalizing the schedule. It is anticipated that the intent of the City is to commission the Project as soon as possible; however, the reasonableness of such timelines will be discussed with the City during development of the Project Schedule.

Task 14. Stewardship of the Watershops Pond Federal Lands to Parks (FLP) Conveyance

As discussed in previous tasks in this Proposal, property rights at and around Watershops Pond may have a profound impact on the FERC licensing of hydropower at Watershops Pond dam. A key aspect of this is the May, 1970, conveyance of two (2) parcels of land totaling 233 acres± that were transferred to City ownership and control by the Federal Lands to Parks (FLP) Program of the National Park Service. The property transferred is known as Watershops Pond. As part of the conveyance agreements, the City agreed to establish and maintain in perpetuity specific locations for public access to Watershops Pond (the Sites). NPS conducted a site inspection of the Watershops Pond area and each of the Sites on August 19, 2016, and their October 25 email to Mayor Sarno expressed concerns related to existing conditions at the Sites. The NPS has requested that the City prepare and submit a FLP Stewardship Report for the Sites. Furthermore, NPS indicated that the stewardship report must adhere to current standards, because NPS no longer accepts the abbreviated reporting format. GZA will prepare the FLP Stewardship Report, following our review of existing field conditions and current and historical information provided by the City.

Task 15. Continued Progress Reports under the City's Preliminary Permit (FERC)

On May 4, 2016, FERC issued to the City of Springfield an "Order Issuing Preliminary Permit and Granting Priority to File License Application" for the Watershops Pond Hydroelectric Project, P-14721-000. Article 4 of the Terms and Conditions of the Preliminary Permit requires that a progress report be filed at the close of each six-month period from the effective date of the permit. To date, the City has filed two progress reports, both prepared and submitted by GZA on behalf of the City.

Under this Task 15, GZA will file the next two required progress reports, assumed for the purposes of this Proposal and Scope of Services to include Progress Report #3 due in October 2017 and Progress Report #4 due in April 2018.

SCHEDULE

GZA will schedule the described work immediately upon receipt of an Accepted Proposal and City of Springfield Contract Agreement and associated Purchase Order. We will maintain regular communication with the City and its NDRC Grant implementation team so that issues and concerns are addressed on a timely basis.

At the present time, GZA anticipates providing a draft of the Feasibility Study within 150 calendar days following execution of the Contract Agreement; however, we must point out that certain aspects of the work may require more time, including but not limited to:

- review and discussions with Eversource relative to interconnection
- responses from regulatory agencies and other stakeholders, and
- legal issues involving determination of property boundaries and rights of way.

Nonetheless, we will advance the draft Feasibility Study to the maximum extent practical while the longer-lead aspects of the study are under continued development.

PRICE PROPOSAL AND BASIS OF BILLINGS

GZA's Scope of Services and Price Proposal are based upon our review of the City's RFQ No. 16-190, our familiarity with providing similar or related services to municipalities and other public agencies, and our specific knowledge of the Project site and its history.

GZA proposes to provide the total scope of services described above, Tasks 1 – 15, on a lump sum (fixed price) billing basis as detailed in Table 1 below. The total Feasibility Study budget, inclusive of expenses, is **$196,000.** This budget represents our best current estimate of the level of effort which will be needed to complete the anticipated and proposed Scope of Services. The proposed lump sum fee is based on a level of participation by GZA personnel plus subcontractor costs and applicable expenses as shown on **Attachment A – Fee Derivation Worksheet**, which represents our present judgment as to the level of effort required. We note that the hourly rates used in our Fee Derivation Worksheet are the same as GZA's rates utilized under GZA's most-recent "Agreement for On-Call Engineering Services" with the City of Springfield, City Contract No. 20140969.

