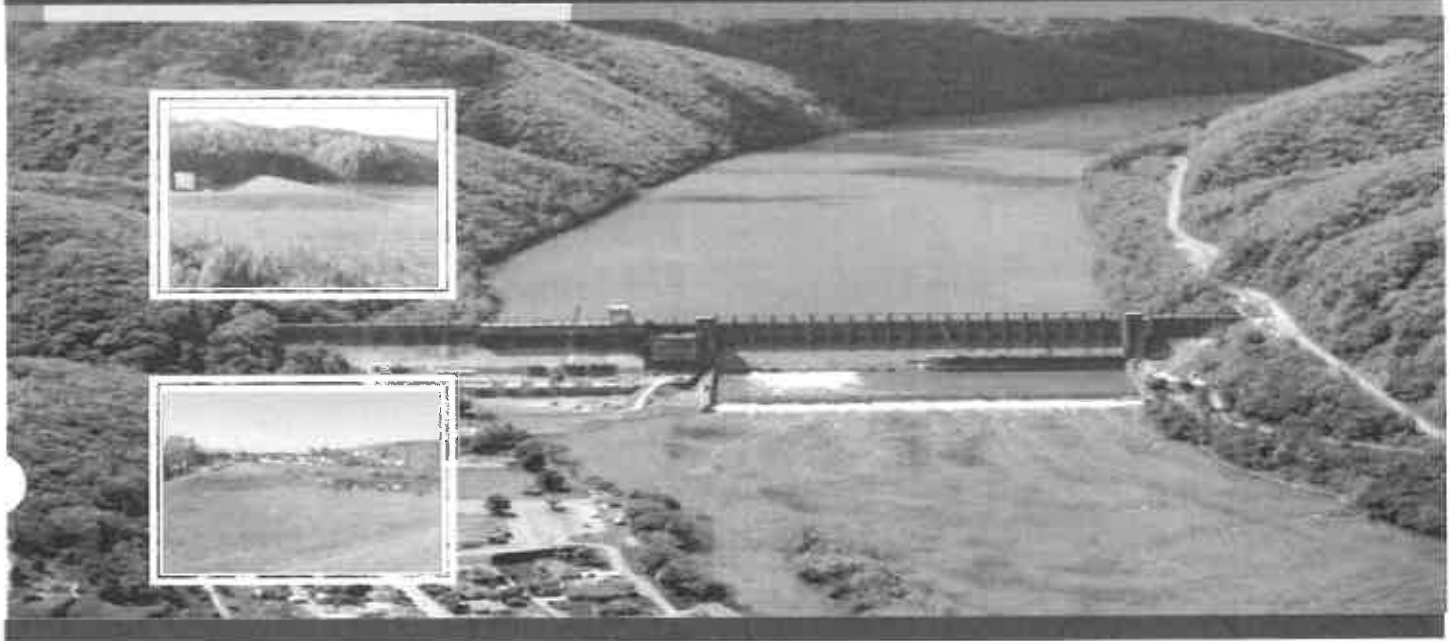


Watershed Dam Rehabilitation Program Experience and Capabilities

SOLICITATION # AGR1500000004

June 2015



Prepared by:

Geosyntec
consultants

Geosyntec Consultants

1108 Third Avenue, Suite 600
Huntington, WV 25701
Phone (304) 526-0081

Prepared for:



West Virginia
Conservation Agency

The West Virginia Conservation Agency

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06/04/15 13:01:30
WV Purchasing Division



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June 4, 2015

Laura E. Hooper
State of West Virginia Purchasing Division
2019 Washington Street East
P.O. Box 50130
Charleston, WV 25305-0130

Subject: Solicitation Number AGR1500000004, WVCA Dam Rehabilitation EOI


Dear Ms. Hooper:

Geosyntec Consultants, Inc. is pleased to provide you with a response to your Expression of Interest for the West Virginia Conservation Agency's Watershed Dam Rehabilitation Program.

We have an office located in Huntington with professional engineers registered in the State of West Virginia, and we have capable and knowledgeable staff who have experience on similar projects to the planning of major dam rehabilitation work for Brush Creek Watershed Sites 9 and 15 and New Creek Watershed Sites 1 and 17. We also have staff with construction inspection and oversight experience that will be required for the Upper Decker's Creek Site 1 construction project.

I have enclosed a proposal describing our specific qualifications and experience, a listing of projects we have completed with similar scope to the projects mentioned above, and our proposed method of approach to the project. I also have included a copy of Federal form SF330, Architect-Engineer Qualifications.

If you have any questions please call or email me at 304.526.0081 or gmenniti@geosyntec.com. We look forward to working with you and the staff of the West Virginia Conservation Agency on this challenging project.

Sincerely,

J. Gregory Menniti, PE, PS
Principal

AGR1500000004



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

State of West Virginia
 Centralized Expression of Interest

Proc Folder: 89810

Doc Description: Addendum #1 WVCA Dam Rehabilitation EOI

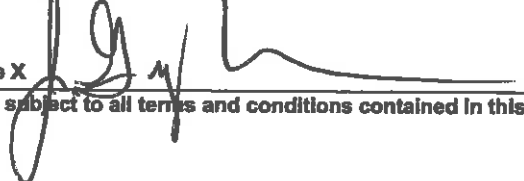
Proc Type: Central Purchase Order

Date Issued	Solicitation Closes	Solicitation No	Version
2015-05-04	2015-06-04 13:30:00	CEOI 1400 AGR1500000004	2

BIDDING LOCATION
 BID CLERK
 DEPARTMENT OF ADMINISTRATION
 PURCHASING DIVISION
 2019 WASHINGTON ST E
 CHARLESTON WV 25305
 US

VENDOR
 Vendor Name, Address and Telephone Number:

FOR INFORMATION CONTACT THE BUYER
 Laura E Hooper
 (304) 558-0468
 laura.e.hooper@wv.gov

Signature X  FEIN # 59-2355134 DATE 6/4/2015

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

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: AGR1500000004

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:

(Check the box next to each addendum received)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6 |
| <input type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8 |
| <input type="checkbox"/> Addendum No. 4 | <input type="checkbox"/> Addendum No. 9 |
| <input type="checkbox"/> Addendum No. 5 | <input type="checkbox"/> Addendum No. 10 |

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

BEOSYNTEC CONSULTANTS
Company
[Signature]
Authorized Signature
JUNE 4, 2015
Date

NOTE: This addendum acknowledgment should be submitted with the bid to expedite document processing.
Revised 6/8/2012

STATE OF WEST VIRGINIA
Purchasing Division
PURCHASING AFFIDAVIT

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

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

DEFINITIONS:

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

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

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

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (W. Va. Code §61-5-3) that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: GEOSYNTEC CONSULTANTS

Authorized Signature: MADEE D. KESSINGER Date: 6-3-15

State of West Virginia

County of Cabell, to-wit:

Taken, subscribed, and sworn to before me this 3 day of June, 2015

My Commission expires March 27, 2022, 2022

AFFIX SEAL HERE

NOTARY PUBLIC

Pamela Grandstaff
Purchasing Affidavit (Revised 07/01/2012)

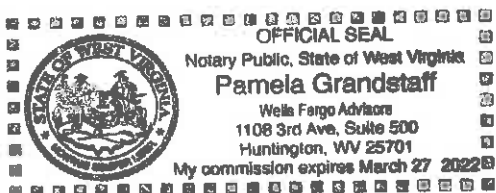


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1.0 INTRODUCTION

Geosyntec Consultants, Inc. focuses on developing site-specific solutions using our expertise in civil, geotechnical and geo-environmental engineering, water resources, and environmental management. Our engineers and scientists combine technical expertise and engineering acumen with the application of cutting edge assessment and analytical tools to develop practical, innovative, and cost-effective solutions for our clients' most challenging projects. In addition to staying abreast of technical developments, our engineers and scientists also keep up to date with regulatory developments and the current state of practice.



Geosyntec has built a record of successful client service by attracting some of the most creative scientists and engineers from the graduate programs of leading universities around the world. Approximately 80% of our technical staff have advanced degrees in engineering, scientific, or business management disciplines. We retain them by providing a management and professional development infrastructure that supports innovation on behalf of clients.

We have over 1,100 employees in more than 50 offices across the U.S. and abroad, and one of our offices is located in Huntington, West Virginia. Our Huntington office will lead and manage this project and be the primary interface with the West Virginia Conservation Agency (WVCA). The Huntington Office will draw upon the resources of our company to execute the work. When clients select Geosyntec for a project, they are working with a team that is at the forefront of innovative, proven technology application.

At Geosyntec, our vision of success builds on a long-held belief that exceptional client service coupled with exceptional project solutions will result in long-term business relationships of mutual reward. We support our clients through an internal culture of technical excellence and innovative and practical thinking.

Our practice encompasses the planning, design and construction of new dams, as well as the rehabilitation of existing dams. We also are familiar with the unique technical and environmental issues facing dam owners and operators. For example, we performed dam and dike safety inspections for American Electric Power at 18 locations throughout the eastern and Midwest U.S., including West Virginia.

As you'll see, we believe we have the qualifications and experience needed to plan the necessary dam rehabilitation work for Brush Creek Sites 9 and 15, and New Creek Sites 1 and 17. We also believe we have the construction management experience required to perform inspection and oversight of construction of Upper Decker's Creek Site 1.

2.0 STAFF QUALIFICATIONS AND EXPERIENCE

2.1 PROFESSIONAL ENGINEERS REGISTERED IN WEST VIRGINIA

Geosyntec has ten (10) professional engineers registered in the State of West Virginia. On the team proposed for this effort, Greg Menniti, Majdi Othman, Mike Hayes, Mark Sutton, and Tom Ramsey all have current West Virginia PE licenses.

2.2 STAFF QUALIFICATIONS & EXPERIENCE ON SIMILAR PROJECTS

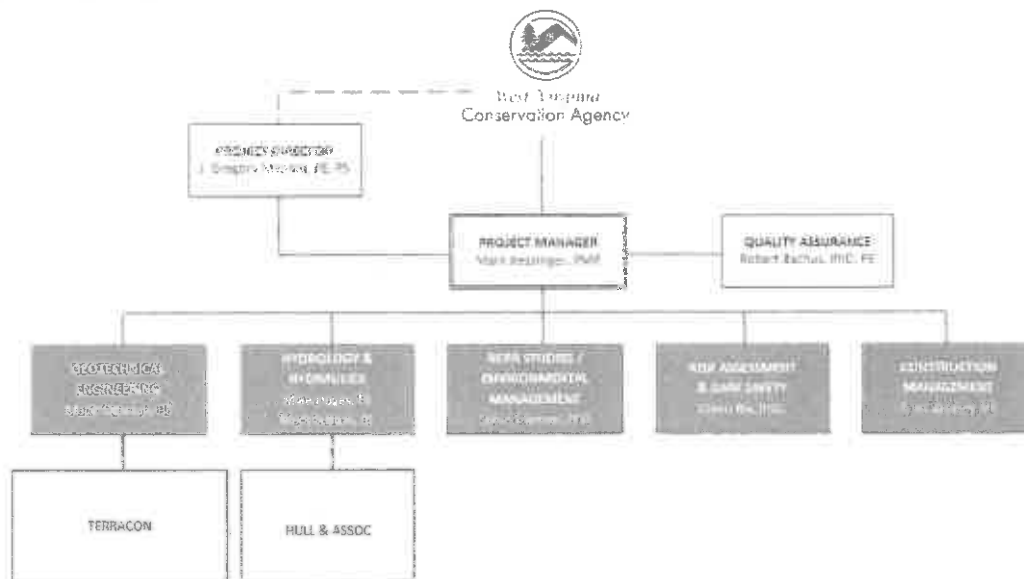
Geosyntec brings a strong, multi-disciplined team with the experience necessary to evaluate dam rehabilitation alternatives, provide construction oversight, and prepare documentation according to the National Environmental Policy Act (NEPA). Geosyntec will provide WVCA staff our team's experience from numerous projects, local resources familiar with West Virginia water issues, and experience with stakeholders involving competing interests such as flood control, water supply, recreation and endangered species. This unique combination will provide the WVCA what is needed to implement scoping, develop alternatives, and determine and mitigate the environmental impacts for each alternative. Key benefits of our experience will be efficiency of identifying environmental issues and information gaps, and result in studies and information gathering that effectively meet project requirements. A highly experienced team of national experts in all the necessary resource areas, combined with local familiarity with West Virginia water issues and information sources, will contribute to effective scoping of issues and add technical credibility to the project.

2.3 STAFF CERTIFICATION AND DEGREES

As stated in section 2.1, many of our team members have professional engineering licenses in West Virginia, and others have professional engineering licenses in other states. In addition, Mark Kessinger, our Project Manager, has achieved Project Management Professional (PMP) Certification. Copies of the team's licenses and certifications can be found in Appendix A.

2.4 STAFFING PLAN AND ORGANIZATION CHART

Geosyntec's Huntington Office will be the lead for this project. J. Greg Menniti, Principal of the Huntington Office, will be the Project Director. Mark Kessinger, also in the Huntington Office, will serve as the Project Manager and be the primary point-of-contact for the WVCA. Dr. Robert Bachus will be responsible for Quality Assurance and Dr. Majdi Othman will oversee the Geotechnical Investigations. Mike Hayes and Mark Sutton of the Huntington Office will be responsible for the Hydrology and Hydraulic studies and Dr. Steve Layman will lead the efforts related to NEPA and Environmental Management. Dr. Glenn Rix will be the lead for Risk Assessment and Dam Safety and Tom Ramsey will head up Construction Management. Our organization chart is presented below.



2.5 SUBCONTRACTOR PLAN

Geosyntec has identified two specialized firms as subcontractors that will collaborate with us in achieving the overarching project goals. For geotechnical drilling and testing, we will team with Terracon of Charleston, WV. For hydrology and hydraulic modeling and analysis, we will partner with Hull and Associates, which has nearby offices in Cincinnati, Columbus and Pittsburgh. Geosyntec has a long-standing relationship with both firms and has worked with both on numerous projects.

Terracon's geotechnical engineering services can support all phases of a project from preliminary design through completion of the project. They can advise on the structural feasibility of the project from the standpoint of subsurface conditions, and they can determine the physical and engineering characteristics of the soil and rock at the project site and their probable behavior under stress. They have experience in interpreting data and recommending design parameters, and can observe conditions during construction and recommend, when necessary, modifications to the design of the project.

Hull and Associates are experienced in hydrologic and hydraulic (H&H) engineering analysis and design. They specialize in complex, multi-disciplinary projects that adhere to regulatory requirements at the federal, state and local levels. They utilize several software applications that are matched to the project including HydroCAD, Storm Water Management Model (SWMM), Hydrologic Engineering Centers River Analysis System (HEC-RAS), Hydrologic Engineering Center Hydrologic Modeling System (HEC-1 and HEC-HMS), TR-55 and TR-20 to name a few. They apply their H&H engineering analysis and design to a variety of project types including reservoir site planning, feasibility studies and design, rainfall/runoff modeling, pond routing and spillway system design, dam break analysis, dam hazard classification, design of pipe networks and pump stations, detention analysis and design, bathymetric studies, low impact design (LID) of stormwater management systems, sediment and erosion control design and inspections, and Storm Water Pollution Protection Plan (SWPPP) preparation and permitting.

3.0 PROJECTS COMPLETED OF SIMILAR SCOPE

Geosyntec has completed an extensive list of projects with similar needs and issues as required for planning and designing the necessary dam rehabilitation work and preparing the NEPA documentation for Brush Creek Sites 9 and 15, and New Creek sites 1 and 17. We also have the construction management experience required to inspect and oversee construction of the Upper Decker's Creek Site 1 Project.

We have project experience in planning, dam engineering and design, dam safety and risk analysis, geotechnical engineering, hydrology and hydraulics, and construction management. We also have completed work for the NRCS in accordance with the National Engineering Manual and National Engineering Handbook.

We have experience in the preparation and analysis of documents in accordance with the National Environmental Protection Act, Endangered Species Act, the National Historic Preservation Act and the National Watershed Program Manual. We have compiled and analyzed biological and economic data, conducted wetland delineation secured a wetlands determination from the U.S. Army Corps of Engineers, and have managed the public involvement process by conducting meetings with the sponsor, scoping meetings, public meetings and agency coordination meetings.

A summary of our projects with similar scope and requirements is given below.

3.1 DAM REHABILITATION PROJECTS

a. Annual Dike and Dam Inspections for an Electric Utility

American Electric Power (AEP) owns, and provides services to many coal fired power plants throughout the eastern and mid-western U.S including West Virginia. As with all coal fired power plants, they generate large amounts of coal ash that is then stored in various types of outdoor storage facilities. AEP's ash handling facilities are included in their Independent Dike and Dam Inspection Program that are monitored and inspected by on-site plant personnel. However, the inspection program provides for an independent dike and dam safety inspection and report by a licensed Professional Engineer. The inspection summary report is transmitted to appropriate state agencies where required. AEP's goal for this program is to ensure that these dikes and dams are not only functioning properly, but that they continue to pose no safety threat to the surrounding communities.

Relevant Task:

- ✓ Review of dike and dam monitoring data
- ✓ Internal pipe inspections
- ✓ Geotechnical evaluations
- ✓ Digital photographic documentation
- ✓ Recommendations for repair and maintenance
- ✓ Onsite personnel training
- ✓ Annual dike and dam safety reports

AEP retained Geosyntec to provide annual dike and dam inspections and our personnel have been involved in coal ash disposal facility design and construction since the early 1970s. We have designed, monitored and provided construction quality assurance (CQA) activities at power plant sites throughout the U.S., and bring a trusted level of knowledge and professionalism to the task.

For the AEP inspection program we were assigned to work at 18 different coal ash storage facilities that included metal cleaning tank containment basins, bottom ash complexes, fly ash ponds and dams, fuel oil containment berms, and evaporation and treatment ponds. At these facilities, Geosyntec inspected dikes and dams that included barrier walls, clay cores, roller compacted concrete, bottom ash drains and fills, geosynthetic liners, concrete and steel structures, pipes, riprap and armor stone. We have also performed internal inspections of discharge pipes that extend through the dikes and dams to the upstream discharge structures.



Although the monitoring and inspections provided many recommendations for improved monitoring and maintenance, Geosyntec's thorough inspections at one ash facility identified a very serious non-visible seepage problem in time for AEP to schedule repair and maintain facility operation. AEP was very satisfied and has retained Geosyntec for other dike, dam and ash facility work.

b. USACE's Herbert Hoover Dike Rehabilitation Project Seepage Cutoff Wall, Martin and Palm Beach Counties, Florida

The U.S. Army Corps of Engineers' (USACE) Herbert Hoover Dike (HHD) rehabilitation project is designed to stabilize and secure the aging dike from potentially damaging severe weather events, and protect the numerous residents and businesses on the southeastern rim of Lake Okeechobee. In 2007, USACE ranked the HHD with a Dam Safety Action Classification I (DSAC I) – Urgent and Compelling.”



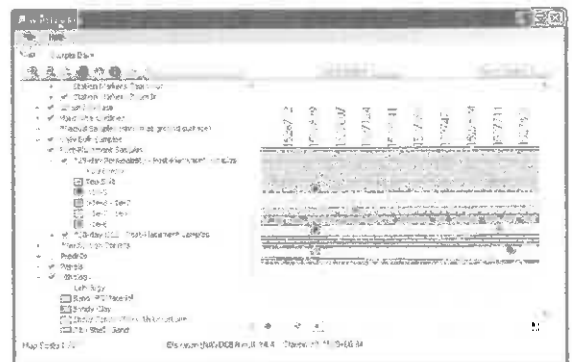
The USACE Jacksonville District prioritized rehabilitation of the dike in segments that were identified as most vulnerable, focusing initial efforts to achieve the most significant impacts. This seepage cutoff wall project, a critical design feature in the dike rehabilitation, is intended to mitigate internal erosion, known as “piping,” and prevent further damage to the internal structure of the dike. A 22-mile stretch from Port

Mayaca south to Belle Glade was considered the most vulnerable section of the 143-mile dike and was the first wall section to be built. The work began in 2008 and was completed in 2013.

- Relevant Tasks:**
- ✓ Dam Modification Alternatives Development and Evaluation
 - ✓ Rehabilitation Reports
 - ✓ Engineering Support During Construction
 - ✓ Planning and Design of Appurtenant
 - ✓ Structures
 - ✓ Civil site layout
 - ✓ Preparation of applications for NPDES
 - ✓ Preparation of construction permits

In May 2008, the USACE Jacksonville District selected the Bauer Foundation Corp. for the first of four major task orders under this major federal Multiple Award Task Order (MATOC) contract to construct a total of 10-miles of the seepage cutoff wall that extends from the dike crest to a depth of nearly 80 feet. BFC selected Geosyntec as part of its team for the firm's notable expertise in construction quality control (CQC) services, as well as geotechnical engineering support, environmental protection monitoring, permitting assistance, document control and civil site layout design support.

To address this challenge Geosyntec developed “WallTracker™,” a database and Geographical Information System (GIS) Application based on a Visual Basic™, Microsoft® Access™ and ESRI® ArcGIS™ platform. WallTracker™ allows HHD data to be viewed in plan and cross-sectional views. Data accessible in the application includes: construction quality assurance metrics, pre-drill and panel dimensions, slurry composition data, and downhole imagery. Users can navigate around these views, select data to be visualized, and access data at a given location through an intuitive user interface. Laboratory reports were



accessed directly from the laboratory's website by selecting location of interest on the WallTracker™ user interface. The data visualized and accessed was updated securely and remotely as new data was collected and entered into the system as part of the overall rehabilitation reporting process.



c. *USACE's Bolivar Dam Seepage Wall Project, Bolivar, Ohio*

Geosyntec is developing the Bolivar Dam Information Management System (BDIMS) to manage the data associated with seepage barrier wall construction beginning in early 2015. The BDIMS consists of an Enterprise Database, from which raw data are fully accessible to USACE and contractors via a Microsoft Access file (with secure links that pass through the ACE-IT firewall to allow "live" access to data tables), and from which analyzed data are accessible in a variety of web-based reports and a fully editable GIS. The GIS interface allows users to view the geospatially accurate position, shape and overlap (as a function of specified limits) of excavated seepage barrier wall panels at a variety of depths. The user can also click on objects to view associated attribute data; to view geotagged photographs; to view geology contained in the gINT database; and to view, graph, and export compiled instrumentation data. Users can also click on several defined cross-sections to view the associated section in profile view with geology along with a current piezometric surface calculated from frequently uploaded data pulled from the Automated Data Acquisition System into the EDB.

Relevant Task:

- ✓ Geospatial Data Management
- ✓ Wall Continuity Analysis
- ✓ Historical Data Integration

The BDIMS is documented in a Data Management Plan (DMP) updated on a biannual basis. The DMP contains a User's Guide that allows "quick reference" access to website and FTP-s credentials, database methodology, GIS access, etc.; a Data Flow Diagram that summarizes the data sources, upload methodology, storage details, and reporting options; and an Entity Relationship Diagram (ERD) that details the EDB schema

(table design, data integrity rules, and table relationships). Additionally, "live" documentation of the EDB is available through documentation tables in the EDB that provide the current details of table and field definitions, assumptions, metadata and more. Several tools are currently in use that either serve data to the BDIMS EDB. These include:

- the Verticality Tool that allows the contractor to import a series of Kodex and Hydromill data files to instantly view a graphical and tabular summary of any depths that are out of compliance with respect to verticality tolerance or overlap;
- the Photo/Video Naming Tool that allows users to rename one or more files to the USACE naming specification, extract geotag information and other metadata, upload selected files to the FTP-s site, and view geotagged photo and video locations on the GIS Viewers; and
- the gINT importer which allows gINT data to be viewed in the profile GIS, queried with other data in the EDB, while still allowing it to be used as a standalone gINT product.



d. *USACE's Center Hill Dam, Smithville, Tennessee*

Geosyntec was contracted by Bauer Foundation Corporation (BFC) to provide instrumentation installation, submittal preparation, and data management services associated with the cut-off wall installation at Center Hill Dam.

Relevant Tasks:

- ✓ Instrumentation
- ✓ Data Visualization/GIS

Geosyntec is tasked with the procurement and installation of several dam and water quality monitoring equipment, and associated training in their reading and maintenance. The data from these instruments are made available in real-time via a web interface that uses Geosyntec's OptiRTC instrument data visualization system.

All data collected during the installation of the cut-off wall, including barrier wall element geometry, grout attributes, drill monitoring, borehole monitoring, slurry laboratory test data, and the highly significant data collected from the three methods of assuring panel and shaft verticality (steerable drilling data transmitted in real-time during drilling operations, and Kodan and SoniCaliper data following each installation), are visualized and accessed through the WallTracker™ Geographical Information Systems (GIS) Application. Geosyntec developed WallTracker to allow multiple users to access all site data in a geospatially accurate view. By clicking on a feature in either the plan or profile views, users can immediately view a table of all data associated with that feature, or open a document associated with that item. For example, clicking on a borehole will display the driller name, date of drilling, and depth to each major geological contact, and will open a .pdf document of the original drill log.



Geosyntec authored a number of documents submitted to the USACE, including comprehensive Data Management Plans that detailed the data processes and the automated grout monitoring methodology developed by Geosyntec to access these data.



Geosyntec developed the WallTracker system to allow quick and easy access to all project data, including construction elements, instrumentation, and water quality

e. *USACE's Wolf Creek Dam, Russell County, Kentucky*

The Wolf Creek Dam is a high-profile dam owned by the United States Army Corps of Engineers (USACE) and managed by the USACE Nashville District. The USACE and their primary construction contractor, the Treviicos-Soletanche Joint Venture (TSJV), require a method to synthesize the abundance of historical data available from previous investigations and construction activities, and new data collected during the ongoing construction and monitoring activities.

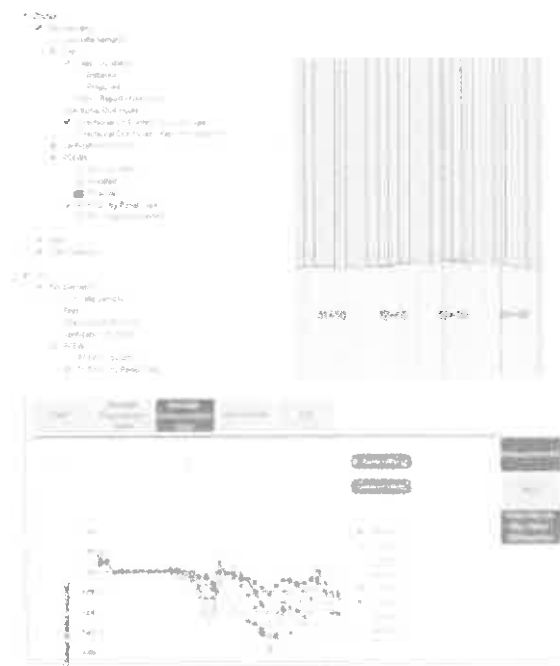
Relevant Tasks:

- ✓ Instrumentation
- ✓ Data Visualization/GIS

Geosyntec designed and implemented the Wolf Creek Information Management System (WCIMS), a workflow that allows automated and quality-controlled assembly of all site data. The WCIMS presents these data in web-accessible reports and two- and three-dimensional interactive tools built using Geographic Information System (GIS) technology. At the heart of the WCIMS is a GIS Viewer, a free tool that shows site data in plan and profile views and provides access to data and reports associated with a feature simply by clicking on the feature. The Viewer and all other WCIMS tools are joined to an internet-enabled comprehensive enterprise database, allowing data to be both uploaded and viewed by users in remote locations (e.g., on-site, in the USACE District office, and anywhere else). A synchronization feature allows tools to be used off-line when users want to assess project information during periods when the internet may be inaccessible.



Geosyntec's deployment of the WCIMS allows owners and stakeholders in the Wolf Creek Dam rehabilitation project to view the entirety of the site data in a single, geospatially accurate system. In this system, disparate data streams can be viewed in context and the safety and success of the construction can be measured with accuracy and quality.



Geosyntec's deployment of tools to manage and visualize all project data, including instrumentation data; data associated with barrier wall construction elements; verticality measurements; and more, give the client and other project team members' immediate access to key project performance metrics.

f. John Sevier Fossil Dam, Holston River, Hawkins County, Tennessee

The John Sevier Fossil (JSF) Dam is located on the Holston River (River Mile 106.3) in Hawkins County, Tennessee, and is 3 miles southeast of Rogersville, Tennessee upstream of the Cherokee Reservoir. The dam is approximately 1,126-feet (ft) long, with a maximum height of approximately 53-ft, and was constructed between 1953 and 1955 by the Tennessee Valley Authority (TVA). The dam served to impound water from the Holston River for the condensing units at the JSF Plant, which is currently being decommissioned. Specifically, JSF Dam was built to store extra water during the week, making water available for condensing units on weekends while the Fort Patrick Henry Hydroelectric Plant (approximately 45 miles upstream) was at peak operation and not normally releasing water on the weekends.

Relevant Task:

- ✓ Stability Analyses
- ✓ Field and Laboratory Investigations
- ✓ Liquefaction Triggering Evaluation
- ✓ Numerical Deformation Analyses
- ✓ Engineering Recommendations



The dam is considered a concrete gravity dam with a concrete overflow spillway, concrete non-overflow section, and two earthen embankments. From left to right (i.e., south to north) the dam consists of: (i) an earthen embankment; (ii) the left training wall; (iii) a concrete overflow spillway with a bridge access superstructure; (iv) two sluiceway bays (inoperable and plugged with concrete); (v) a wide, ungated concrete cascade overflow spillway; (vi) the right training wall; and (vii) a rolled fill earthen embankment armored with concrete-chocked riprap (i.e., rock riprap with a cement grout to fill voids).

Geosyntec is currently conducting a detailed stress and stability analyses, inclusive of both the earth embankment and concrete portions of the dam. The main objectives of the stress and stability analyses are: (i) evaluating deformations and factors of safety against instability; (ii) developing threshold values and action levels for uplift pressures and piezometric water levels; (iii) identifying likely consequences to the dam stability, should these threshold values be exceeded; and (iv) developing recommendations and conclusions from the outcome of the stress and stability analyses. The scope of services includes efforts associated with the following tasks: (i) data reconnaissance, review, and evaluation of existing information; (ii) development and implementation of field investigation and laboratory testing programs; and (iii) engineering analysis and reporting.

3.2 NEPA RELATED PROJECTS

a. Supplemental Environmental Impact Statement (SEIS), Mississippi Barrier Island Restoration, USACE, Mobile District.

Dr. Steven Layman managed the preparation of the preliminary draft SEIS for the USACE Mobile District to support the Mississippi Coastal Improvements Program Comprehensive Barrier Island Restoration. The proposed restoration activities involved the placement of 22 million cubic yards of sandy material along the barrier islands of Mississippi Sound within the National Park Service's (NPS') Gulf Islands National Seashore. Development of the preliminary draft SEIS involved close coordination NPS scientists and NEPA specialists. The SEIS will serve as the basis for evaluating the Corps' plans to implement the authorized construction action and to ensure compliance with NEPA.

b. Environmental Assessment (EA), Birmingham Regional Intermodal Facility, Norfolk Southern Railway Company, Birmingham, Alabama.

Dr. Layman led NEPA coordination with cooperating agencies and the development of key analyses in the preparation of an EA for the proposed Birmingham Regional Intermodal Facility in Alabama. Coordinated NEPA documentation with Federal Highway Administration and Alabama Department of Transportation, managed subcontractors conducting aquatic protected species surveys, consulted with the U.S. Fish and Wildlife Service on protected species issues, prepared the alternatives analysis and aquatic resources sections of the EA, and developed and presented information in three public meetings. The project was approved and construction began in April 2011.

c. FERC Licensing, Morgan Falls Project, Georgia Power, Atlanta, Georgia.

Dr. Layman led development of one of the first license applications in the nation under the Federal Energy Regulatory Commission's Integrated Licensing Process (ILP) for Georgia Power's 16.8-MW Morgan Falls Project in metropolitan Atlanta. The project was located in the Chattahoochee River National Recreation Area managed by NPS. Participated in NEPA scoping. Managed implementation and delivery of seven resource studies, including water resources; reservoir dredging feasibility evaluation; fisheries and fish entrainment; recreation surveys; wildlife and botanical resources and invasive species; wetlands and riparian habitat; and rare, threatened, and endangered species. Supported successful negotiations with the Department of the Interior to address mandatory conditioning authorities of NPS and the U.S. Fish and Wildlife Service. Led preparation of Exhibit E, the Environmental Report, of the license application, which was written in the form of an applicant-prepared environmental assessment and served as the basis of FERC's environmental assessment pursuant to NEPA.

d. FERC Licensing, Bartlett's Ferry Project, Georgia Power, Georgia and Alabama.

Dr. Layman managed comprehensive environmental resource studies, consultation, and documentation supporting FERC relicensing of Georgia Power's 173-MW Bartlett's Ferry Project on the Chattahoochee River along the Georgia/Alabama border. Participated in NEPA scoping. Led preparation of the Pre-Application Document, FERC-approved Study Plan, eight resource study reports, and Exhibit E of the license application, which was written as an applicant-prepared environmental assessment to facilitate NEPA compliance. Activities included consultation with a diverse interstate group of resource agencies and stakeholders, participation in site visits and scoping, analysis of resource issues, key presentations in Study Results Meetings and Preliminary Licensing Proposal Meetings, and development of environmental enhancement proposals for Exhibit E.

e. Tri-State Water Allocation Environmental Impact Statements, U.S. Army Corps of Engineers, Mobil District, Georgia, Alabama, Florida.

Dr. Layman served as biological task lead for NEPA review of interstate water allocation agreements being negotiated for the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa river basins. Coordinated with the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service in preparing the fisheries and aquatic resource sections of the Draft Environmental Impact Statements (EISs) for both basins.

f. Chattahoochee River Aquatic Ecosystem Restoration, U.S. Army Corps of Engineers, Mobile District, Georgia and Alabama.

In support of U.S. Army Corps of Engineers aquatic ecosystem restoration of the Chattahoochee River in Georgia and Alabama, Dr. Layman scoped the environmental permitting requirements and associated costs. The project would involve breaching two FERC-licensed dams to restore 2.3 miles of unimpounded river for the purposes of riverine habitat restoration and ancillary whitewater boating improvements. Key permitting elements included FERC license surrender and NEPA review.

g. Tri-State Water Allocation Biological Assessment, U.S. Army Corps of Engineers, Mobil District, Georgia, Alabama, Florida.

Dr. Layman led preparation of the supporting information for the Biological Assessments (BAs) being prepared by the Corps for ACF and ACT basin water allocation under the Endangered Species Act (ESA). Evaluated current and historical distribution for Federally-listed species to identify the species most likely to be affected by changes in water management, and assessed the potential for impacts to these species to assist the U.S. Fish and Wildlife Service in making final determinations of potential effect.

h. Arkansas River Corridor Master Plan, Tulsa County, Oklahoma.

As part of a master plan for the Arkansas River Corridor, Dr. Layman assisted Tulsa County in identifying and evaluating potential environmental constraints related to the construction of low-head dams for the purposes of increasing connectivity between the river and surrounding communities, improving habitat for the federally endangered Interior Least Tern, improving the function of the river, and improving recreational opportunities. Led the evaluation of potential project effects to Interior Least Tern nesting and foraging habitat and upstream and downstream passage of highly migratory fish species of interest.

i. EA's and EIS's FERC, Multiple States.

Dr. Layman assisted FERC staff in preparing EAs and multiple-project EISs for 16 hydroelectric projects in Wisconsin, Michigan, New York, South Carolina, and Georgia. Assessed complex fisheries' issues related to turbine-induced mortality, downstream fish protection, upstream passage, and instream flow needs. Participated in NEPA scoping and resource agency 10(j) negotiations.

j. Ludington Pump Storage Project, Lake Michigan.

Dr. Layman assessed fish entrainment and the effectiveness of using a 2.5-mile-long barrier net at the 1,872-MW Ludington Pumped Storage Project (Lake Michigan) for FERC using site-specific data and literature review. The analysis was part of an EA evaluating a settlement agreement for proposed permanent fish protection measures at the facility.

3.3 CONSTRUCTION MANAGEMENT PROJECTS

Geosyntec Consultants is a proven leader in the delivery of specialized construction services that support solid waste, environmental remediation, geotechnical, and civil construction projects. Our integrated approach to construction project delivery focuses on well-coordinated scheduling, timely submittal approval, superior construction management, strict quality control, vigilant quality assurance, and thorough construction record documentation.

Taking a complex project from concept to construction is often a challenging endeavor. With more than 30 years of experience in managing construction projects, Geosyntec offers a wide range of services that assure safe, timely and controlled project execution with lasting performance.

Our construction services practice is strongly focused on construction management, construction quality assurance, and construction quality control services supporting projects in which contractor oversight, rigorous data collection, and schedule management are critical to success. Our practitioners accomplish this by establishing a thorough understanding of design, contract documents and site conditions, and by incorporating essential, non-technical drivers such as schedule and project economics into our planning.

Geosyntec has experience in quality control inspections and documenting daily construction activities, preparing and reviewing as-built drawings, reviewing contractor submittals and verifying pay estimates, reviewing surveys for compliance with contract documents, monitoring pollution control measures to ensure compliance with state and federal regulations, developing cost estimates for contract modifications and monitoring safety plans, and monitoring and analyzing construction schedules.

a. USACE's Herbert Hoover Dike Rehabilitation Project Seepage Cutoff Wall, Martin and Palm Beach Counties, Florida

The Herbert Dike (HHD) rehabilitation project was designed to stabilize and secure the aging dike from potentially damaging severe weather events, and protect the numerous residents and businesses on the southeastern rim of Lake Okeechobee. In 2007, the U.S. Army Corps of Engineers (USACE) placed the HHD on the Top 10 list (at No. 6) of dams in the nation needing repair. The USACE Jacksonville District prioritized rehabilitation of segments that were identified as most vulnerable, focusing initial efforts on achieving the most significant impacts. Geosyntec was responsible for development of specialized work plans; design and certification of the work platform; coordination of local and state permitting of the construction activities; management of the USACE Quality Control System (QMS); development and implementation of a project environmental monitoring program; provision of technical guidance during the cutoff wall mix design; monitoring the field and laboratory quality control testing program; and management of all aspects of the CQC program for the USACE. Geosyntec was given full time quality control and quality management system (QMS) responsibilities on this major federal Multiple Award Task Order contract. The QMS allows for the controlled flow of technical and administrative information between the contractor and the government, and the QMS is the primary contract mechanism for gauging construction progress and overall compliance with the contract specifications.

Within a week of being given one of our first major task assignments (i.e., coordinating construction permits) Geosyntec was instrumental in expediting the issuance of several permits including those issued by the Florida Department of Environmental Protection and South Florida Water Management District pertaining to Stormwater management, consumptive water use, and fugitive air emissions. Geosyntec also developed a sophisticated information management system (WallTracker™) that allows production and QC data compilation in an efficient quality-controlled fashion and viewing through an intuitive interface, managers and stakeholders are able to easily track during this very complex and time critical construction project.

b. Landslide Stabilization at Vandale Junkyard Superfund Site, Marietta, Ohio

The Vandale Junkyard NPL site was operated as a permitted junkyard for over 40 years, and was included on the NPL in 1986. After extensive site investigation activities conducted by others, U.S. EPA Region 5 issued the Record of Decision (ROD) in 1994 calling for a non-time critical remedy involving capping. During the junkyard's active life, waste in one area of the site was ignited at the top of a 150-ft high slope, which resulted in a solid waste residue (SWR) consisting of glass, metal debris, and ash mixed with soil. The SWR was pushed down the slope over the natural colluvium present over bedrock. The planned remedy developed by others for the site included placement of stockpiled waste from other areas of the site over the SWR and a final cover system installed over the placed waste materials. At the onset of remedy implementation, it was discovered that the hillside was geologically unstable and the surficial SWR and colluvial soil were actively creeping downslope. The EPA required the site PRP group to quickly investigate the cause of the geologic instability and to develop a revised site design to stabilize the slope and achieve the environmental remedial action objectives. The PRPs retained Geosyntec to undertake this scope of work.