TABLE 1.
PROPOSAL BUDGET / SCHEDULE OF VALUES

Task #	Description	Cost
1	Incorporate Recent Dam Investigation Reports	$35,700
2	Develop Preliminary Site Plans and Layout Drawings	$45,000
3	Develop Preliminary Electrical One Line	$10,100
4	Develop Preliminary List of Mechanical and Electrical Equipment	$ 7,600
5	Perform Updated Hydrologic Analysis	$21,800
6	Revise Projected Power Output	$ 3,800
7	Perform Interconnection Analysis	$ 7,800
8	Perform Potential Risk Assessment	$ 8,000
9	Preliminary Discussions with Regulatory Agencies	$ 9,500
10	Perform Limitations and Alternatives Assessment	$ 8,700
11	Develop Cost Estimates	$ 5,800
12	Develop Feasibility Study Based on Current Information	$17,300
13	Develop a Project Schedule	$ 4,100
14	Stewardship of the Watershops Pond FLP Conveyance	$ 9,300
15	Continued Progress Reports under the City's Preliminary Permit (FERC)	$ 1,500
	Total	**$196,000**

GZA will prepare its invoices to the City so as to provide such information and documentation as typically required by City of Springfield Contract Agreements for similar professional services.

CONDITIONS OF ENGAGEMENT

Conditions of Engagement to be per City of Springfield Contract Agreement for similar professional services.

ACCEPTANCE

Acceptance of this Proposal may be indicated by providing GZA with a Notice to Proceed and assigning a City Contract number, with signed contract and Purchase Order to follow. This proposal is valid for a period of 30 days from the date of issue.

Thank you for this opportunity to propose our services to the City of Springfield on this exciting Project. We are of course available to address any questions you may have—please contact Tom Jenkins at (413) 726-2121 or thomas.jenkins@gza.com at your convenience.

Sincerely,

GZA GEOENVIRONMENTAL, INC.

Thomas E. Jenkins, P.E.
Project Manager / Principal-in-Charge

Chad W. Cox, P.E.
Civil Engineer / Principal

Attachments:

Attachment A – Fee Derivation Worksheet *(dated July 14, 2017)*

GZA GeoEnvironmental, Inc.
Springfield, MA
413-726-2100

ATTACHMENT A

Fee Derivation Worksheet

PROJECT WORKSHEET
Feasibility Study for Hydropower Facility at Watershops Pond Dam - 15.P000031.17
City of Springfield RFQ NO. SPG-16-190-