Geosyntec conducted an extensive geotechnical investigation that included soil borings, rock corings, and the installation and monitoring of slope inclinometers, piezometers, and settlement points. The displaced shape of the inclinometer revealed that slope movements were limited to the SWR and colluvial soil that overlies interbedded sandstone and mudstone bedrock, with the locus of slope movement found to be in the colluvium near the bedrock interface. Our investigation also included laboratory shear strength testing of the colluvium using a torsional ring shear device. This testing was performed to obtain residual shear strength parameters along the existing colluvium slip surfaces. Piezometer data indicated a rapid response to rain events as indicated by the buildup of water head in the SWR and colluvium above bedrock. Review of field instrumentation data revealed that slope inclinometer movement rates were temporally correlated to periods of rainfall.

Geosyntec developed a slope stabilization plan incorporating a geosynthetic-reinforced, mechanically stabilized earth and crushed rock (MSE/CR) buttress keyed into bedrock near the toe of slope. Compacted crushed rock having a high angle of internal friction comprises the lower portion of the buttress. The crushed rock portion of the buttress disrupts and intersects the zone of critical potential slip surfaces within the colluvium. The overlying MSE portion of the buttress was constructed on top of the crushed rock to both increase the normal stress in, and hence frictional strength of, the crushed rock and also to retain the SWR and stockpiled material consolidated from other areas of the site.

c. Engineering and Construction Services for the Center Hill Dam Foundation Remediation - DeKalb County, Tennessee

Center Hill Dam is one of the multipurpose projects that make up the Corps of Engineers' system for development of the water resources of the Cumberland River Basin. As a major unit in the system, Center Hill Dam and Lake function to control the floodwaters of the Caney Fork River and contribute to the reduction of flood levels at municipal, industrial and agricultural areas along the Cumberland, lower Ohio and Mississippi Rivers. In addition to the far-reaching effects of flood control, the project contributes to the electrical power supply of the area through the generation of clean, safe and efficient hydroelectric power.

In late 2011, The U.S. Army Corps of Engineers Nashville District selected Bauer Foundation Corporation to construct a subsurface concrete barrier wall to stabilize the earthen embankment portion of the aging dam. The \$106 million contract is the major feature of a multi-phase dam rehabilitation program. This second phase of a three-phase rehabilitation plan includes the construction of a continuous concrete barrier wall for long-term stability and seepage prevention through the earthen dam embankment. The vertical seepage barrier wall will extend down over 300 feet beneath the top of the dam and require embedment of over 100 feet into

the limestone bedrock. Bauer's specialty excavation equipment will remove long columns of the earthen dam and rock foundation which will be replaced with concrete. The concrete columns will overlap to form a long, continuous concrete wall acting as a barrier for potentially harmful seepage water moving beneath the earthen dam.

As part of the Bauer Team, Geosyntec provided geotechnical engineering support for a variety of construction services including: preparation of technical submittals; value engineering; instrumentation; automated data acquisition; and waste slurry disposal management. Geosyntec was also responsible for developing the construction data management and visualization system which controls the flow of information between the contractor and the government and is the primary mechanism for gauging construction progress and overall compliance with the contract specifications. In order to manage the numerous and diverse data compiled for these projects, Geosyntec developed WallTracker™, a database and GIS application based on a Visual Basic™, Microsoft® Access™ and ESRI® ArcGIS™ platform. This innovative tool allowed the contractors and the USACE to view and search data securely and remotely as it was collected.

Geosyntec's WallTracker™ application streamlined the project workflow, allowing data to be compiled and accessed through an intuitive user interface as it was collected and verified. Project managers and other stakeholders could track progress as well as analyze and respond to trends in the data, which maximized efficiency of this complex, time-critical and high-profile construction project.

4.0 GENERAL DISCUSSION OF TECHNICAL APPROACH

Geosyntec has reviewed the four dam assessment reports dated March 2011 prepared by Gannett-Fleming (GF) for dams within the Brush Creek and New Creek Watersheds. As stated in the documents, *"the report provides a description of the dam, an assessment of the current conditions and status of operation and maintenance, and the scope of potential rehabilitation alternatives."* The document also reported that *"In addition to assessing the overall integrity of the structure, available design information was reviewed to determine whether the structure meets current NRCS design criteria."* The reports are well organized and provide consistent information for each of the four facilities. Based on information provided in the assessment reports, all four dams identified in the EOI were classified as "High Hazard", and in some cases the document noted that the facilities do not currently meet the design criteria for this classification. Therefore, in each of the assessment reports, potential rehabilitation options and alternatives are identified.

Using these reports as a starting point, Geosyntec proposes to collaborate with the WVCA to select and implement the most appropriate rehabilitation option that meets the objectives of the agency while leveraging the available rehabilitation funding to the maximum extent possible. Specifically, Geosyntec's technical approach is organized into the following four tasks:

- Task 1: Concurrence with Assessment Reports and Meet with WVCA;
- Task 2: Identification of Design Deficiencies;
- Task 3: Assessment of Risk and Risk-Reduction Options; and
- Task 4: Selection and Implementation of Rehabilitation Options.

A brief discussion of the rationale and the specific activities included in these four tasks follows.

4.1 TASK 1: CONCURRENCE WITH ASSESSMENT REPORTS AND MEET WITH WVCA

During the intervening four years since the preparation of the assessment reports, there may have been changes in conditions at the sites that warrant a different risk assessment and requisite rehabilitation alternatives. This first task will be focused on visiting each site to review and “ground proof” the conditions described in the assessment reports. A brief status report and presentation will be prepared for the WVCA to help establish the appropriate go-forward strategy. During the meeting/presentation with the agency, Geosyntec will present the advantages and disadvantages of potential rehabilitation options with the specific goal of understanding the agency’s objectives in rehabilitating each dam. For example, the ability to meet the design spillway discharge criterion may be achieved by raising the dam, lowering the spillway elevation, or widening the spillway. Each of these options has different NEPA impacts and entails different performance objectives and risks. It is Geosyntec’s goal to understand the short- and long-term objectives of the agency and to assess the potential for leveraging the resources available for rehabilitation to the maximum extent possible, recognizing that there are other dams in the WVCA inventory that are likely to require rehabilitation.

4.2 TASK 2: IDENTIFICATION OF DESIGN DEFICIENCIES

Based on review of the assessment reports and current conditions at each dam, and comparing them to the NRCS Engineering Manual and the NRCS National Watershed Program Manual, Geosyntec will identify the deficiencies of each dam that must be addressed to enable the dams to meet current design criteria for a high-hazard dam classification. At a minimum, rehabilitation measures must be selected to address these deficiencies. In addition, the assessment reports note that each of the four dams “should” be investigated to assess the compatibility between the various construction components. This implies that the original dam construction did not consider filter design criteria, a tenant of modern dam design and construction. Geosyntec notes that many State regulatory agencies require that any rehabilitation activity on a high-hazard dam include a retrofit to include an appropriately designed filter. As part of Task 2, Geosyntec will review with WVCA the various rehabilitation techniques that can be implemented to meet current and (potentially) future design criteria. Geosyntec believes that this strategy will be helpful in understanding the interaction between the various rehabilitation options and identify the most appropriate rehabilitation options that will comply with the relevant dam design criteria.

4.3 TASK 3: ASSESSMENT OF RISK AND RISK REDUCTION OPTIONS

Each of the assessment reports includes an assessment of the relative risk rating for the dam using the NRCS rating system. Geosyntec believes that the information presented in the spreadsheets will be invaluable as part of the go-forward strategy for each facility. While Task 2 focused on identifying the activities/features that need to be considered to meet minimum design criteria, this task will focus on the impact that each rehabilitation option (i.e., including the “required” and “desired” options) will have on reducing risk. In this context, Geosyntec proposes to undertake a screening-level potential failure modes analysis (PFMA) for each facility and to “rank” the ability of each potential rehabilitation option to reduce risk. For example, expenditure of funds to raise the dam to meet the requisite hydraulic performance may inadvertently increase the risk associated with piping and erosion. Geosyntec’s goal for this task is to work with the WVCA to establish a rational methodology for selecting the most appropriate rehabilitation option for each facility in its inventory. Geosyntec will develop a complementary spreadsheet and data management strategy to allow “apples-to-apples” comparisons of various rehabilitation options.

4.4 TASK 4: SELECTION AND IMPLEMENTATION OF REHABILITATION OPTION

This final task focuses on the selection of the appropriate rehabilitation option that allows the facility to meet its relevant dam design criteria, minimize overall risk, control project implementation costs, and recognize potential NEPA impacts. Geosyntec's experience related to both design and construction will prove invaluable in helping the WVCA select the most appropriate rehabilitation technology, prepare design drawings and details, select construction contractors, and provide construction quality assurance during construction.

4.5 SUMMARY

In summary, Geosyntec's technical approach for this initial project is to meet the immediate needs and goals of the WVCA. However, Geosyntec proposes to use this opportunity to build upon the valuable information that has been compiled on behalf of the agency to establish a rational protocol for assessing the rehabilitation options available to the agency. This protocol will be based on assuring compliance with dam design criteria, reducing the risk posed by the dam, and controlling project costs. Geosyntec believes that this strategy will allow the rehabilitation funds to be leveraged to the maximum extent possible and, importantly, will form a basis for assessing rehabilitation options for the remaining facilities in the WVCA inventory.

5.0 PROJECT SCHEDULE

Geosyntec has proven experience managing and executing project schedules. Our project manager assigned for this project, Mark Kessinger, has over 20 years of experience as a project manager with the U.S. Army Corps of Engineers. He has managed large civil works projects, and has a background in dam safety. He has developed and maintained project schedules and budgets, spoken in front of large groups during public hearings, and issued press releases and public notifications.

If we are awarded the contract by August 1, 2015, we are confident we can achieve the WVCA's schedule to have the Brush Creek Site 15 draft NEPA document completed by June 30, 2016 and the final by November 30, 2016, and the Brush Creek Site 9 draft NEPA document by October 31, 2016 and final by March 31, 2017.

Likewise, we have the resources to complete the New Creek Site 17 draft NEPA document by December 1, 2016 and the final by April 30, 2017, and the New Creek Site 1 draft NEPA document by January 1, 2017 and final by May 31, 2017.

Appendix A – STAFF CERTIFICATIONS



STATE BOARD OF EXAMINERS OF LAND SURVEYORS

To all to whom these presents shall come Greeting
Know Ye That The State Board of Examiners of Land Surveyors
of the State of West Virginia, reporting special confidence in the
Intelligence, Integrity and Discretion of

Does In Pursuance of Authority Vested In It
by law, hereby certify that this person, having submitted
satisfactory evidence of their ability and experience, is a

Professional Surveyor

License Number 1131

To Hold and use such title in the practice of their profession, subject
to the conditions prescribed by law

Given under the hand and the Seal of
the Board this 10th day of
in the year of our Lord One Thousand
Nine Hundred and
and of the State the



STATE BOARD OF EXAMINERS OF LAND SURVEYORS

(Signature)

(Signature)

(Signature)

(Signature)

The State of West Virginia

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

To all to whom these presents shall come, Greeting,
Know ye that the State Board of Registration for Professional Engineers,
of the State of West Virginia, expressing special confidence in
the Intelligence, Integrity and Discretion of
Joseph G. Menniti

Having the DULCUMENTS OF AUTHORITY VESTED IN US

by law, hereby certify that he having submitted
satisfactory evidence of his ability and experience, is a

REGISTERED PROFESSIONAL ENGINEER

Registration Number [REDACTED]

To hold and use such title in the practice of his profession,
subject to the conditions prescribed by law.

Given under the hand and the Seal
of the Board at the Capitol in the
City of Charleston
this 21st day of Oct. in the
year of our Lord One Thousand
Nine Hundred and Eighty-one
and of the State the One Hundred
Eighteenth

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

[Signature]

Robert E. Schmitt

[Signature]

Bill L. Utley

Project Management Institute

THIS IS TO CERTIFY THAT

Mark D Kessinger

HAS BEEN FORMALLY EVALUATED FOR DEMONSTRATED EXPERIENCE, KNOWLEDGE AND PERFORMANCE
IN ACHIEVING AN ORGANIZATIONAL OBJECTIVE THROUGH DEFINING AND OVERSEEING PROJECTS AND
RESOURCES AND IS HEREBY BESTOWED THE GLOBAL CREDENTIAL

Project Management Professional

IN TESTIMONY WHEREOF, WE HAVE SUBSCRIBED OUR SIGNATURES UNDER THE SEAL OF THE INSTITUTE



Steven V. DelGrasso
Steven V. DelGrasso - Chair, Board of Directors

Mark A. Langley
Mark A. Langley - President and Chief Executive Officer

PMI® Number [REDACTED]

PMI® Original Grant Date 28 June 2008

PMI® Expiration Date 27 June 2018



North Carolina Board of Examiners for Engineers and Surveyors



This is to certify that
Robert C. Bachus
is duly licensed and entitled to practice
Engineering
until December 31, 2015 when this certificate expires.
Registration Number: [REDACTED] Status: CURRENT

Willy E. Stewart

Willy E. Stewart, Chair

Linda A. Thurman

Linda Thurman, Secretary

University of Wisconsin-Madison



The Board of Regents of the University of Wisconsin System,
on the nomination of the faculty, has conferred upon

MAJDI AHMAD OTHMAN

The Degree of

DOCTOR OF PHILOSOPHY

Together with all honors, rights, and privileges belonging to that degree.
In witness whereof, this diploma is granted.

Given at Madison in the State of Wisconsin
this twenty-third day of August in the year nineteen hundred ninety-two
and of the University the one hundred forty-second.

Katherine Lyall
President, University of Wisconsin System

John P. Sibley
Chancellor, University of Wisconsin-Madison

Robert K. Meyer
President of the Board of Regents



STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

To all to whom these presents shall come, Greeting.

Know Ye That The State Board of Registration for Professional Engineers of the State of West Virginia, reposing special confidence in the Intelligence, Integrity and Discretion of Kenneth M. Hayes

Does, in Pursuance of Authority Vested in it by Law, hereby certify that he, having submitted satisfactory evidence of his ability and experience, is a REGISTERED PROFESSIONAL ENGINEER

Registration Number [Redacted]

To Hold, and use such title in the practice of his profession, subject to the conditions prescribed by law



Given under the hand and the Seal of the Board at the Capitol in the City of Charleston, this 25th day of January in the year of our Lord 2000 and of the State the 136th

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

[Handwritten signature]

[Handwritten signature]

[Handwritten signature]



BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

To all to whom these presents shall come Greeting
Know Ye That The State Board of Registration for Professional Engineers
of the State of West Virginia, upon being satisfied as to
the Intelligence, Capacity and Character of

Mark W. Sutton

DOMS IN PURSUANCE OF AUTHORITY VESTED IN IT

by law hereby certify that he having submitted
satisfactory evidence of his ability and experience is

REGISTERED PROFESSIONAL ENGINEER

Registration Number [REDACTED]

To Hold and use such title in the practice of his profession,
subject to the conditions prescribed by law.



Given under the hand of the
Chief of the Bureau at the Capitol in the
City of Charleston
This 25th day of June
in the year of our Lord 2008
and of the State

The University of Alabama

has conferred upon

Steven Richard Layman
the degree of

Doctor of Philosophy

with all the rights and privileges thereto appertaining.

In Witness Whereof, this diploma duly signed has
been issued and the seal of the University affixed.

Issued by the Board of Trustees upon recommendation
of the faculty at the University on this the
fourteenth day of May, 1994.



C. Ross Sargent
President

Ronald Logan
Dean



THE UNIVERSITY OF TEXAS
AT AUSTIN

has conferred on
GLENN JAY RIX

the degree of
Doctor of Philosophy

and all the rights and privileges thereto appertaining.
In Witness Whereof, this diploma duly signed has
been issued and the seal of the University affixed.

Issued by the Board of Regents upon Recommendation of the Faculty.
AWARDED ON THIS TWENTY-FOURTH DAY OF DECEMBER, 1969

J. S. Burt
CHAIRMAN, BOARD OF REGENTS

W. H. C. Jr.
PRESIDENT

Harry Mark
CHANCELLOR

Colman S. Livingston
DEAN



West Virginia State Board of Registration for Professional Engineers

THOMAS B. RAMSEY
WV PE [REDACTED]

This is to certify that the above named **PROFESSIONAL ENGINEER** has met the requirements of the law, is duly registered and is entitled to practice engineering in the State of West Virginia.

EXPIRES December 31, 2016

Appendix B – RESUMES

J. GREGORY MENNITI, P.E., P.S.

Project Director

EDUCATION

B.S., Civil Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania, 1976

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer, Ohio, No. [REDACTED]

Professional Engineer, Pennsylvania, No. [REDACTED]

Professional Engineer, West Virginia, No. [REDACTED]

Professional Surveyor, West Virginia, No. [REDACTED]

CAREER SUMMARY

Mr. Menniti has over 37 years of experience in providing water, wastewater and environmental facility design and permitting services to a diverse group of public and private sector clients. He has served as Client Manager and/or Technical Manger under numerous Professional Services Agreement contracts with industrial, commercial, and governmental clients including: Norfolk Southern Railway, CSX Transportation and General Motors Corporation. As a Principal with Geosyntec Consultants, Mr. Menniti is responsible for the administration and coordination of the process engineering, design and permitting services throughout the company. His responsibilities include supervising the engineering designs, preparation of engineering reports, and field investigations on stormwater, water and wastewater collections, treatment and permitting projects. Mr. Menniti's project experience includes municipal, government and industrial water and wastewater treatment plants, groundwater pumping and treatment systems, pump stations, collection and distribution systems, air quality and other related facility designs, permitting, and operation services. His experience in the public sector includes multiple million-dollar wastewater treatment plant improvement projects for the Cities of Huntington, WV; Wheeling, WV; Hickory, NC; and Auburn, AL, as well as the design of wetlands mitigation projects for the U.S. Army Corp of Engineers. He has also provided services to clients throughout the United States for various industries including iron and steel, aluminum, fabricated metal products, automotive, railroad, chemical, coatings, polymers, pharmaceutical, electrical power systems, gas and oil production and transmission, coal production, handling and transportation and wood products manufacturing.

Representative examples of Mr. Menniti's project experience are below.

Representative Experience

Mr. Menniti's project experience with industrial clients includes environmental engineering, client and project management, facility design and operation consulting services for over seven hundred and fifty projects. He has over 24 years of railroad industry experience completing over 750 environmental and engineering projects. He has designed major industrial treatment facilities using both conventional and advanced state-of-the-art treatment technologies for industrial clients throughout the United States. Over the last five years he has completed major environmental infrastructure design projects in the Cities of El Monte and Long Beach, California, wastewater treatment plants for both CSX Transportation and Norfolk Southern Railroad for their locomotive shops in Huntington, WV and Altoona, PA, and has also completed a major wastewater treatment plant project that included completely renovating the wastewater treatment facility for the General Motors Corvette Manufacturing Plant in Bowling Green, KY.

Mr. Menniti has completed numerous engineering projects for municipal utilities and the US Army Corp of Engineers incorporating all aspects of engineering design, project management and construction management services. A representative list of the type of public sector projects that he completed includes: design, permitting, construction and operation services of secondary and advanced secondary wastewater treatment plants; design, construction and operation services for sewage sludge dewatering and incineration systems; design and construction services of underground utilities, pump stations and urban infrastructure renewal; certificates of convenience and necessity preparation and expert testimony presentation; wetland mitigation design and consultation services; municipal solid waste landfill permitting, design and operation services. In addition to the engineering project services provided to municipal and government clients, he also provided utility management and general consultation services and served as the Acting General Superintendent for the Huntington, WV Sanitary Board for ten years (1986 to 1996) and was an active member and past president of the Ohio River Valley Water Sanitation Commission's (ORSANCO) POTW advisory committee.

A recent project Mr. Menniti initiated provides a good example of his ability to develop solutions to complex problems that both protect the environment and improve community relations. He spearheaded the design of an industrial treatment system for one of North America's largest locomotive shops. The design required retro-fitting of the shop, originally constructed in 1872, with state-of-the-art equipment and controls. This system provides pretreatment of approximately 440,000 gallons per month of industrial wastewater prior to discharge to a publicly owned treatment works (POTW). The design he successfully completed eliminates the chance of upsetting the downstream POTW with a concentrated industrial discharge.

Mr. Menniti has also initiated several Green Technology projects and is managing a design project that utilizes innovative treatment technologies to replace chemical addition in wastewater treatment. One design project uses walnut shells as filtering media in the treatment process. Although this technology has been used previously by the petro-chemical industry, he successfully adapted it to general industry use and had the walnut shell media installed

downstream of an oil/water separator to provide the level of treatment necessary to meet stringent NPDES discharge effluent requirements rather than installing a more conventional treatment system such as dissolved air filtration (DAF).

Additionally, Mr. Menniti continues to develop water use and re-use programs for industrial manufacturing and material handling facilities. He is currently managing the design of a stormwater capture and treatment system for a major material handling rail facilities on the Chesapeake Bay to reduce the facility's use of potable water with the potential to result in a zero discharge. His work on these water conservations and re-use programs focus upon protecting facility personnel, reducing potable water use and compliance costs, as well as, reducing the quantity of water and waste requiring the handling, treatment or disposal at the facilities.

Environmental Infrastructure

Boeing Corporate Real Estate, Long Beach, CA, Chief Design Engineer

Mr. Menniti was the Chief Design Engineer for the Boeing Corporate Real Estate, Boeing Building 10/Douglas Park, Long Beach, California. As the Chief Design Engineer on the project, Mr. Menniti prepared detailed design drawings and specification documentation for the conveyance piping and controls for the groundwater remediation at the former Boeing Building 10 site in Long Beach, California. He also developed the detailed design drawings and specification documentation of the environmental infrastructure at the Boeing Douglas Park development site in Long Beach, California.

El Monte Operable Unit, San Gabriel Valley Superfund Site, El Monte, CA, Chief Design Engineer.

As the Chief Design Engineer on the El Monte Operable Unit, San Gabriel Valley Superfund Site, El Monte, California, Mr. Menniti prepared detailed design drawings and specification documentation for the Groundwater conveyance piping and treatment systems for the remedial action at the El Monte Operable site in El Monte, California. The design services included process design, CAD services, instrumentation and controls, facility design, pump system design, architectural design, and mechanical design of a 600 gallon-per-minute deep remedy treatment system and a 200-gallon-per minute shallow system.

Norfolk Southern Corporation – Shaffers Crossing Yard, Roanoke, VA

Mr. Menniti was the Chief Engineer for the Rail Car Cleaning facility at Shaffers Crossing Yard, Roanoke, VA. Six operations at the Shaffers Crossing yard were investigated and new corrective measures were developed to improve overall compliance at the yard. Design engineering services included improvement to the “dry Side” as well as , a new wastewater treatment facility at the rail car cleaning facility in addition to stormwater and DAF system improvements.

Industrial Wastewater

General Motors Corporation – Bowling Green, KY Assembly Plant Wastewater Treatment Facility Improvements, Chief Engineer

Mr. Menniti was the Chief Engineer for the General Motors Corporation - Bowling Green Assembly Plant, Bowling Green, KY wastewater treatment plant improvement project. As the Chief Engineer on the project, Mr. Menniti was responsible for the conceptual design of wastewater treatment alternatives for petroleum- and metals-impacted wastewaters, including the evaluation of various types of oil/water separation equipment, metals precipitation processes, and cost comparisons. The project included detailed engineering design, including CAD services, management of structural and electrical design, instrumentation and controls, site improvements, pump system design, client management, surveying, process design, and mechanical design. Bid phase assistance services was also provided, including coordination and management of the pre-bid meeting, bid analysis and comparison, and client and bid contractor management. Mr. Menniti also oversaw construction management services, including quality assurance, contractor management, on-site construction observation, safety management, equipment procurement, scheduling, start-up services, and report generation. The treatment system pretreats the wastewater from the assembly plant prior to its discharge into the City of Bowling Green's POTW.

CSX Transportation – Huntington, WV Locomotive Shops, Wastewater Treatment Plant Installation, Chief Engineer

Mr. Menniti was the Chief Engineer for the CSX Transportation Wastewater Treatment Plant Installation project at CSX Transportation's locomotive shops in Huntington, WV. Mr. Menniti provided design of industrial wastewater segregation, collection, and treatment alternatives as part of a two-phase, two-year project, including cost comparisons. Mr. Menniti also provided detailed engineering design for segregation and collection phase and for treatment facility installation. Additionally, as Principal-in-Charge for CSX Transportation's preferred provider program, Mr. Menniti has provided project engineering and management services to CSX Transportation, Inc. for numerous projects, including gravity and pressure sewers, Wastewater Treatment Facility (WWTF) maintenance and improvements, turnkey WWTF installation, hazardous materials containment, and fuel transfer and storage facilities.

Power Industry

Duke Energy, Oconee Nuclear Station – Modifications to Treatment System

The Project included an upgrade of the facility's chemical treatment system, which involved the Design/Build of new chemical treatment ponds with synthetic liners, construction of a chemical additions building with automatic chemical feeds and tote storage, design of aeration systems to provide homogeneous mixing within the ponds, and replacement of discharge pumps, valves, recirculation piping, and transfer piping to and from the treatment ponds.

FPL Sanford Plant – Modifications to Basin Treatment System

The Project included Design of new piping system at the lamella sludge removal system, isolation of the caustic feed pump system, aerator/mixers in the treatment basins, anti-erosion concrete structures under mixers, a slide gate inside the diversion manhole to allow for blow down, a submersible pump in the bottom of the diversion manhole, piping from the submersible pump to the ash sump.

FPL Fort Lauderdale Plant – Modifications to Water System

Plant waterline extension project - This project included the installation of approximately 4,200 ft of 12" water service main to connect the Fort Lauderdale plant to the city water system, a pipe bridge over the stormwater canal, both below ground piping and above ground piping.

Southern Company, Savannah Electric, Savannah River Plant – Oily Water Collection and Treatment System

This project included the design and installation of an oily water collection and treatment system for Savannah River Peaking Plant located adjacent to the river. Project included the design of submersible pumps, piping routed through plant, corrugated plate oil/water separator, and permitting of the effluent discharge.

Municipal Wastewater Treatment

City of Wheeling, WV - Wastewater System Improvements, Chief Engineer

Mr. Menniti served as Chief Engineer for the City of Wheeling, West Virginia, Wastewater Collection System and Treatment Plant Improvement Project. The City of Wheeling's wastewater treatment plant receives both storm and sanitary sewerage, and at the time of this project was the largest Combined Sewer Overflow (CSO) community, per capita in the United States. A review of the City's wastewater collection and treatment system resulted in the Wastewater Collection System Improvements project. As the Chief Engineer on the project, Mr. Menniti was responsible for review of the City's existing wastewater collection and treatment system and developing system improvements for the \$15 million dollar wastewater treatment, CSO abatement and collection system improvement project.

City of Huntington, WV - Wastewater System Improvements, General Superintendent/Principal-in-Charge

During his tenure as the acting General Superintendent for the Huntington, West Virginia Sanitary Board, Mr. Menniti initiated, supervised, and was the Principal-In-Charge of developing the city's Combined Sewer Overflow (CSO) long term control plan strategy that included a GIS based urban drainage modeling component to evaluate the CSO impacts on the receiving water. The City of Huntington, West Virginia, has a combined sewer system with 23 Combined Sewer Overflow (CSO) discharge points permitted under the National Pollution

Discharge Elimination System (NPDES) program. The GIS based urban drainage model was developed to comply with the National CSO strategy and used to predict the quality and quantity of CSO discharge from observed rainfall inputs to meet the requirements of the CSO strategy.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Huntington, WV, 2005 - present

Chester Engineers (USFilter Engineering and Construction), Pittsburgh, PA, 1976 – 2005

AFFILIATIONS

Industrial Wastes Committee – Water Environment Federation

Mark D. Kessinger, PMP, FSAME

Project Manager

EDUCATION

BS, Civil Engineering, West Virginia University, Morgantown, WV, 1982
MS, Engineering Management, Marshall University, Huntington, WV, 1992

CERTIFICATIONS:

Certified Project Management Professional
OSHA Hazardous Wastes Operations Certification

CAREER SUMMARY

Mr. Kessinger is a Senior Environmental Engineer with Geosyntec Consultants with a professional practice focusing on water resources engineering. He joined Geosyntec following a 33-year career with the U.S. Army Corps of Engineers (USACE) where his experience included the areas of hydrology and hydraulics, dam safety, ecosystem restoration, project management and construction management. Mr. Kessinger is a member of Geosyntec's Water and Natural Resources Action Group,

PROJECT EXPERIENCE

National Program Manager for USACE support to the U.S. Department of Energy's National Energy Technology Laboratory (NETL). Served as the U.S. Army Corps of Engineers (USACE) Senior Project Manager for 24 contracts totaling over \$35 million in services to NETL related to environmental remediation, regulatory compliance, decontamination and decommissioning, cost engineering, project management and construction management.

Senior Project Manager for USACE's support to the U.S. Department of Energy's Project Management Initiative. Led teams that executed over \$47 million in project management and project controls services at 16 DOE sites across the U.S.

Huntington District's Account Manager for the State of Ohio. Served as USACE's Liaison to the State of Ohio on water resource related projects. In addition to managing Ohio projects in the USACE's Huntington District, was responsible for developing and facilitating the annual meeting among State agencies and the 4 USACE districts (Buffalo, Huntington, Louisville and Pittsburgh) and the Great Lakes and Ohio River Division Office in Cincinnati that serve Ohio.

PROJECT EXPERIENCE (Continued)

Mark D. Kessinger, PMP

USACE Huntington District's Liaison to the Muskingum Watershed Conservancy District (MWCD). As the USACE's primary point-of-contact to the MWCD, was responsible for managing and monitoring all USACE projects with the MWCD and developing and facilitating the semi-annual meetings between the USACE and the MWCD.

Project Manager for USACE support to the Town of Boone, NC. A \$3.5M ecosystem restoration project to restore the South Fork of the New River, an American Heritage River, in the Town of Boone. Work involved bank stabilization, creation of wetlands, and development of the riparian corridor.

Project Manager for USACE support to the Federal Highways Administration. A \$2M construction project to place stone around historic Blennerhassett Island to minimize erosion. The project was funded by the Federal Highways Administration and the West Virginia Department of Highways as part of mitigation for an interstate bridge pier that was placed on the island.

Project Manager for USACE support to the Ohio EPA, Newark, Ohio. A \$2.5M construction project at the former Newark Aluminum Processing Facility for the Ohio EPA. Aluminum dross and other metals from this Brownfield site were eroding into the Licking River. The project involved river bank stabilization and armoring, proper surface water drainage, and placing security fencing around the site to make it secure.

Lead Business Management Specialist for the USACE Great Lakes and Ohio River Division's Business Management Division, Cincinnati, Ohio. Chaired regional governance meetings and was the primary lead for regional initiatives and programs. Led the effort for regional ISO-9001 certification and helped develop standard business processes for the entire region. Improved corporate-level regional business strategies to better position the Great Lakes and Ohio River Division to meet current and future program execution.

Project Manager for \$160 million NASA Plum Brook Reactor Decommissioning Project, Sandusky, Ohio. Coordinated and directed all work activities associated with decommissioning NASA's only nuclear reactor. Managed and supervised a 20 member multi-disciplinary team made up of members from 6 Corps districts and the U.S. Department of Energy. Also coordinated with numerous contractors and briefed the project to senior NASA and USACE staff, the media and the public.

PROJECT EXPERIENCE (Continued)

Mark D. Kessinger, PMP

USACE Senior Liaison to the U.S. Department of Energy, Office of Science and Technology, Washington, DC. As the Corps' Senior Liaison to the Office of Science and Technology (OST) interacted with OST Director and other senior DOE staff and assembled the required resources and expertise from within the USACE to meet OST's objectives and missions across the U.S. Supervised and managed multi-disciplinary teams from 13 USACE districts on projects involving environmental remediation, decontamination and decommissioning, cost engineering, project management, and research and development.

Engineer Manager for Winfield Locks and Dam. Was responsible for all environmental, engineering and design aspects for the construction of the new \$200M lock chamber at the Winfield Locks and Dam. Managed and supervised a multi-disciplinary team through planning, designing, engineering and construction and remediated a large industrial site as part of project. This effort required coordination with USEPA, West Virginia EPA, U.S. Department of Justice, the former owner of site, USACE Headquarters, Congressional Representatives, media and the public. Developed litigation report with Justice Department which caused previous owner to remediate the site at its cost and saved the Government over \$100M in remediation costs. This accomplishment was the feature article for August 14, 1995 issue of *Engineering News Record*.

Chief of Engineering Management Branch, Engineering Division, USACE Huntington District. As Section Chief, managed and supervised 7 Engineer Managers and 5 support staff and directed the management and execution of all projects within Engineering Division's \$70 million annual program. Prepared budgetary estimates and allocations, determined amount of manpower required to accomplish work, and evaluated and procured services of contractors to meet project requirements.

Staff Specialist for Engineering Division, USACE Great Lakes and Ohio River Division Office, Cincinnati, Ohio. Improved engineering and design aspects of all Ohio River Division civil works projects and for ensured all project requirements and agreements were met during design and construction. Established working relationships with technical counterparts in districts within the region and established a process whereby CADD drawings could be electronically transmitted between districts and the division to expedite the review process.

Executive Assistant, Executive Office, USACE Huntington District. Evaluated capability of district to perform necessary work within established budgets and schedules. Took actions necessary to achieve district goals and developed budgets and schedules for new work. Reviewed and maintained accounting and budgetary data on critical projects and gave periodic briefings to District Engineer and senior staff on status of district projects.

PROJECT EXPERIENCE (Continued)

Mark D. Kessinger, PMP

Hydraulic Engineer, USACE Huntington District. Responsible for design of hydraulic features and for execution of District's Dam Safety Assurance Program. Conducted studies on each of the District's 35 dams to determine if they met current safety standards. Designed modifications to dams to meet current safety standards.

SPECIALIZED TRAINING:

Gallup Leadership Training, Organizational Leadership for Executives, Middle Management Institute, Human Resources Management, Coaching and Team Building Skills for Supervisors, Facilitative Leadership and Team Building, Program Development and Execution, Programming and Budgeting, Contracting, Value Engineering, Financial Management Systems, Project Management, Risk Communications, Environmental Law, Organizational Behavior, Emergency Operations, Emergency Management, Hazardous Waste Operations

HONORS, AWARDS AND SPECIAL ACCOMPLISHMENTS:

- 2012 Huntington District Project Manager of the Year.
- 2009 Selected for Corps' Senior Leadership Development Program.
- 2008 Department of Energy Achievement Award for Work on Best-In-Class Program.
- 2008 Corps' Project Management Community of Practice Level 2 Certification.
- 2008 Project Management Professional Certification.
- 2002 Life Member in the Society of American Military Engineers.
- 2000 Corps' Division Commander's Award for Superior Civilian Service on NASA Reactor Project. This is the highest award a Division General can give a civilian.
- 2000 NASA Director's Achievement Award for Performance on NASA Reactor Project. This award is rarely given to an employee outside of NASA.
- 2000 District Commander's Award for Civilian Service on NASA Reactor Project.
- 1999 Leader of Great Lakes and Ohio River Division Project Delivery Team of the Year. Project: Decommissioning NASA's only nuclear reactor.
- 1998 Huntington District Federal Environmental Engineer of the Year
- 1998 Inducted into Academy of Fellows for the Society of American Military Engineers. At age 38, youngest member inducted into the Academy at that time.
- 1997 Corps' Ohio River Division Civilian Employee of the Year.
- 1996 Engineer Manager for Corps' Ohio River Division Project Team of the Year.
- 1996 Engineer Manager for Huntington District Project Team of the Year.
- 1996 Huntington District Civilian Employee of the Year.
- 1995 District Commander's Award for Civilian Service.
- 1992 Huntington District Federal Environmental Engineer of the Year.
- 1990 Huntington District Procurement Excellence Award.

ROBERT C. BACHUS, PhD, PE

Quality Assurance

EDUCATION

Stanford University: Ph.D., Geotechnical Engineering, 1982

University of Illinois at Chicago Circle: M.S., Civil Engineering, 1975

University of Illinois at Chicago Circle: B.S., Civil Engineering, 1974

PROFESSIONAL REGISTRATION

Georgia Professional Engineer, [REDACTED]

Arkansas Professional Engineer, No. [REDACTED]

Mississippi Professional Engineer, No. [REDACTED]

CAREER SUMMARY

Dr. Robert Bachus, P.E., principal engineer based in Georgia with more than 30 years of experience, focuses on geotechnical engineering, geosynthetic engineering, waste by-product characterization, and waste containment. He provides design, analysis, and forensic investigation on projects related to these practice areas. He also provides expert consultation on matters in litigation. He is nationally recognized for his expertise in geotechnical site characterization, in situ and laboratory testing, settlement and slope stability analysis, and performance monitoring of geotechnical and earthen structure systems. He has worked extensively on the design and rehabilitation of earth dams, levee structures, and earth retaining systems, with extensive experience on strength characterization and slope stability assessments. Dr. Bachus recently applied his expertise in engineering analyses and earthen structure design to resolve construction difficulties related to a 250-ft high gold mine tailings dam and is currently addressing design and construction issues associated with permanent access roads on levees and dredged material containment dikes. He has extensive expertise and national recognition as a leading specialist in the characterization, assessment, and construction of engineered structures in areas underlain by karst geologic features. While a professor on the geotechnical engineering faculty at Georgia Institute of Technology, Dr. Bachus focused his research on the beneficial re-use of coal combustion by-product materials and engineering applications for geosynthetic materials, focusing on reinforcing and drainage product development. He continues to work in these areas and recently advanced the state-of-the-practice by serving as the lead author of a design guidance document related to drainage geocomposites used in civil engineering applications. He

served as co-chair of the ASCE GEO-Institute's GeoCongress 2006, a national conference emphasizing "geotechnical engineering in the information age." His applied research in geotechnical engineering and solid waste management has yielded significant advancements in performance monitoring instrumentation used for assessing settlement beneath embankments and other earthen structures. In addition to his ongoing research, Dr. Bachus has authored or co-authored more than 100 technical publications including several technical design guidance documents on behalf of the Federal Highway Administration regarding geotechnical engineering design. Dr. Bachus earned his Ph.D. in geotechnical engineering from Stanford University. He earned his M.S. and B.S. in civil engineering from the University of Illinois at Chicago Circle.

Geotechnical Engineering

Dr. Bachus has been the project manager for a wide range of projects requiring geotechnical investigation, site characterization, specialty geotechnical analysis, and geotechnical testing. He has nearly 30 years experience in geotechnical engineering, much of this related to the analysis of earth retention structures, site characterization, and soil property evaluation for a wide range of private and public-sector clients. He has extensive experience within the electric power generation industry. He recently provided senior review for annual dam inspections at fly ash retention embankments throughout the Midwestern U.S. for the American Electric Power (AEP) Company. He also participated on the forensic investigation team studying the failure of a large fly ash containment dike sited on a karst foundation in North Georgia and has investigated the cause and rehabilitation of Georgia Highway 53 after it was adversely impacted by the sinkhole activity that was activated by nearby mining activities. Other notable projects include the subsurface investigation, in situ and laboratory testing, and slope stability analysis for dredge material containment dikes in Savannah, Georgia and Wilmington, Delaware and the technical oversight for the slope stability and performance assessment of compacted earth dams throughout Georgia, and in Alabama and North Dakota. Dr. Bachus has conducted numerous static and seismic slope stability analysis and designs across the country. He applied this experience with his expertise in foundation and waste settlement evaluation, soil liner material evaluation, and laboratory testing to the Department of Energy (DOE) Fernald Environmental Management Project (FEMP) on-site disposal facility design and the geotechnical site characterization for the DOE's Savannah River Site in Aiken, SC. He has worked on the assessment of the hydraulic performance of low permeability compacted clay liners at several sites across the country, including the hazardous waste disposal site in Adams County, Colorado. Dr. Bachus has worked extensively in the area of slope stability assessment and seepage.

He directed the innovative slope stability assessment and erosion protection of a riverbank embankment subject to undermining erosion in Oklahoma City, Oklahoma and adjacent to a fly ash disposal pond in Macon, Georgia.

Dr. Bachus has also worked on residential, commercial, and industrial development projects where foundation problems developed. Specific projects included a forensic investigation in a housing development where excessive structural distress developed and gas migration occurred soon after construction was completed, design of underpinning and excavation protocols for structural foundations at an industrial development constructed over decomposing organic materials, and tunneling beneath a dike for a water intake pipe installation.