Task	Description	Principal Engineer	Assoc Principal Engineer	Senior Project Engineer	Project Engineer	Assistant Project Engineer	Eng I	Eng II	Sr. CAD Draft	Admin	Vendor / Subcontractor	Expenses		TASK TOTAL	USE THIS VALUE IN THE SCHEDULE OF VALUES:
1	Incorporate Recent Dam Investigation Reports													$35,735	$35,700
	a. Identify Impacts from FERC Criteria	2.00	2.00	4.00	12.00					1.00		$25		$3,520	
	b. Preliminary Geotechnical Assessment and Development of Existing Conditions	1.00	1.00	12.00	2.00	4.00		8.00		2.00		$250		$4,520	
	c. Stability Analysis	4.00	2.00	20.00	16.00	40.00	8.00			4.00		$50		$13,490	
	d. Identify and Detail Costs Associated with Dam Updates/Repairs	4.00	6.00	6.00	24.00	16.00	16.00			2.00		$25		$10,765	
	e. Head and Potential Head for Dam	1.00	2.00		4.00	12.00	6.00					$10		$3,420	
2	Develop Preliminary Site Plans and Layout Drawings													$44,963	$45,000
	a. Site Survey and Layout Drawings	8.00	12.00	4.00	26.00	16.00			40.00	4.00	$12,500	$250		$29,935	
	b. Develop Bathymetry Plan, Cross Sections, and Perform Sediment Investigations	2.00	8.00	4.00	12.00		24.00	16.00		4.00	$5,750	$350		$15,028	
3	Develop Preliminary Electrical One Line	4.00	2.00		12.00					1.00	$6,500	$10		$10,110	$10,100
4	Develop Preliminary List of Mechanical and Electrical Equipment	6.00	4.00		12.00					1.00	$3,200	$25		$7,580	$7,600
5	Perform Updated Hydrologic Analysis													$21,840	$21,800
	a. Update Probable Maximum Flood Study	4.00	8.00	8.00	12.00	24.00				4.00		$25		$8,605	
	b. Perform Incremental Damage Assessment	4.00	6.00	4.00	16.00	16.00				2.00		$25		$7,655	
	c. Perform Stream Gage Analysis and Evaluate Climate Change Potential	4.00	4.00		10.00	6.00				1.00		$25		$4,190	
	d. Verify Bypass Flow Exemption	1.00	2.00		4.00							$10		$1,230	
6	Revise Projected Power Output	2.00	2.00	2.00	6.00					0.50	$1,500	$10		$3,793	$3,800
7	Perform Interconnection Analysis	4.00	6.00		12.00					0.50	$3,500	$10		$7,803	$7,800
8	Perform Potential Risk Assessment	4.00	8.00		16.00	12.00				1.00	$1,200	$25		$7,980	$8,000
9	Preliminary Discussions with Regulatory Agencies	8.00	12.00	4.00	12.00	6.00				8.00	$600	$250		$9,500	$9,500
10	Perform Limitations and Alternatives Assessment	4.00	8.00	8.00	12.00		12.00			2.00	$2,000	$50		$8,690	$8,700
11	Develop Cost Estimates	2.00	4.00	4.00	12.00					4.00	$1,500	$50		$5,785	$5,800
12	Develop Feasibility Study Based on Current Information	8.00	12.00	8.00	24.00	8.00	8.00		16.00	8.00	$2,500	$800		$17,346	$17,300
13	Develop a Project Schedule	2.00	4.00	2.00	8.00					4.00	$800	$10		$4,060	$4,100
14	Stewardship of the Watershops Pond Federal Lands to Parks (FLP) Conveyance		9.25		37.25	6.17		4.75	7.00	4.75	$0	$10		$9,301	$9,300
15	Continued Progress Reports under the City's Preliminary Permit (FERC)	1.00	1.00		6.00					2.00	$0	$10		$1,520	$1,500
		80.00	118.25	88.00	309.25	160.17	74.00	28.75	63.00	60.75	$41,750	$2,305	←Subtotals		
	Billing Rates:	$240	$220	$175	$150	$125	$105	$95	$120	$75	5%	0%	Markup		
	Subtotal:	$19,200	$26,235	$15,400	$46,388	$20,021	$7,770	$2,731	$7,560	$4,556	$43,838	$2,305			
	Subtotal, Labor:	$149,861													
	Vendors, Subcontractors, & Expenses:	$46,143													
	Total Budget:	$196,004												$196,004	
	SAY,	$196,000													$196,000
	Hourly rates are per GZA's most recent "Agreement for On-Call Engineering Services", with the City of Springfield, City Contract No. [illegible], dated April 10, 2014. These hourly rates will be held throughout any agreement resulting from this RFQ No. SPG 16-190.														

www.pinck-co.com

From: Garvey, Peter J. [mailto:PGarvey@springfieldcityhall.com]
Sent: Wednesday, August 02, 2017 1:45 PM
To: Quagliato, Tina <tquagliato@springfieldcityhall.com>; Michael Fitzgerald <mfitzgerald@pinck-co.com>
Subject: FW: Revised Proposal for Feasibility Study - Watershops Pond Hydropower.

I have forwarded this proposal to procurement for a contract.
Thank,s
peter

From: Thomas Jenkins [mailto:thomas.jenkins@gza.com]
Sent: Thursday, July 27, 2017 8:17 AM
To: Garvey, Peter J.
Cc: Sullivan, Pat; Chad Cox; Todd Monson
Subject: Revised Proposal for Feasibility Study - Watershops Pond Hydropower.

Hello Peter,

Attached is GZA's revised Follow-Up Proposal for Professional Consulting Services, dated July 27, 2017.