He is nationally-recognized for his expertise in the areas of in situ testing, laboratory testing, site characterization, and site stabilization for projects in soil, rock, and industrial by-product materials. Dr. Bachus has devoted a considerable effort in developing and utilizing in situ testing equipment and analytical techniques for interpreting in situ test results. These efforts have largely been directed towards the self-boring and pre-bored pressuremeter, but also include the piezoelectric cone penetrometer and the flat plate dilatometer. For the past 20 years, Dr. Bachus has worked extensively in the site characterization of sites underlain by soft soils, loose sands, stiff glacial till, and karst including the geotechnical investigation for a Salt Waste Processing Facility at the Department of Energy (DOE) Savannah River Site in Aiken, South Carolina, where it is critical to assess the engineering characteristics of a soft soil layer attributed to the weathering of limestone at a depth of nearly 100 feet. He has worked with the Federal Aviation Administration (FAA) regarding a guidance tower in northwestern Florida whose stability had been compromised by the karst foundation conditions and well as anchored towers in North Carolina and self-supporting towers in Florida damaged by hurricanes.

For the past five years, he has been extensively involved in the development and implementation of geotechnical data management systems, starting with an innovative project for the Maryland State Highway Administration (MSHA) on the Woodrow Wilson Bridge reconstruction and with the Federal Highway Administration (FHWA) regarding the development of standardized geotechnical management systems by highway agencies across the country. He has developed data management and visualization strategies for geotechnical projects on behalf of the Georgia Department of Transportation (GDOT) and has developed workshops for the transportation industry related to geotechnical data management practices.

Dr. Bachus taught in the geotechnical engineering program for eleven years at the Georgia Institute of Technology. He was primarily responsible for teaching graduate courses dealing with the engineering properties and physical-chemical properties of soils, clay mineralogy, and field testing techniques, seepage and slope stability, rock mechanics, soil construction, and soil/site improvement techniques in addition to undergraduate courses in soil mechanics and foundation engineering. One of his notable research projects was in collaboration with Southern Company Services in the southeastern US and the Electric Power Research Institute (EPRI) regarding the beneficial reuse of coal combustion by-product (CCB) materials. This project included three full-scale highway construction projects focused on the use of CCBs. He was recognized with four outstanding teaching awards from the American Society of Civil Engineers (ASCE) Student Chapter and a similar award from the Student Government Association. Dr. Bachus organized and prepared lectures for several continuing education short courses, technical seminars, and invited lectures. He currently teaches university extension courses for the University of Florida and the University of Wisconsin on the design, testing, and performance of low permeability clay liners and slope stability analysis techniques. He has prepared and delivered a course on behalf of the Tennessee Valley Authority (TVA) related to seepage and drainage design methodologies. He was co-editor of the ASTM publication STP 1084, *Deep Foundation Improvements: Design, Construction and Testing*. He recently co-authored several state-of-the-practice design guidelines titled *Geotechnical Engineering Circulars* under contract to the FHWA and is currently a certified lead instructor for the FHWA-sponsored *Soils and Foundations Workshop* and a certified instructor for the ongoing FHWA workshops titled *LRFD for Highway Bridge Substructures and Earth Retaining Structures*.

Waste Management

For the past 15 years, Dr. Bachus has worked on the siting, design, permitting, construction and closure of municipal and hazardous waste landfills throughout the United States. He has led the permitting and design efforts for waste facilities in Georgia, Indiana, Florida, Tennessee, Arkansas, Mississippi, and Illinois, and has participated on and managed several design teams for landfill projects in Pennsylvania, New York, California, Ohio, Lisbon, Portugal, and Salinas, Puerto Rico. His work includes specialized analyses for waste facilities constructed in areas underlain by karst geologic features, design of landfill bioreactors, construction over soft and compressible foundations, and innovative concepts for vertical expansion over solid waste, including the use of mechanically stabilized earth retaining structures to enhance landfill capacity. The results of these analyses have been used to assess the impact on the performance of

composite-lined landfills. Dr. Bachus has been invited to meet with state regulatory agency personnel across the country and present these analysis methodologies and approaches.

Dr. Bachus has extensive experience in the design and implementation of subsurface investigation programs in a wide range of geological settings, including soft foundation conditions and in karst areas. His work in karst areas has included hydrogeologic studies regarding preferential pathways for ground-water and gas migration, engineering solutions to permit construction over karst features, and assessment of sinkhole hazards related to land development restrictions. This work involved large projects in Georgia, Alabama, Tennessee, and Florida. Most notable are projects in northwest Georgia related to the siting of ash and gypsum disposal ponds, a gypsum disposal facility located in karst and a closed CERCLA site in Idaho containing soluble gypsum, and six sites located across Tennessee for the development of municipal solid waste disposal facilities. His expertise related to karst characterization and development was recognized recently by the invitation to deliver the keynote lecture at the 10th International Karst Conference in 2005. Dr. Bachus has directed the design of several landfill gas recovery systems which included site redevelopment and the beneficial end use of the collected gas. He has recently co-authored a design guidance manual related to the leachate distribution and gas collection in bioreactor landfills. He has worked on the design of leachate treatment systems at sites characterized by abnormally high levels of ammonia in the leachate. He has taught university extension courses related to landfill design for the past 14 years and recently taught a course regarding the slope stability assessment at solid waste facilities and on the design and operation of landfill gas and leachate recovery systems.

Dr. Bachus has conducted analyses for the vertical and lateral expansions of solid waste landfills, the design of cover systems for steep sideslopes, and the forensic assessment of landfill slope failures. He has been working on the design of final cover systems which support beneficial end-use plans and innovative leachate recirculation and gas recovery plans. He has been active in the design, operation, and compliance monitoring of landfill gas collection and control systems. Dr. Bachus' activities includes work for both private and public sector clients, including Browning-Ferris Industries; Waste Management; Chambers Development Company; USA Waste Services; Metro Dade County, Florida; Town of Babylon, New York and Town of Huntington, New York. Dr. Bachus has also worked on several remediation design projects, primarily on aspects related to low-pH and chromium impacted sites, slurry wall containment, and soil/waste stabilization and compatibility testing. He is currently working on RCRA

Facility Investigations (RFIs) and Corrective Measures Studies (CMSs) for NASA at the Kennedy Space Center, Florida.

Geosynthetics

For the past 15 years, Dr. Bachus has been active in design projects using geosynthetic and in research projects focused on geosynthetic product development and innovative use of geosynthetics. This research focused on construction survivability of geotextiles, compression creep performance of drainage composites, effects of boundary conditions on geocomposite transmissivity, hydraulic conductivity ratio testing of geotextiles, performance of reinforced soils at high strain rates, stabilization of embankments constructed over soft subgrades, hydraulic and chemical transmission measurements through geomembranes, clogging and blinding characteristics of geotextiles, and strength and compatibility testing of geosynthetic clay liners. Dr. Bachus has also been an instructor for the Federal Highway Administration (FHWA)-sponsored course on design using geosynthetics and has co-authored design guidance documents focusing on filtration design using geotextiles and drainage design of composite drainage systems, including *The GSE Drainage Design Manual*, which was received International Geosynthetics Society (IGS) Award at the 8th International Conference on Geosynthetics in Yokohama, Japan in 2006.

PROFESSIONAL HISTORY

GeoSyntec Consultants, Atlanta, Georgia; 1990 - date;
Georgia Institute of Technology, Atlanta, Georgia, Assistant Professor of Civil
Engineering, 1983 - 1990, Instructor, 1979 - 1983

AFFILIATIONS

International Geotextile Society
North American Geosynthetics Society
American Society for Testing and Materials
 D-18 Geotechnical Committee
 D-35 Geosynthetics Committee
American Society of Civil Engineers
 Geotechnical Committee, Georgia Section
 Soil Properties Committee, Member
International Society of Soil Mechanics and Foundation Engineering
Transportation Research Board
 Soil Properties Committee (A2LO2), Member (Friend of the Committee)

Technical Affiliate, Association of Drilled Shaft Contractors
United States Society on Dams – Materials for Embankment Dams Committee

LIST OF PUBLICATIONS

- 06-1 Bachus, R.C., Zettler, T.E., and Fleming, J.E., "Use of a Settlement Profiler to Assess Waste Compressibility", Accepted for publication GeoCongress'06, ASCE, Atlanta, March, 2006. .
- 05-1 Bachus, R.C., "Geotechnical Analysis in Karst: The Interaction Between Engineers and Hydrogeologists," Keynote Lecturer, *Sinkholes and the Engineering and Environmental Impact of Karst*, ASCE, Geotechnical Special Publication No. 144, San Antonio, Texas, 2005. pp 3-9.
- 04-1 Bachus, R.C., Houlihan, M.F., Kavazanjian, E., Isenberg, R., and Beech, J.F., "Bioreactor Landfill Stability: Key Considerations", MSW Management Magazine, Sept/Oct., 2004.
- 03-1 Bachus, R.C., Phillips, J., and S. Simmons, S.L., "Use Of GIS Techniques To Assist In The Stability Assessment Of Dredged Materials Containment Dams," Dam Safety Conference, 2003.
- 03-2 Bachus, R.C., "Design Guidance for Landfill Bioreactors," Second International Landfill Research Symposium, Asheville, North Carolina, 2003.
- 03-3 Bachus, R.C., Corrigan, C., Performance of Landfill Liner Systems and the Potential Benefits to RCRA Facilities, RCRA Conference, 2003.
- 03-4 Bachus, R.C., Jaber, J., and Harris, J., Design Methodology for Bioreactor Landfills, RCRA Conference, 2003.
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MAJDI A. OTHMAN, Ph.D., P.E.

Geotechnical Engineering

EDUCATION

Ph.D., Geotechnical Engineering University of Wisconsin, Madison, 1992
 M.S., Geotechnical Engineering, University of Wisconsin, Madison, 1989
 B.S., Civil Engineering, Kuwait University, 1987

REGISTRATIONS AND CERTIFICATIONS

P.E., Alabama, [REDACTED]	P.E., Kentucky, [REDACTED]	P.E., Oklahoma, [REDACTED]
P.E., Arkansas, [REDACTED]	P.E., Louisiana, [REDACTED]	P.E., South Carolina, [REDACTED]
P.E., Florida, [REDACTED]	P.E., Mississippi, [REDACTED]	P.E., Tennessee, [REDACTED]
P.E., Georgia, [REDACTED]	P.E., New Mexico, [REDACTED]	P.E., West Virginia, [REDACTED]
P.E., Illinois, [REDACTED]	P.E., North Carolina, [REDACTED]	P.E., Wisconsin, [REDACTED]

Level II Certified Design Professional, Georgia Soil and Water Conservation Commission,
 Certification Number [REDACTED]

CAREER SUMMARY

Dr. Othman has 25 years of engineering experience in geotechnical, environmental, and civil engineering projects. His work focuses on waste disposal facility siting, design, permitting, and construction; design and permitting of bioreactor landfills; landfill air permitting and compliance; design and permitting of landfill gas collection and utilization projects; hydrogeologic investigations and groundwater impact analysis and protection; remediation of contaminated sites; renewable energy projects; and construction management.

Dr. Othman has conducted geotechnical and hydrogeologic investigations and performed site suitability and feasibility evaluations for the development of new landfills on “greenfield” sites and for the lateral and vertical expansions of existing landfills. He served as the project manager and engineer of record on numerous permit applications for coal combustion byproduct (CCB) waste, hazardous waste, municipal solid waste, and construction and demolition waste landfills. He also led design efforts for low-level radioactive waste containment systems. His designs often involve the innovative application of technologies such as alternative liner and cover systems, mechanically-stabilized earth retaining walls, and bioreactor systems. Dr. Othman was the engineer of record for over 20 gas collection and control system (GCCS) design and phasing plans. He led investigations of landfill gas migration issues, performed GCCS trouble shooting activities, and developed corrective action plans for several landfill sites. Dr. Othman prepared construction bid documents for the construction of waste disposal cells and landfill GCCSs. He

assisted several clients with the development of renewable energy projects, including landfill gas to energy (LFGTE), solar, and waste to energy (WTE) projects, and with emission reduction and carbon trading activities. Dr. Othman performed contaminant fate and transport analyses to assess the potential impacts of landfills on groundwater quality, and provided expert testimony on this topic.

Dr. Othman provided advisement to regulatory agencies including the U.S. Environmental Protection Agency, California Integrated Waste Management Board, and Maine Department of Environmental Protection. He has published 25 technical articles and guidance reports. He served as an editor of the international journal Geotechnical News. Dr. Othman was a recipient of the 1994 American Society of Civil Engineers Collingwood Prize.

Waste Planning and Design

Santee Cooper – Winyah Generating Station

Dr. Othman will lead pond closure and landfill design and permitting activities for the Coal Combustion Residual (CCR) Management project for the 1200 megawatt generating facility located in Georgetown, SC. He will direct activities related to geotechnical and hydrogeological evaluations, waste preloading and consolidation, cap design, landfill design, and regulatory permitting.

Engineering Studies, Design, and Construction Services, Potential On-Site Disposal Cell (OSDC) for Low-Level Radioactive Waste, Piketon, Ohio

Dr. Othman has been serving as design team leader for the design, permitting, and construction of a potential On-Site Disposal Cell (OSDC) and associated waste disposition support facilities for the decontamination & decommissioning (D&D) of the U.S. Department of Energy's (DOE's) Portsmouth Gaseous Diffusion Plant (GDP) in Piketon, Ohio. The design activities include: (i) developing design criteria to meet functional design requirements and Applicable or Relevant and Appropriate Requirements (ARARs); (ii) site and earthwork planning and layout of support facilities to minimize the amount of imported structural fill required for OSDC construction; (iii) developing and implementing work plans for engineering studies including a Test Pad program for Compacted Clay Liner and Cover System, Leachate-Liner Compatibility Study, Soil-Geosynthetic Interface Shear Testing, Geomembrane Liner and Cover Leak Detection Study, Construction Materials Source Evaluation Study, and Large Equipment Placement Evaluation; (iv) preparation of engineering design documents including drawings, calculations, and specifications; (v) seeking regulatory approval from Ohio EPA through 30, 60, 90, and 100% design submittals; (vi) providing construction engineering support; and (vii) assisting with support for public meetings and other regulatory interface.

Tennessee Valley Authority Kingston Peninsula Site Coal Combustion By-product Disposal Landfill Design, Permitting, and Construction Support.

Dr. Othman served as the engineer of record for the design and permitting of a stormwater

detention pond geosynthetic liner system, a coal combustion by-product (CCB) temporary stacking area, and CCB permanent disposal cells. The design documents included engineering drawings, technical specifications, engineering calculations, and operations plans. He also served as the construction quality assurance (CQA) certifying engineer for these facilities.

Evaluation of Multiple Landfill Sites for Solar Power Development

Developed a database of landfill sites and ranked them for solar power development potential. Performed preliminary screening of some of the highly ranked site.

Robins Air Force Base Waste to Energy Feasibility Study

Dr. Othman conducted a feasibility study (FS) of currently available waste-to-energy (WTE) technologies that could potentially be utilized at Robins Air Force Base for using waste streams for energy generation while achieving waste reduction. Based on a preliminary evaluation of identified WTE technologies, a technology was selected that can achieve the Base's goals. This thermal conversion technology was evaluated in detail based on technical, regulatory, and economic feasibility. A conceptual design for the WTE facility was presented in the FS report.

Solar Power System Feasibility Study, County of Santa Cruz Landfill, California

Dr. Othman evaluated the technical and financial feasibility of development of solar power on the County of Santa Cruz Ben Lomond Landfill site. In particular, the top deck of the landfill and the roof of the transfer station were considered as potential areas for installation of photovoltaic panels for the production of electricity.

Special Waste Landfill Permitting and Contained Landfill Expansion, Kentucky

Dr. Othman prepared a permit modification application for the Contained Landfill in Kentucky and met with Kentucky Department of Environmental Protection (KDEP) to present the application. The application intended to: (i) redesign the landfill bottom grades; (ii) revise grades of the perimeter berms, roads, and ditches to ensure they are constructible; (iii) improve the design of the leachate collection and storage system; (iv) revise the liner and final cover system cross sections; (v) increase the final cover grades; (vi) decrease the number of sedimentation basins; (vii) change the location of the main site entrance; and (viii) add a special waste disposal unit.

Hickory Ridge Landfill Closure and Gas Collection System Design

Dr. Othman served as the designer and engineer of record for landfill closure and gas extraction system construction at the Hickory Ridge Landfill. In support of constructing a solar power system on an exposed geomembrane cap, Dr. Othman prepared surface water calculations to evaluate the increase in surface water runoff resulting from changing the final cover system from a subtitle D cover system with a vegetative soil cover to an exposed geomembrane cover. He proposed modifications to the surface water management ditches and pond outlet structures to accommodate the increased runoff rates.

Green Site Investigation and Landfill Design and Permitting, Richland Landfill, South Carolina

Dr. Othman served as project manager and engineer of record for the Richland Landfill Horizontal Expansion. He performed a site suitability study to evaluate the site with regard to location criteria included in the regulations. For this purpose, jurisdictional wetlands/waters of the U.S. occurring within the site were delineated, protected species were surveyed, and cultural resources were evaluated. Dr. Othman supervised a detailed geotechnical and hydrogeologic investigation program for the green site. He prepared design and permit documents for the landfill including engineering drawings, calculations, and plans. The project was successfully completed based on an aggressive schedule. The South Carolina Department of Health and Environmental Control (DHEC) issued a permit for the landfill. Dr. Othman provided construction support services for the horizontal expansion area.

Engineering Reports for Constructing Transmission Lines in the Buffers of Two Georgia Landfills

Dr. Othman prepared an engineering report in support of constructing Tennessee Valley Authority (TVA) transmission lines in the buffer of the Dalton-Whitfield Regional Solid Waste Management Authority (DWRSWMA) Old Dixie Highway Landfill. He also prepared an engineering report in support of constructing Georgia Power transmission lines in the buffer of the Waste Management Inc. RTS Landfill. The reports were prepared to assess the potential impacts on the Landfill operations and environmental protection measures.

Vertical Expansion Design and Permitting for the Grady Road Landfill

Dr. Othman served as project manager and engineer of record for preparing engineering design and permit application for the vertical expansion of the Grady Road Landfill located in Polk County, Georgia. Site suitability was evaluated in accordance with siting criteria included in the Georgia solid waste regulations and in Circular 14 entitled "Criteria for Performing Site Acceptability Studies for Solid Waste Landfills in Georgia". The vertical expansion involved lowering the subgrades for several cells and modifying the final cover grades by decreasing the widths of final cover surface water benches. Design calculations were prepared in support of the design modifications including static and seismic slope stability analyses, hydrologic modeling, leachate collection system hydraulic capacity and structural stability calculations, liner system settlement analyses, and surface-water management system design calculations. The Design and Operations (D&O) Plan was updated.

Riegel Ridge Landfill

For the proposed Riegel Ridge Landfill in Columbus County, North Carolina, Dr. Othman provided engineering services in support of demonstrating site suitability. He supervised the preparation of geotechnical engineering analyses including static & seismic slope stability analyses, settlement analyses, and liquefaction potential analyses. He also prepared and served as the engineer of record for the proposed facility plan drawings and report. Dr. Othman managed the installation and development of groundwater monitoring wells and rain gauges at the site to establish a base line for groundwater elevations in the wetlands adjacent to the proposed facility construction and to allow monitoring of the potential impacts of the construction on these wetlands.

Confidential Greenfield Landfill Site, South Carolina

Dr. Othman conducted a site suitability and feasibility evaluation for the development of a new landfill at a Greenfield site in South Carolina. He evaluated if developing a municipal solid waste (MSW) landfill at the site is consistent with the location restrictions included in the South Carolina Department of Health and Environmental Control (DHEC) regulations for MSW landfills, and the regulations for landfill facilities included in the county ordinances. He reviewed available information on the regional, local, and site topography, geology, and groundwater use and assessed the landfill siting restrictions related to airports, floodplains, wetlands, faults, seismic impact zones, unstable areas, drinking water supplies, perennial streams, protected aquifers, surface water bodies, and human-occupied structures. Dr. Othman also assessed if developing the landfill is technically and economically feasible. He identified issues that typically require considerable effort and time to resolve or that can make constructing the landfill relatively expensive for the developed airspace volume. As part of the feasibility Study, Dr. Othman also developed conceptual grading plans for the purpose of calculating potential airspace that can be permitted at the Site. Dr. Othman designed and supervised the implementation of a preliminary subsurface investigation program including advancement of geotechnical borings and installation of groundwater piezometers.

Oakridge Construction and Demolition Landfill, Dorchester County, South Carolina

Dr. Othman prepared a permit application for the Oakridge construction and demolition (C&D) landfill located in Dorchester County, South Carolina. The application included design drawings that showed the civil layout and the surface water management system proposed of the landfill. He analyzed groundwater elevation data available from the past several years and established the bottom grades of the landfill to maintain a separation distance from the highest groundwater elevations at the site. The application also included an engineering report; settlement, stability, and surface water design calculations; an operations plan; a contingency plan; and a closure and post-closure plan.

Low-Level Radioactive Waste On-Site Disposal Facility (OSDF), Ipoh, Malaysia

Dr. Othman managed the development of a design criteria package for Cell 2 of the low-level radioactive waste OSDF in Ipoh, Malaysia. The design criteria related to the final cover system components, geochemical barrier, surface water management system, and stability and settlement of the OSDF.

Vertical and Lateral Expansion Applications for the Tontitown Landfill, Arkansas

Dr. Othman was the project manager and engineer of record for the Tontitown Landfill vertical and lateral expansion engineering designs. Each design was presented on engineering drawings, a design report, and design calculations and was submitted to the Arkansas Department of Environmental Quality (ADEQ) for review and approval. Dr. Othman provided engineering support during the construction of the lateral expansion area including responding to design clarifications and design changes, and providing geotechnical laboratory testing interpretation.

Professional Services for the Screaming Eagle Road Landfill, South Carolina

Dr. Othman provided professional services and served as project manager since July 1994 for the

Waste Management, Inc. Screaming Eagle Road Landfill located in Elgin, South Carolina. In 1994, he modified the landfill design to include several environmental upgrades to meet criteria included in new regulations adapted by the South Carolina Department of Health and Environmental Control. In 1995, he prepared design and construction drawings for vertical expansion on an old unlined portion of the landfill. He performed static and seismic slope stability analyses and settlement analyses for the liner system to be placed on the existing waste and designed a gas collection system for the existing waste. Also in 1995, Dr. Othman prepared construction drawings for an 18-acre cell and for a new site entrance facility. In 1996, he prepared permit applications for vertical expansion of the landfill and for lowering the base grades of a portion of the landfill. The applications included design drawings, which addressed the civil layout of the proposed expansion area, as well as leachate, gas, and surface water management systems proposed of the landfill. The application also included an engineering report, design calculations, construction quality assurance plan, gas monitoring plan, and closure and post-closure plan. He investigated the hydrogeologic impacts of the proposed modifications and assessed the adequacy of an existing network of ground water monitoring wells. Between 1997 and 2011, Dr. Othman prepared construction documents for several landfill cells and for closure of landfill areas that reached final grades.

Fernald Environmental Management Project.

Dr. Othman prepared design calculations for the liner and cover system and leachate management system components of the on-site disposal facility (OSDF) for low level radioactive waste at the U.S. Department of Energy Fernald site near Cincinnati, Ohio. The key design issues for this effort were the design life (200 to 1000 years), nature of waste, and regulatory compliance. Dr. Othman also prepared an operation and maintenance plan for the OSDF systems to be used by personnel at the site. In addition, Dr. Othman interpreted compacted clay test pad laboratory and field compaction and hydraulic conductivity test data.

Zoning Application, Alternative Final Cover Permitting, and Closure Construction Support, Piedmont Landfill, North Carolina

Dr. Othman prepared a general industrial zoning application for the Piedmont Landfill which was submitted to the Winston Salem City-Forsyth County Planning Board (Board). The application included site development plans and details. The Design and Development Review staff recommended the Board approve the application. In 2004, Dr. Othman prepared an alternative final cover system application for use in closure of the landfill. The application was approved by the North Carolina Department of Environment and Natural Resources (NCDENR). In 2005, Dr. Othman prepared construction drawings and design analyses to support reconstruction of a section of the final cover system which experienced slope stability issues. Dr. Othman participated in a meeting with the NCDENR regulators to discuss the project and obtain approval of the design. The final cover system was successfully reconstructed and has performed as designed since 2005.

Bioreactor Technology Design for the Hickory Hill Landfill, South Carolina

Dr. Othman prepared detailed design/permitting documents and served as engineer of record for the Hickory Hill Landfill Bioreactor Technology Implementation project. He designed a liquids

injection system and a landfill gas (LFG) extraction system for the bioreactor. He performed analyses to evaluate the proposed bioreactor design and to assess its compliance with applicable environmental regulations. The analyses he performed relate to: (i) designing the liquid injection system including estimating size and spacing of pipes and properties of pump; (ii) designing the gas extraction system including sizing the header pipe, flare, blower, and condensate traps; (iii) evaluating the maximum head on the liner system; and (iv) evaluating factors of safety for stability of the bioreactor landfill. Dr. Othman prepared an operations plan, monitoring and data collection plan, and a contingency plan for the bioreactor.

Henrico Road Landfill Investigation, DeKalb County, Georgia

The Atlanta International Industrial Park, Inc. (AIIP) was considering the purchase of the 50-acre, 25-year old Henrico Road Landfill site for potential redevelopment. The site was operated as a solid waste landfill for five years before it was closed in 1980. Dr. Othman reviewed relevant background information to identify potential issues related to environmental liability at the site and related to redevelopment of the site. Dr. Othman provided recommendations for additional investigations related to the identified potential issues. He performed methane monitoring along the perimeter of the landfill to evaluate if landfill gas is migrating away from the site and conducted a site reconnaissance visit to document the condition of the site. Dr. Othman summarized the findings of his evaluation and investigation in a report to AIIP.

Expansion Design and Construction Drawings for the Hickory Hill Landfill and Recycling Center.

Dr. Othman served as project manager and engineer of record for a vertical expansion application for the Hickory Hill Landfill and Recycling Center located in Ridgeland, South Carolina. The application proposed to increase the permitted airspace of the landfill by increasing the heights of the perimeter berms and by increasing the final slopes of the landfill. The application consisted of a set of design drawings, engineering design report, and several plans (including an operational plan, a construction quality assurance (CQA) plan, a groundwater monitoring plan, and a gas monitoring plan). Dr. Othman prepared construction drawings and estimated quantities of construction materials for several landfill cells and for closure of a landfill area that reached final grades.

Professional Services for the Chilton County Landfill.

Dr. Othman prepared a minor permit modification application for the Chilton County Landfill located in Thorsby, Alabama, to propose changes to the perimeter berm slope inclination, liner system configuration, and leachate transmission system piping network. He prepared construction bid documents (i.e., drawings, specifications, CQA plan, and bid forms) for several disposal areas at the site. He also prepared a waste excavation plan for an old disposal area at the site to allow for utilization of underlying soils in the construction of the new disposal areas at the site.

Design of the Oakridge Landfill, South Carolina

Dr. Othman prepared and served as the engineer of record for a permit application for vertical expansion of the Oakridge Landfill, Dorchester County, South Carolina. The expansion involved construction of a 40-ft high berm along the entire perimeter of Phase 2 and increasing the final

slope of the landfill to 3.5H:1V. The application included design drawings, which addressed the civil layout of the proposed expansion area, as well as leachate, gas, and surface water management systems proposed of the landfill. The application also included an engineering report, which described the proposed expansion design and summarized engineering evaluations of the design. The application included the results of liquefaction analyses performed for the site and proposed methods for ground improvement based on a blast densification pilot program implemented at the site. Dr. Othman also prepared drawings and material quantity estimates for construction of new landfill cells and for closure of old cells at the landfill.

Design and Permitting of the Bolton Road Landfill, Atlanta, Georgia

Dr. Othman prepared and served as the engineer of record for two permit applications for the expansion of the Bolton Road Landfill, Atlanta, Georgia. The expansions involved construction of mechanically stabilized earth retaining walls (MSERWs). The applications included design drawings, which addressed the civil layout of the proposed expansion area as well as leachate, gas, and surface water management systems proposed of the landfill. The applications also included engineering reports which described the proposed expansion design and summarized engineering evaluations of the design including: (i) static and seismic slope stability of the landfill foundation soils, waste mass, liner and cover systems, and the MSERW; (ii) settlement of foundation soils and waste mass and their impacts on landfill systems; (iii) and performance of the leachate, gas, and surface water management systems. Dr. Othman also prepared construction level drawings, specifications, and estimates of construction material quantities for the expansion areas. When the site reached final grades in 2009, Dr. Othman served as the project manager and engineer of record for closure of the 30-acre landfill. He prepared construction drawings and material quantity estimates for the project.

Seismic Impact Analyses of three BFI Landfills.

Dr. Othman performed seismic impact analyses for the Browning-Ferris Industries (BFI) Vienna Junction Landfill, Michigan, the Bigfoot Run Landfill, Ohio, and the Ottawa County Landfill, Ohio. He Performed liquefaction potential, pseudo static slope stability, and simplified deformation analyses for all three landfills, and prepared reports to summarize these analyses.

Liner System Evaluation at Norridgewock Landfill.

Dr. Othman evaluated potential sources and causes of elevated levels of liquid in the leak detection system of Phase 7 of the Norridgewock Landfill, Maine. He prepared a detailed evaluation report summarizing the results of the evaluation.

Liner System Design for Olinda Alpha Landfill.

Dr. Othman prepared an engineering design report for a canyon area sideslope liner system at the Olinda Alpha Landfill, Orange County, California. The report addressed the mechanical and hydraulic design of components of the liner system, a leachate collection and removal system (LCRS), a subdrain seepage collection system (SSCS), and a leachate transmission and storage system (LTSS).

Evaluation of Liquid Collection in Lysimeter Located beneath the Pine Bluff Landfill.

Dr. Othman estimated volumes of liquids to be collected in a 10,000 ft² lysimeter constructed beneath the sump area of a cell at the Pine Bluff Landfill located in Cherokee County, Georgia. He identified potential sources of liquids and estimated their magnitudes and the rates at which they would accumulate in the lysimeter. He prepared the first lysimeter monitoring report, which summarized actual volumes of liquids collected and compared these volumes to the predicted volumes.

Final Cover System Design for Newberry Springs and Lucerne Valley Landfills.

Dr. Othman prepared design reports to demonstrate that in the arid desert environment of the San Bernardino Valley, California, an alternative final cover system, which contains a thick sandy soil layer and a GCL, satisfies the performance standards established in the State of California and federal regulations, and outperforms the prescriptive cover which contains a compacted clay barrier. The USEPA HELP model was used to evaluate the hydraulic performance of the alternative and the prescriptive cover systems.

Stability Analyses Two BFI Landfills in Tennessee.

Dr. Othman performed liner system shear strength laboratory testing and static and seismic slope stability analyses for the BFI Middle Point and Carter Valley Landfills, in Rutherford County and Hawkins County, Tennessee, respectively.

GCLs in Composite Liners for ALCOA Secure Landfill.

Dr. Othman collected and analyzed data on flow in leak detection systems (LDSs) located beneath composite liners which incorporate GCLs. He made recommendations regarding use of GCLs in the secondary composite liner at the ALCOA Secure Landfill, Massena, New York.

Permit Application for CSI Landfill.

Dr. Othman prepared several parts of a permit application for the Central States Inc. Waste Disposal Systems (CSI) Landfill, Weddington, Arkansas, including leachate management plan, engineering design report, and geotechnical report.

Permit Application for Countryside Landfill.

Dr. Othman prepared a leachate management plan and an engineering report for the USA Waste Services, Inc. Countryside Landfill, Illinois, as part of a permit application.

Seismic Impact Analysis for Lorain County Landfill.

Dr. Othman performed analyses to evaluate the impact of seismic events on the structural components of the Lorain County Landfill, Ohio.

Pollution Prevention Plan for Clinch River Landfill.

Dr. Othman prepared a storm water pollution prevention plan to address construction of the Appalachian Power Company (APCo) Clinch River Plant Area 3 Coal Ash Landfill Expansion and associated structures in Russell County, Virginia.

Design of Soil Borrow Area at the Cuyahoga Landfill.

Dr. Othman designed a soil borrow area and haul road for the Cuyahoga Landfill, Solon, Ohio. He prepared a sediment and erosion control plan for the site. He also prepared a storm water pollution prevention plan and a National Pollutant Discharge Elimination System (NPDES) permit application. He prepared a wetlands delineation report and a wetlands crossing permit application.

Siting Report for New Halls Ferry Road Landfill.

Dr. Othman prepared a siting report for the New Halls Ferry Road Landfill, St. Louis County, Missouri. He considered siting restrictions such as airports, floodplains, wetlands, and parks.

Evaluation of Liner System at Arbor Hills Landfill.

Dr. Othman evaluated the performance of a liner system constructed over existing waste at the Arbor Hills Landfill, Washtenaw County, Michigan. He performed settlement analyses to estimate effects of local waste heterogeneities on strains in the liner system.

Anchor Trench Design for ALCOA Secure Landfill.

Dr. Othman developed a model for the analysis of a liner system embedded in an anchor trench. He performed analyses to estimate the pullout capacity of an anchor trench at the ALCOA Secure Landfill, Massena, New York, and to compare this capacity to stresses that may develop as a result of construction and operational practices.

Material Specifications for Babylon Landfill.

Dr. Othman wrote construction material specifications for the Babylon Ash Landfill, New York, final cover system.

Design of Cover Systems for Two Anne Arundel County Landfills.

Dr. Othman performed engineering analyses to estimate settlement and evaluate slope stability of the final cover system and to design the final cover system drainage layer for the Sudley Road and Millersville Landfills, Maryland. He reviewed computations and assumptions of surface water management system design and analyses.

Slope Stability Analysis of Eagle Mountain Landfill.

Dr. Othman performed slope stability analyses for the 1H:1V sideslope liner system of the Eagle Mountain Landfill, California, using the computer programs XSTABL and XSP.

Review of Hyland Ash Monofill Design.

Dr. Othman reviewed engineering and hydrologic design analyses for the Hyland Ash Monofill, Angelica, New York, as part of preparation for expert testimony (for Dr. Craig Benson).

Air Permitting, Landfill Gas Collection and Control, and Landfill Gas to Energy

Webster Parish Landfill GCCS Construction Quality Assurance

Dr. Othman served as the Construction Quality Assurance (CQA) certifying engineer for a gas collection and control system (GCCS) at the Webster Parish Landfill located in Minden, Louisiana. The GCCS consisted of 22 vertical gas extraction wells, thousands of feet of lateral

and header pipes, control valves, and condensate sumps.

Crymes Landfill Perimeter Gas Extraction System and Closure Design/Build Services

Dr. Othman served as the engineer of record for the preparation of a gas collection and control system (GCCS) design and permitting package for the Crymes Landfill located in Gwinnett County, Georgia. He also served as the principal in charge for constructing the GCCS components including vertical gas extraction wells, header lines, condensate sumps and pumping system, flare station, and methane monitoring wells. Dr. Othman assisted in updating the corrective action plan for the site, prepared closure design and permitting documents, and served as the project director for the site closure construction activities.

Greenhouse Gas Monitoring Plan and Database Development for Several Landfill Sites

Dr. Othman prepared greenhouse gas (GHG) monitoring plans and databases to comply with the U.S. Environmental Protection Agency (USEPA) Mandatory Greenhouse Gas (GHG) Reporting Rule for the Dalton-Whitfield Regional Solid Waste Management Authority Landfill and the Catoosa County Landfill, both located in Georgia. The monitoring plans identified the processes and methods used for data collection as well as calibration of the various monitors (e.g., landfill gas flow meter, gas analyzer, and waste truck scale). The databases included detailed information for each GHG source category (e.g., landfill itself, flare, etc.) and GHG monitors. They also included the GHG monitoring data records and calculations of total methane quantity generated by landfill, methane destroyed by each landfill gas destruction device (e.g., flare), and emissions from the landfill and from each destruction device.

Methane Migration Corrective Action Plan and Other services for the Catoosa County Landfill

Dr. Othman served as project manager and engineer of record for the preparation and implementation of a methane migration corrective action plan for the Catoosa County, Georgia Landfill. He evaluated existing information and data related the landfill, performed a field investigation program to assess the performance of the gas collection and control system (GCCS), analyzed the newly-collected and historic field data, evaluated the design and operation of the GCCS, made recommendations for upgrades and/or modifications to the GCCS, assessed the design and performance of the perimeter gas extraction trenches, evaluated the extent of methane migration and potential pathways and causes of gas migration, and prepared a corrective action plan that summarized the results of the above activities and associated recommendations. Dr. Othman managed a field and laboratory testing program to finger print gas detected on an adjacent property and determine its source. He directed all activities related to implementation of phase 1 of the corrective action plan including balancing of the GCCS wells, monitoring and balancing of the active gas extraction trenches, manual dewatering of several GCCS wells, inspection and repair of air leaks into some of the GCCS wells, inspection of silt accumulation in a few GCCS wells, and relocation of one methane monitoring probe. Dr. Othman designed a perimeter gas collection system for Site 1 to control gas migration. He also assisted the County staff with evaluating feasibility of a gas to energy facility at the site and with discussions with the utility that will be purchasing renewable power from the facility.

Landfill gas to energy feasibility and carbon trading, Fulton County Merk/Miles Road and Morgan

Falls Landfills, Georgia

Dr. Othman served as the project manager for evaluating potential landfill gas to energy (LFGTE) use options for the Merk/Miles Road Landfill. As part of this evaluation, a detailed economic cost-benefit model for electricity generation was developed and the potential of obtaining carbon credits from the Chicago Climate Exchange (CCX) for voluntary gas collection was identified as a significant revenue stream for the County. Preliminary offset project approval was obtained for both of the County's landfills from the CCX. As part of this approval, a preliminary baseline survey of green house gas (GHG) emissions was performed in accordance with World Resource Institute's GHG protocol, from County-owned facilities. Dr. Othman supervised work related to the aggregation, verification, registration, and sale of carbon credits from both landfills at the CCX.

Escambia County Perdido Landfill Gas to Energy Feasibility Study

Dr. Othman participated in a feasibility study to evaluate landfill gas to energy (LFGTE) development options for Escambia County's Perdido Landfill in Florida. Options included electricity generation using Internal Combustion (IC) engines and direct use at facilities located 7 to 10 miles away from the landfill. He assisted the County in the preparation of an RFP for the project and with reviewing received proposals.

Bid Package and CQA for Gas Collection and Control System at the West Camden Landfill

Dr. Othman served as the engineer of record for the preparation of a gas collection and control system (GCCS) bid package and for performing construction quality assurance (CQA) activities for the GCCS at the West Camden Landfill located in Benton County, Tennessee. The GCCS construction consisted of installing gas extraction wells and gas collection header lines and connecting the new gas extraction wells to the existing and new gas collection headers using lateral gas collection pipes. The bid package consisted of engineering drawings, technical specifications, quantity estimates and bid forms, narrative describing the scope of work, and sample contract documents. The GCCS CQA activities included participation in pre-construction and project progress meetings, preparation of meeting minutes, full-time field monitoring, review of surveying data, verification that equipment and materials used by the Contractor are consistent with the technical specifications, review of contractor submittals, documentation of the Contractor's and manufacturer's construction quality control activities, preparation of daily field reports, and preparation of as-built drawings and a Final CQA certification report.

Gas Collection and Control System Designs for several landfills

Dr. Othman supervised and served as certifying engineer for the preparation of New Source Performance Standards (NSPS) gas collection and control system (GCCS) designs for the Pine Bluff Landfill, Cherokee County, Georgia, the Hickory Hill Landfill, Jasper County, South Carolina, the Seminole Road Landfill, DeKalb County, Georgia, and the Chestnut Ridge Landfill, Anderson County, Tennessee. Each GCCS design included engineering drawings and detailed calculations including gas generation rate estimates, radius of influence calculations, and lateral and header pipe head loss calculations. The engineering drawings illustrated the locations of the gas extraction wells, lateral and header pipes, flare stations, and condensate drip legs and knockout sumps.