Revisions include:

> *Task 2.a. Develop Preliminary Site Plans and Layout Drawings - Site Survey and Layout Drawings*
> has been revised to include, "... General Arrangement drawing(s); ... "
>
> *Task 10. Perform Limitations and Alternatives Assessment*
> has been revised to include, "Review of the Site constraints for the layout and construction will be described and discussed."
>
> *Task 12. Develop Feasibility Study Based on Current Information*
> has been revised to include, "GZA will submit a draft of the Feasibility Study in electronic (PDF) format, for review by the City and its consultants. GZA will respond to one round of comments, after which the Feasibility Study will be finalized and produced. GZA will provide two (2) bound hard, color copies of the Feasibility Study, along with an electronic copy of the complete study with all attachments and appendices in unlocked, searchable PDF (compatible with Adobe Reader Version 6.0 or later) format."

Other than the above, and a slight modification to the attachment reference on the last page (to indicate that the Fee Derivation Worksheet, dated July 14, 2017, remains as originally submitted with our July 14 proposal), there were no other modifications to the proposal.

Please let us know if you require anything further.

We look forward to working with the City of Springfeild on this exciting Project.

Thank you,

Tom Jenkins, P.E.
Associate Principal / Senior Engineer
GZA | 1350 Main Street, Suite 1400 | Springfield, MA 01103
o: 413.726.2121 | c: 413.563.7986 | thomas.jenkins@gza.com | www.gza.com

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CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 10/17/2017

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Risk Strategies Company
160 Federal St. 2nd Floor
Boston, MA 02110

CONTACT NAME:
PHONE (A/C, No, Ext): 617-330-5700
FAX (A/C, No): 617-439-3752
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Great Divide Insurance Company/ Nautilus Ins Group	25224
INSURER B : The First Liberty Insurance Corp	33588
INSURER C :	
INSURER D : Hartford Casualty Insurance	29424
INSURER E : Lexington Insurance Company	19437
INSURER F :	

INSURED
GZA GeoEnvironmental, Inc.
1350 Main Street, Suite 1400
Springfield MA 01103

COVERAGES **CERTIFICATE NUMBER:** 38400668 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	✓ COMMERCIAL GENERAL LIABILITY	✓	✓	GLP2007957-14	2/28/2017	2/28/2018	EACH OCCURRENCE	$ 1,000,000
	CLAIMS-MADE ✓ OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 500,000
	✓ Deductible - $25,000						MED EXP (Any one person)	$ 10,000
	per occurence BI/PD						PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 1,000,000
	✓ POLICY PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$ 1,000,000
	OTHER:							$
B	AUTOMOBILE LIABILITY	✓	✓	AS2-Z11-261208-017	2/28/2017	2/28/2018	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
	ANY AUTO						BODILY INJURY (Per person)	$
	✓ OWNED AUTOS ONLY; SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	✓ HIRED AUTOS ONLY; ✓ NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$
	DED RETENTION $							$
D	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N	N/A		08WBRI5941	2/28/2017	2/28/2018	✓ PER STATUTE OTH-ER	
	ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N (Mandatory in NH)						E.L. EACH ACCIDENT	$ 1,000,000
	If yes, describe under DESCRIPTION OF OPERATIONS below						E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000
E	Professional Liability			031711017	2/28/2017	2/28/2018	Each Claim/ $2,000,000 Aggregate $2,000,000	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Re: Job #15.0166625.00, City of Springfield Watershops Pond Project Consulting Services/Feasibility Study of the Hydro-electric Plant - Contract #20180234.
City of Springfield is included as an additional insured with respects to General Liability and Auto Liability per policy provisions and where required by signed contract. Waiver of Subrogation applies in favour of City of Springfield with respect to General Liability and Auto Liability per policy provisions and where required by signed contract.

CERTIFICATE HOLDER

15.0166625.00

City of Springfield
Attn: Theo Theocles
Office of Procurement, 36 Court Street
Room 307
Springfield MA 01103

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE
Michael Christian