Gas Collection and Control System Phasing Plans for several landfills

Dr. Othman supervised and served as certifying engineer for the preparation of gas collection and control system (GCCS) life cycle (phasing) plans for the Chastang Landfill, Mt. Vernon, Alabama, the Chestnut Ridge Landfill, Anderson County, Tennessee, the Hickory Hill Landfill, Jasper County, South Carolina, the Superior Landfill, Chatham County, Georgia, and the West Camden Landfill, Benton County, Tennessee. Each GCCS phasing plan included engineering drawings that illustrated temporary and final GCCS components for different stages of the landfill operational life, showed which measures to install and which measures to abandon for every phase, and provided GCCS construction quantity estimates for each phase. The phasing plans emphasized system requirements to maintain landfill compliance for NSPS, gas migration, and odor control.

Air Permitting and Emission Reporting for the Grady Road Landfill

Dr. Othman prepared an initial Title V permit application for the Grady Road Landfill located in Polk County, Georgia. He visited the site, reviewed existing documents, and interviewed site personnel to define all potential emission units present at the site. The application included facility-wide information, an inventory of emission units and applicable rules, and estimates of potential emissions as well as anticipated actual emissions. A draft Title V permit was issued for the facility in June 2004. Dr. Othman also submitted to the Air Protection Branch of the Georgia Department of Natural Resources a 2003 NMOC Emission Rate Report for the facility.

Live Oak Landfill Gas Collection and Control Plan, DeKalb County, Georgia

Dr. Othman supervised the development of a gas collection and control system (GCCS) plan for the Live Oak Landfill. The plan consisted of design drawings that illustrated the proposed GCCS components including vertical gas extraction wells, lateral and header pipes, condensate collection system, and flare/blower stations. A design report was also prepared which included gas generation, well radius of influence, pipe sizing, and flare/blower capacity calculations. A methane surface emission monitoring plan was also prepared as part of the GCCS plan.

Gas Collection and Control System Design, Catoosa County Landfill Site 2

Dr. Othman served as engineer of record for the preparation of a gas collection and control system (GCCS) for Site 2 at the Catoosa County, Georgia Landfill. The design involved converting existing passive vents in the landfill into active extraction wells and connecting the well field of Site 2 to the existing flare/blower station of Site 1.

Seminole Road Landfill, DeKalb County, Georgia

DeKalb County, Georgia selected Geosyntec to perform environmental monitoring and gas collection and control system (GCCS) operation and maintenance (O&M) activities at the Seminole Road Landfill for more than eight years. Dr. Othman served as project manager or principal-in-charge for Geosyntec. Under his management, Geosyntec provided services related to groundwater, surface water, and leachate monitoring; methane monitoring and reporting; surface emission monitoring; monthly monitoring and adjustment of the GCCS and a perimeter control system; Title V reporting; flare/blower station maintenance; construction of gas extraction wells, header line, and condensate sump; facility Title V and SIP permitting; landfill gas to

energy (LFGTE) facility design/build RFP preparation and administration and construction management; and conversion of landfill gas to compressed natural gas for alternative-vehicle fuel project grant application, preliminary design, permitting, RFP development, and construction support.

Hydrogeologic Investigations and Groundwater Monitoring and Protection

Request for Suspension of Groundwater Monitoring at the Valencia Regional Landfill

Dr. Othman performed fate and transport analyses for the proposed Section 27 North and South Cells at the Valencia Regional Landfill, Los Lunas, New Mexico. The analyses were performed using the U.S. EPA MULTIMED computer model to demonstrate that there is no potential for migration of hazardous constituents from the landfill to the uppermost aquifer during the active life or post-closure care period of the landfill. This demonstration was performed to request suspension of the ground water monitoring requirements of the New Mexico Administrative Code for the landfill. Dr. Othman provided responses to comments and expert testimony in support of the request, which was approved by the New Mexico Environment Department and the secretary of the state.

Assessment of Impacts to Ground-Water Quality at the Graham Road Facility.

Dr. Othman evaluated the containment capabilities of the liner system designed for an expansion area at the Graham Road Recycling and Disposal Facility located in Medical Lake, Washington. He assessed the potential for constituent migration from the facility, through the liner system, to nearby domestic water wells. For this effort, he performed analyses to estimate potential leachate generation rates and rates of leachate migration through the liner system. Then, he evaluated chemical constituents found in leachate collected from an existing disposal unit and performed quantitative assessments of leachate migration to nearby wells using the U.S. EPA MULTIMED computer model.

Liner System Performance Demonstration for the Federal Paper Board Landfill Site.

Dr. Othman evaluated compliance of a proposed alternate liner system for the Federal Paper Board Landfill located in Augusta, Georgia, with ground water protection standards. He assessed the potential for constituent migration from the landfill, through the liner system and the vadose zone, to the underlying aquifer and then to a point of compliance coinciding with the property line. The fate and transport analyses were performed using the computer program MULTIMED.

Groundwater Protection Demonstration for the Bolton Road Landfill

Dr. Othman demonstrated compliance of the Bolton Road Landfill with ground water protection standards for municipal solid waste landfills in the State of Georgia. He assessed the potential for the landfill to impact groundwater quality using MULTIMED.

Site Hydrogeologic Investigations and Groundwater Monitoring Plans for Several Landfills

Dr. Othman planned and conducted several hydrogeologic investigation programs for potential landfill sites, and prepared groundwater monitoring plans for several landfills including the Pine Hill Landfill, Oakwood Landfill, Screaming Eagle Road Landfill, 78 C&D Landfill, and Bolton Road Landfill.

Hydrologic Evaluation of North Sea Landfill.

Dr. Othman performed water balance analyses using the USEPA HELP model to evaluate the performance of the cover system at the North Sea Landfill, New York.

Hydrologic Evaluation of Azusa Landfill.

Dr. Othman performed water balance analyses using the USEPA HELP model to evaluate the performance of Zone II of the Azusa Landfill, California.

Site Remediation

On-site Disposal facility, Hanlin-Allied-Olin Site, Moundsville, West Virginia

The Hanlin-Allied-Olin site is a former chemical manufacturing complex located along the Ohio River near Moundsville, West Virginia. As result of the manufacturing processes, more than one million pounds of chemical product are estimated to be in the subsurface alluvial deposits, and several solid waste management units (SWMUs) exist at the site. The United States Environmental Protection Agency (USEPA) approved the concept of an on-site disposal facility (OSDF) for the land disposal of more than 400,000 cubic yards of process waste material and contaminated soils. Dr. Othman served as the engineer of record for the design of the OSDF, which consisted of two separate double-lined waste disposal cells equipped with leachate collection and leak detection systems. A mechanically stabilized earth retaining wall was used to maximize the disposal capacity of the cells. A geotechnical testing program was performed on the wastes and soils found at the site. The results of the testing program were incorporated into detailed settlement and slope stability analyses performed to ensure adequate factors of safety existed for the OSDF cells. The OSDF design was approved by USEPA and was successfully constructed, filled, and closed.

Pond Closure Design and Construction Support, Hanlin-Allied-Olin Site, Moundsville, West Virginia

One of the ponds at the Hanlin-Allied-Olin site received spent lime and muds that came from the purification of raw brine. The 1.7-acre geomembrane-lined pond had berms that rise to a height of up to 12 feet above the surrounding grade. Dr. Othman developed a remedy for this pond that included consolidating and dewatering the waste, creating a stable subgrade for final cap, and installing of a geosynthetic cap system which would isolate the waste and reduce rainwater infiltration into the waste. Dr. Othman supervised a geotechnical investigation and laboratory testing program to obtain relevant geotechnical properties for the waste and the berms including moisture content, strength, and consolidation properties. Dr. Othman supervised geotechnical analyses that showed the waste was not strong enough initially to consolidate using a single loading event. Therefore, the closure plan included staged construction to allow the shear strength of waste to improve over time. The closure design components included: surface grading/smoothing; installation of a water collection system, installation of pore pressure and settlement monitoring devices, two stages of fill loading, and construction of a geosynthetic cap system. Currently, the two stages of fill loading have been completed and the collected data shows waste has behaved in a manner that is consistent with the predicted behavior in terms of consolidation/dewatering and settlement.

Remedial Design for the Yeoman Creek Superfund Site

Dr. Othman took a major role in remedial design of the Yeoman Creek Superfund Site located in Waukegan, Illinois. He developed design drawings and calculations to support selected final remedies including contaminated sediment removal and consolidation, waste excavation and relocation, creek isolation, final cover of waste, and gas extraction and treatment. Dr. Othman prepared technical documents in support of use of cost-saving design alternatives. He designed an active gas extraction system for a large landfill unit and designed a passive gas venting system for two small landfill units at the Site. He prepared gas system layout and design drawings, performed design calculations, and prepared technical specifications for the piping network, condensate collection traps, transfer forcemain, and storage tank, and blower and flare station. He participated in meetings and engaged in technical discussions with the U.S. Environmental Protection Agency and the Waukegan storm-water management commission in support of the selected design. He served as the design engineer-of-record for the project during construction.

Bailey Superfund Site.

Dr. Othman evaluated the hydraulic performance of alternatives for a remedial cap design for the Bailey Superfund Site in Orange County, Texas. He compared the performance of these alternatives and made recommendations for appropriate cap selection. He also performed detailed analyses to support use of a light geosynthetic cap to be placed over highly compressible materials found at the site.

Field Testing and Construction Monitoring

Geotechnical Investigation, Analyses, and Monitoring for Embankment Construction over Soft Clays

Dr. Othman evaluated construction of a 25-ft high roadway embankment over very soft saturated clay. The roadway needed to pass over a 25-ft wide creek bed. Anticipating the construction of the embankment near the creek area was complicated, the original design (by others) called for the construction of a bridge over the creek and surrounding area. However, due to the high cost of the bridge the owner requested Dr. Othman evaluate if and how a roadway embankment can be constructed in lieu of a bridge. He completed a detailed geotechnical investigation program at the site, including advancement of boreholes, standard penetration testing, collection of undisturbed samples, and installation of piezometers. A laboratory testing program was carried out on the soil samples and detailed slope stability and settlement analyses were performed under his direction. Dr. Othman concluded that staged construction of the embankment is feasible and made recommendation on construction and monitoring. The roadway embankment construction was completed successfully.

Hopkins County Regional Landfill, White Plains, Kentucky

Dr. Othman assisted in the preparation of an application for minor modification of the existing permit for the Hopkins County Regional Landfill located in White Plains, Kentucky. The minor permit modification addressed decreasing the perimeter berm size, adding sideslope riser pipes for leachate collection, modifying temporary liner termination and anchor trench details, adding protective soil layer for the liner system, and resizing the leachate storage tank pad area. Dr. Othman successfully managed the construction quality assurance (CQA) personnel and served as

the engineer of record for the construction of the first phase of the landfill. Dr. Othman served as an expert witness and testified in an administrative hearing about the design and construction of the leachate drainage layer component of the liner system.

Blast Densification Pilot Program and Full-Scale Implementation

Dr. Othman designed and implemented a pilot program for blast densification of a 15-ft thick, 30-ft deep very loose and saturated sand layer underlying a site located in a seismic area along the eastern U.S. The objective of the program was to assess the effectiveness of blasting on increasing the density and shear strength of the sand, and thus decreasing the potential for liquefaction under seismic loading conditions. Dr. Othman wrote a work plan for the pilot program and coordinated work of drilling, blasting, vibration monitoring, and surveying subcontractors. He documented results of pilot program and made recommendations regarding full-scale implementation of blast densification at the site. Dr. Othman successfully managed the first phase of the full-scale implementation in late 2005/early 2006, the second phase in 2007, and the third phase in 2011.

Evaluation of Test Fill at the Rocky Mountain Arsenal.

Supervised activities related to obtaining 14-in. diameter block samples from a compacted clay test fill at the Rocky Mountain Arsenal, Commerce City, Colorado. The test fill was built to demonstrate the ability to construct a low hydraulic conductivity clay liner for a proposed landfill at the site. Evaluated results of hydraulic conductivity testing performed on the block samples. Peer reviewed the test fill construction and testing documentation report.

Shear Strength of Geosynthetic Clay Liners (GCLs).

Dr. Othman designed and was responsible for construction quality control of 13 final cover system test plots incorporating different GCLs on 3 horizontal to 1 vertical (3H:1V) and 2H:1V slopes. The plots were built in November 1994 in Cincinnati, Ohio, to evaluate the internal mid-plane shear strength of GCLs under field conditions.

Field Infiltration Test at Highway 36 TSDF.

Dr. Othman analyzed data from infiltration tests conducted using the sealed double-ring infiltrometer (SDRI) at Highway 36 Treatment, Storage, and Disposal Facility in Colorado.

Effect of Freeze-Thaw on a Test Pad at Ridge View Landfill.

Dr. Othman obtained large block and Shelby tube specimens from a test pad at the Ridge View Landfill (Waste Management of Wisconsin Inc.). He performed hydraulic conductivity tests in flexible-wall permeameters on specimens from before and after winter to evaluate damage caused by freeze-thaw.

Construction of Test Plot at Live Oak Landfill.

Dr. Othman assisted in the construction and testing of a final cover test plot at the Waste Management Inc. Live Oak Landfill, Atlanta, Georgia. The test plot was instrumented with a lysimeter for collection of infiltration water, a surface runoff system to collect surface water runoff, and climatologic instruments to measure precipitation, temperature, relative humidity,

solar radiation, and wind speed and direction. The purpose of the test plot was to evaluate the hydrologic performance of landfill final covers.

Hydrology and Hydraulics

Design of a Major Storm Water Collector Pipe Outfall Area at the Beirolas Landfill.

Dr. Othman prepared a design and construction report for the Beirolas Main Collector Pipe (BMCP) outfall area at the Beirolas Landfill, Lisbon, Portugal. The BMCP is a 3.5 m x 4.0 m reinforced concrete pipe which discharges storm water at a design flow rate of 29 m³/sec to the Tagus River Estuary. The pipe was built on 10-m deep piles in very soft soils. The 50 m x 170 m pipe outfall area was graded and stabilized to prevent soil erosion and assure slope stability of the soft soils and nearby structures.

Evaluation of Canal Liner for Lake Charles Plant.

Dr. Othman evaluated the use of several types of geomembranes to line the bottom of a bypass canal at the Lake Charles Plant, Louisiana. He assessed several potential dewatering techniques and designed a dewatering system capable of keeping the bottom of the canal accessible by construction equipment and laborers. He performed slope stability analyses to verify canal slopes have adequate factors of safety against instability. To ensure compatibility of the selected geomembrane to effluent from the plant, he evaluated effluent chemical constituents and assessed resistance of the geomembrane to these constituents.

Research and Regulatory Advisement

Effect of Freeze-Thaw on Compacted Clays

Dr. Othman conducted research on the effects of freeze-thaw on the structure and hydraulic conductivity of compacted clays. He performed numerous laboratory tests to investigate the effects of soil type, compactive effort, molding water content, number of freeze-thaw cycles, ultimate freezing temperature, rate of freezing, and state of stress on hydraulic conductivity. He conducted a small-scale field experiment to evaluate the effects of freeze-thaw on compacted clays in the field. Dr. Othman studied ice lenses and shrinkage cracks that form in frozen soils and modeled flow of fluids through soil containing cracks. Furthermore, he investigated the effects of admixtures (flyash, cement, and lime) on the hydraulic conductivity of compacted clays and evaluated potential for admixtures to minimize damage caused by freeze-thaw.

Performance of Modern Landfills

Dr. Othman took a lead role on a project for the U.S. Environmental Protection Agency (U.S. EPA) on evaluation of performance of modern landfills. He collected and analyzed data on quantities and qualities of leachate collection and leak detection system flows for more than 55 double-lined landfills in the U.S. He evaluated the hydraulic efficiency of single and composite liners and the effectiveness of final cover systems. He studied leachate generation rates for active and closed landfills and how these rates are related to region, type of waste, and time factors. Dr. Othman compared actual leachate generation rates to typical design values estimated using the U.S. EPA HELP model. He also determined how leachate chemical quality varies based on the landfill region and type of waste. The project findings and results were summarized

in a U.S. EPA guidance document.

Final Cover System Design and Performance Criteria

Dr. Othman prepared a final cover system guidance document for the State of Maine Department of Environmental Protection (MDEP). The document summarized the state of practice regarding municipal solid waste landfill final cover system design considerations and methods. MDEP uses this document as a technical resource for training new employees of the department and for review of final cover system designs. Dr. Othman evaluated landfill daily, intermediate, and final cover materials, designs, laboratory and field testing procedures, and performance standards for the California Integrated Waste Management Board (CIWMB). He authored a guidance document titled "Performance Standards for Landfill Covers".

Effect of Admixtures on Compacted Clays Research, Spring 1991.

Investigated the effects of admixtures (flyash, cement, and lime) on the hydraulic conductivity of compacted clays. Evaluated potential of admixtures for minimizing the damage caused by freeze-thaw cycling. This research was funded by the Graduate School at the University of Wisconsin-Madison.

Hydrologic Analysis of Portage Co-composting Landfill.

Dr. Othman performed research sponsored by the Solid Waste Research Council, State of Wisconsin, on hydrologic analysis of the Portage Co-composting Landfill. He measured the in-situ hydraulic conductivity of a natural soil liner using a SDRI. He performed laboratory tests to measure shear strength, compaction, hydraulic conductivity, resistance to desiccation and freeze-thaw, and leachate characteristics of compacted municipal solid waste compost. He performed laboratory tests to estimate geotechnical characteristics of landfill liner and cover materials.

Construction of Waste Geotechnics Laboratory, Fall 1990.

Designed, built, and supervised Waste Geotechnics Laboratory at the University of Wisconsin-Madison.

Uplift Capacity of Shallow Anchors Research, September 1988-July 1990.

Conducted research (under the supervision of Professor Tuncer B. Edil at the University of Wisconsin-Madison) on the effect of plate flexibility on the pullout capacity of shallow anchors in sand. Performed experimental and analytical analyses on anchors subjected to uplifting. Designed, developed and tested a model for the analysis of flexible plate anchors. This research was funded by the University of Wisconsin Sea Grant Institute.

Plastic Collapse of Portal Frame on Sand Research, May 1986-May 1987.

Performed research (under the supervision of Professor Mohammad Abdul-Rahman at Kuwait University) on the plastic collapse of portal frame built on sand. Examined the effects of footing size, column eccentricity, and column-foundation connection on the performance of the structure-foundation system. This research was funded by the College of Engineering and Petroleum at Kuwait University.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Atlanta, Georgia, 1992- Present, Principal, 2008-Present [Associate, 2002-2008 Senior Engineer, 1998-2002, Project Engineer, 1994-1998, Assistant Project Engineer, 1992-1994]
University of Wisconsin, Madison, Department of Civil and Environmental Engineering, Graduate Research Assistant, 1990-1992, Graduate Teaching Assistant, 1988-1990
Independent Consulting Engineer, 1990-1992

AWARDS

Recipient of the 1994 ASCE Collingwood Prize for paper entitled "Hydraulic Conductivity of a Compacted Clay Frozen and Thawed In Situ" published in the February 1993 issue of ASCE Journal of Geotechnical Engineering.

AFFILIATIONS

American Society of Civil Engineers (ASCE)
International Society of Soil Mechanics and Foundation Engineering (ISSMFE)
Jordan Engineers Association (JEA)
Chi Epsilon
Solid Waste Association of North America (SWANA)

TEACHING EXPERIENCE

Teaching Assistant, September 1988-June 1990.

Responsible for conducting laboratory for the Soil Mechanics course, Department of Civil and Environmental Engineering, University of Wisconsin-Madison. Prepared, lectured, and supervised laboratory work. Tutored and graded homework and laboratory assignments. Assisted professors in proctoring and grading exams and occasionally prepared and gave lectures for professors. Repeatedly received excellent ratings (greater than 4.52/5.00) when evaluated by students.

Short Course Instructor, November 1996.

Instructed in short course entitled "Static and Seismic Slope Stability for Waste Containment Facilities" in Nashville, Tennessee, for the University of Wisconsin Department of Engineering Professional Development. The course was attended by regulators, consulting engineers, and owners and received an overall rating of 4.50/5.00.

PRESENTATIONS AND SHORT-COURSE INSTRUCTION

"Sustainability Projects at Landfills". First International Conference - Geological and Geotechnical Engineering, University of Wisconsin-Madison, Madison, WI, September 13-14, 2012.

"Alternative Landfill Final Cover Systems". SWANA Georgia and Alabama Chapters Joint Meeting, Orange Beach, Alabama, April 2, 2012.

“Solar Power on Landfill Sites”. SWANA Georgia Chapter Spring Conference, Savannah, Georgia, April 14, 2010.

“Solar Power Systems on Landfill Sites”. The Society of American Military Engineers (SAME) Robins AFB Post Meeting, 20 January 2010.

“Landfill Gas Migration Control - Success Story and Lessons Learned”. SWANA Georgia Chapter Spring Conference, Brasstown Valley Resort, North Georgia Mountains, Georgia, April 15, 2009.

Successful Control of Landfill Gas Migration, SWANA WASTECON, Reno, Nevada, October 16, 2007.

Alternative Revenue Streams from Carbon Trading for Landfills-Do you Qualify to Sell Credits for Collecting Landfill Gas? SWANA 2007 Quad State Conference, Pigeon Forge, Tennessee, August 22, 2007

Framework for Estimating Landfill Gas Generation and Recovery Rates, 12th Annual Landfill Symposium and Planning & Management Conference, San Diego, California, June 26, 2007.

“Successful Control of Subsurface Migration of Landfill Gas”. SWANA Georgia Chapter Spring Conference, Albany, Georgia, April 5, 2007.

“Bioreactor Technology”, Conference on Leveraging Landfills with Public-Private Partnerships: Improving Local Government Financial Performance by Protecting the Environment Wednesday June 8, 2006.

“Landfill Gas Collection and Control (GCCS) Phasing Plans”, SWANA 2005 Quad State Conference, South Carolina, September 1, 2005.

“Accurately Predicting Landfill Site Life”, SWANA Low Country 2003 Fall Conference, Savannah, Georgia, September 4, 2003.

“Mechanically-Stabilized Retaining Walls in Landfill Applications”, SWANA Palmetto Chapter Conference, Charleston, South Carolina, April 5, 2002.

“Liners and Covers for Waste Containment Facilities”, Short Course Sponsored by the Geo Institute, Atlanta, Georgia, November 14-16, 2001.

“Performance Observations of Modern Landfill Liner and Cover Systems”, The Engineering Society of Detroit Conference on Emerging Issues in Landfill Design, Construction, and Operations, Ypsilanti, Michigan, March 5, 1997.

“Static and Seismic Slope Stability for Waste Containment Facilities”, Short Course for the University of Wisconsin College of Engineering, Nashville, Tennessee, November 6-8, 1996.

"Compaction of Clay Hydraulic Barriers: Criteria and Case History", Purdue University, September 13, 1993.

"Soil Liners Compaction Control Criteria", University of Wisconsin-Madison, September 8, 1993.

EDITORIAL AND PEER REVIEWING

Journal of Geotechnical Engineering, ASCE
American Society of Testing and Materials (ASTM) Technical Publications
Transportation Research Board (TRB)
Geotechnical News
Sixth International Conference on Geosynthetics

REPRESENTATIVE PUBLICATIONS

- 91-1 Benson, C. H. and Othman, M. A., "Geotechnical Characteristics of Compacted Municipal Solid Waste Compost," *Proceedings, 34th Annual AEG Meeting*, Chicago, September 1991, pp. 683-691.
- 91-2 Othman, M. A. and Benson, C. H., "Influence of Freeze-Thaw on the Hydraulic Conductivity of a Compacted Clay," *Proceedings, 14th Annual Madison Waste Conference*, Madison, Wisconsin, September, 1991, pp. 296-312.
- 92-1 Abdel Rahman, M., Othman, M. A., and Edil, T. B., "Effect of Plate Flexibility on Behavior of Shallow Anchors," *Journal of Soil Mechanics and Foundation Engineering, Japan*, Vol. 32, No. 3, 1992, pp. 137-143.
- 92-2 Othman, M. A. and Benson, C. H., "Effect of Freeze/Thaw on the Hydraulic Conductivity of Three Compacted Clays from Wisconsin," *Transportation Research Record* 1369, 1992, pp. 118-125.
- 93-1 Benson, C. H. and Othman, M. A., "Hydraulic Conductivity of a Compacted Clay Frozen and Thawed In Situ," *Journal of Geotechnical Engineering, ASCE*, Vol. 119, No. 2, Feb. 1993, pp. 276-294.
- 93-2 Othman, M. A. and Benson, C. H., "Effect of Freeze-Thaw on the Hydraulic Conductivity and Morphology of Compacted Clay," *Canadian Geotechnical Journal*, Vol. 30, 1993, pp. 236-246.
- 93-3 Othman, M. A. and Edil, T. B., "Force-Displacement Behavior of Flexible Plate Anchors," *Journal of Geotechnical Engineering, ASCE*, Vol. 119, No. 3, March 1993, pp. 590-597.
- 93-4 Benson, C. H. and Othman, M. A., "Hydraulic and Mechanical Characteristics of a Compacted Municipal Waste Compost," *Waste Management and Research*, November, 1993, pp. 127-142.
- 93-5 Abdel-Rohman, M., Abu-Ikmiel, A., and Othman, M. A. "Foundations response up to plastic collapse of portal steel frames built on sandy soil", *Kuwait Journal of Science and Engineering, Academic Publication Council-Kuwait University*, Vol. 20, No.1, 1993.
- 94-1 Othman, M. A., Benson, C. H., Chamberlain, E. J., and Zimmie, T. F., "Laboratory Testing to Evaluate Changes in Hydraulic Conductivity of Compacted Clays Caused by Freeze-Thaw: State-of-the-Art," *Hydraulic Conductivity and Waste Contaminant Transport in Soil*, ASTM STP 1142, D. E. Daniel and S. J. Trautwein (Editors), 1994, pp. 227-254.

- 94-2 Bowders, J. J. and Othman, M. A., "Molding Water Content and Hydraulic Conductivity of Compacted soil Subjected to Freeze/Thaw," *Transportation Research Record 1434*, 1994, pp. 55-60.
- 94-3 Othman, M. A. and Luettich S. M., "Compaction Control Criteria for Clay Hydraulic Barriers," *Transportation Research Record 1462*, 1994, pp. 28-35.
- 94-4 Othman, M. A., Luettich, S. M., and Leigh, S., "Performance Standards of landfill Covers," Report Prepared for the California Integrated Waste Management Board (CIWMB), August 1994, 208 p. (plus appendices).
- 95-1 Bonaparte, R. and M. A. Othman, "Characteristics of Modern MSW Landfill Performance," *Geotechnical News*, Vol. 13, No. 1, March 1995, pp. 25-30.
- 95-2 Othman, M. A., Bonaparte, R., Gross, B. A., and Schmertmann, G. R., "Design of MSW Landfill Final Cover Systems," *Landfill Closures...Environmental Protection and Land Recovery*, Geotechnical Special Publication No. 53, R. J. Dunn and U. P. Singh, Eds., 1995, pp. 218-256.
- 95-3 Othman, M. A., "Final Cover System Guidance Document," Report Prepared for the Maine Department of Environmental Protection, November 1995, 82 p. (plus appendices).
- 96-1 Bonaparte, R., Othman, M. A., Rad, N. S., Swan, R. H., and Vander Linde, D. L., "Evaluation of Various Aspects of GCL Performance", Appendix F in *Report of 1995 Workshop on Geosynthetic Clay Liners*, D. E. Daniel and H. B. Scranton, authors, EPA/600/R-96/149, USEPA National Risk Management Research Laboratory, Cincinnati, OH, 1996, pp. F1-F34.
- 96-2 Othman, M. A., Bonaparte, R., and Gross, B. A., "Preliminary Results of Survey of Composite Liner Field Performance", *Proceedings, 10th Conference of the Geosynthetic Research Institute (GRI)*, Philadelphia, PA, December 1996, pp. 110-137.
- 97-1 Gross, B. A., Bonaparte, R., and Othman, M. A., "Inferred Performance of Surface Hydraulic Barriers from Landfill Operational Data", *Proceedings of the 1997 International Containment Technology Conference*, St. Petersburg, February 1997.
- 97-2 Othman, M. A., Bonaparte, R., and Gross, B. A., "Preliminary Results of Composite Liner Field Performance Study", *Geotextiles and Geomembranes*, Vol. 15, 1997, pp. 289-312.
- 98-1 Areias, L., Van Impe, W. F., Knight, M. A., and Othman, M. A., "Liner System Regulations for MSW Landfills in Belgium, Canada, and the USA", *Third International Congress on Environmental Geotechnics*, Lisbon, Portugal, September 1998, pp. 3-8.
- 98-2 Othman, M. A., Beech, J. F., and Ramsey, T. B., "Preliminary Results of a Blast Densification Pilot Program," *Geotechnical News*, Vol. 16, No. 4, December 1998, pp. 43-47.
- 99-01 Banner, P., Ramsey T. B., Briscoe W., and Othman M. A., "The Screaming Eagle Road Landfill: Achieving Environmental Excellence", *Environmental Excellence in South Carolina*, Vol. 1, No. 2, 1999, pp. 12-15.
- 02-1 Othman, M. A., Bonaparte, R., Gross, B. A., and Warren, D., "Evaluation of Liquids Management Data for Double-Lined Landfills," Appendix E in "Assessment and Recommendations for Optimal Performance of Waste Containment Systems," R. Bonaparte, D. E. Daniel, and R. Koerner, Authors, EPA/600/R-02/099, USEPA National

- Risk Management Research Laboratory, Cincinnati, Ohio, 2002, pp. E1-E206.
- 06-1 Kulasingam, R. and Othman, M.A. "Gas Collection and Control System Phasing Plan". Accepted for publication in the 44th Annual WASTECON, September 19-21, 2006, Charlotte, North Carolina, Solid Waste Association of North America.
- 08-1 Othman, M. A. and Seymour, J. "Use of Tire Chips in the Final Cover System of a Superfund Site Landfill". *Proceedings of GeoCongress 2008*, ASCE, Geotechnical Special Publication No. 177, M. V. Khire, A. N. Alshawabkeh, and K. R. Reddy (Eds.), 2008, pp. 304-311.
- 11-1 Sura, J. M. and Othman, M. A., "Case History of Roadway Embankment Construction over Very Weak Clay". *Proceedings of GeoFrontiers 2011*, ASCE, Dallas, Texas, March 2011, pp. 3304-3311.

MICHAEL HAYES, P.E.

Hydrology & Hydraulics

EDUCATION

MS, Environmental Engineering, Marshall University Graduate College, Huntington, WV, 2004

BS, Civil Engineering, West Virginia University, Morgantown, WV, 1995

REGISTRATIONS AND CERTIFICATIONS

West Virginia P.E. Number [REDACTED]

Missouri P.E. Number [REDACTED]

Maryland P.E. Number [REDACTED]

40 Hour HAZWOPER

CAREER SUMMARY

Mr. Hayes is a Professional Engineer with more than 20 years of experience in all aspects of civil and environmental engineering. Work has included project management and engineering experience for projects including; water and wastewater treatment; pumping systems and pump stations; landfill capping and closure; petroleum distribution; storage tank design and containment; site investigations; remediation of hazardous waste sites; Brownfield redevelopment; and wetlands mitigation. Additionally he has a great deal of experience in the preparation and development of SPCC Plans and Corporate SPCC Programs and engineering planning; SW3P Plans; groundwater protection plans (GPP's); and EPA Facility Response Plans (FRP's) and Emergency Response Action Plans (ERAP's). Mr. Hayes' experience includes working directly with public advisory groups, citizen's action panels, negotiations with government agencies, and presentations to local government officials.

Civil, Water and Wastewater

Process Engineering Lead, Dominion Power, Chesterfield Generating Station, Richmond, VA. In support of Geosyntec's overall scope of services associated with the closure of the existing ash ponds at the station, Mr. Hayes has lead for the design of the proposed low volume wastewater treatment system. The project includes a flow monitoring program for the sources of flow, the design of a solids removal system, physical/chemical treatment and equalization for the combined waste stream. The conceptual design is complete and the preliminary design is currently underway.

Wastewater Project Lead, Santee Cooper, Winyah Generating Station, Georgetown,

SC. As part of Geosyntec's overall management of coal combustion residuals project for the Winyah Generating Station, Mr. Hayes is serving as the wastewater lead. This work has the ultimate goal of meeting the proposed USEPA Effluent Guidelines for discharges from the facility and the proposed Coal Combustion Residual regulations for leachate generated from ash storage cells. The data collection and evaluation phase has been complete for wastewater streams at the facility, including low volume wastewater, scrubber wastewater, cooling water and storm water. A sampling and monitoring program was completed that collected data from multiple sources for the individual units. Along with this data, weather station and plant generation data was used to prepare a waste stream model for the facility for use in the design of the ultimate treatment system. The conceptual segregation of waste streams has been completed and the design basis report for the wastewater treatment plants is nearing completion. Bench testing of potential unit processes has been completed and field pilot testing planned for late summer 2015. Discharge location and existing permit evaluations have been conducted to prepare for the discharge strategy.

Process Engineering Lead - Dewatering, Confidential Power Industry Client, Eastern U.S. Prepared ash pond dewatering design for three power generation stations. Design included pumping systems for controlled dewatering rates to reduce the impact of dewatering on the integrity of the dikes, mechanical and structural connections to existing pond discharge structures, and the associated treatment systems for meeting effluent requirements.

Project Engineer, Confidential Power Industry Client, Eastern U.S. Prepared a report that described and evaluated potential treatment options for the dewatering water and leachate from an ash storage facility. The report evaluated options based upon proposed reductions to allowable concentrations being proposed by the State and the USEPA's dual proposal to regulate coal combustion residuals.

Project Engineer, Confidential Power Industry Client, Eastern U.S. Project Engineer for proposal and design of a 50 million dollar design/build/operate water and wastewater system to serve an alternative fuel power plant.

Project Manager/Engineer, Greenbrier Resort, White Sulphur Springs, WV. Investigation of historic drawings and development of utility drawings for resort, which is over 230 years old. Utilized this information to develop a water system model for resort and 14 mile water supply line in order to develop master plan for improvements to water system.

Project Manager/Engineer, CSX Transportation, Inc., Raceland, KY. Performed characterization of a sewer system segregation for a large industrial facility to correct waste water treatment facility bypasses during storm events. A phased approach for the design and construction of the project was developed to be completed over a four-year period to meet the clients' budgetary constraints. Prepared the design, system model, specifications, bid documents and permits for the final design of three phases of the project. The design included sanitary sewers, pressure sewers, industrial sewers and storm sewers.

Project Manager, CSX Transportation, Inc., Niagara Falls, NY. Design of major modifications and retrofits for industrial wastewater treatment facility (WWTF), including new process equipment, pump station and controls.

Project Manager, CSX Transportation, Inc., Clifton Forge, VA. Design of modifications and retrofits for industrial wastewater treatment facility (WWTF), including dissolved air floatation (DAF) modifications, chemical addition system and pump station.

Project Manager, Southern Water, Floyd County, KY. Design/Build/Operate project for a multi-million dollar municipal waterline extension, including: water storage tanks and booster pump stations.

Project Engineer, CSX Transportation, Inc., Euclid, OH. Design/Build project for a industrial wastewater treatment plant for the support a mainline locomotive fueling facility. Due to space limitations for the treatment system, the project included a large diameter underground pipe network for equalization and storage of the wastewater during storm events. The volume of water to be treated was too large for the local municipality to accept into their system, so the effluent was permitted to drain to the State Highway's storm sewer system that emptied directly to Lake Erie. Due to the discharge to Lake Erie, the discharge limits for oil & grease were very low. The treatment plant was design with a corrugated plate separator for primary removal, and a Walnut Shell Filter for polishing.

Project Engineer, CSX Transportation, Inc., Tampa, FL. Designed and permitted perimeter fire protection system for a large industrial facility.

Project Engineer, Various Municipalities, WV and OH. Design, specifications and permits for several rural waterline extension projects, including tanks and booster pump stations.

Project Engineer, U.S. Army Corps of Engineers, Point Pleasant, WV. Design of roadway realignment for the construction of earthen dikes during a wetlands mitigation

project.

Project Engineer, CSX Transportation, Inc., Cumberland, MD. Design of a rail tank car unloading system, including a spill containment system, unloading platform, piping and pump system.

Project Engineer, CSX Transportation, Inc., Cleveland, OH. Design of a large mainline locomotive fueling system, including storage tank, containment dike, pump system, piping and other environmental controls.

Project Manager, Dominion Oil & Gas, WV, PA and OH. Design SPCC site improvements at natural gas compressor stations, including: dikes; curbing and tanker truck unloading containment pads.

Graduate Student, Marshall University Graduate College. Prepared and presented final Master's Degree Project on the use of Walnut Shell Filtration for the removal of oil and grease from an industrial wastestream to meet stringent discharge requirements.

Environmental Remediation/Site Redevelopment

Engineering Design Lead, Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites, Torrance, CA. Preparation of Preliminary and Intermediate Remedial Design tasks required by Unilateral Administrative Order. Tasks included the following: Preliminary Design Criteria Report; Preliminary Basis of Design Report; Preliminary Specifications Outline; Preliminary Project Delivery Strategy and Construction Schedule, Preliminary Drawings; and Preliminary Cost Estimate. The project includes over 15 miles of extraction and injection piping, 14 extraction wells and 7 injection wells and an 700-gpm treatment system.

Project Engineer, El Monte Operable Unit, El Monte, CA. Design of groundwater conveyance and treatment system, including piping, pump stations, wastewater treatment facility (WWTF), and controls.

Project Engineer, FMC Corporation, South Charleston, WV. Remediation of former chemical facility through WVDEP Voluntary Remediation Program, including: preparation of work plans; coordination, planning and negotiations with WVDEP; presentations to Public Advisory Group; technical assistance to contractors and developers constructing two car dealerships on redeveloped parcels; and the review and analysis of investigations performed by previous consultant.

Project Manager/Engineer, FMC Corporation, Nitro, WV. Remedial activities at former landfill through WVDEP Voluntary Remediation Program, including: preparation of Off-Site Removal Work Plan; preparation of Interim Cap Work Plan; management and coordination of construction activities; management of confirmatory

sampling activities; coordination, planning and negotiations with WVDEP; coordination and planning with the West Virginia Department of Natural Resources (WVDNR) for the future construction of a boat launch area that will become the future use of the site; coordinated the disposal of hazardous waste removed from site; project presentations to the local City Council and mayor; presentations to Citizen's Advisory Council; coordination of utility relocations; preparation of necessary environmental and construction permits.

Landfills

Engineer of Record, Honeywell International, Hanlin-Allied-Olin NPL Site, Moundsville, WV. Certification of construction and engineering during construction for a hazardous waste disposal cell.

Senior Engineer, Allied Waste, Buford, GA. Design of a sequencing batch reactor treatment system for biological treatment of municipal landfill leachate.

Senior Engineer, Waste Management, Inc., Altamont Landfill, Altamont, CA. Engineering feasibility study and conceptual design for leachate collection system and pump stations for landfill expansion project.

Project Manager/Certifying Engineer, West Virginia Department of Environmental Protection (WVDEP), Charleston, WV. Construction Quality Assurance (CQA) and certification of the closure of a large landfill and leachate collection and treatment system through the WVDEP Landfill Closure Assistance Program.

Project Manager/Engineer, U.S. Army Corps of Engineers, Minden, WV. Design of an engineered landfill final cap and storm drainage system for a USEPA Superfund Site contaminated with PCB's.

Project Manager/Engineer, FMC Corporation, Nitro, WV. Remedial activities at former landfill through Voluntary Remediation Program, including: preparation of Off-Site Removal Work Plan; closure design, preparation of Interim Cap Work Plan; management and coordination of construction activities; coordination, planning and negotiations with regulators; preparation of necessary environmental and construction permits.

Environmental Compliance and Permitting

Program Manager, CSX Transportation, Inc., System-wide East Coast of U.S., Prepared and certified Spill Prevention Countermeasure and Control (SPCC) Plans for over 25 major rail facilities.

Project Manager, Various Clients, East Coast, Prepared and certified SPCC Plan revisions for various transportation, natural gas compressor stations and retail facilities.

Project Manager, CSX Transportation, Inc., Cleveland, OH, Preparation of Facility Response Plan (FRP) and Emergency Response Action Plan (ERAP) for newly, EPA regulated major oil storage facility.

Project Manager, CSX Transportation, Inc., Selkirk, NY, Revision of Facility Response Plan (FRP) and Emergency Response Action Plan (ERAP) for EPA regulated major oil storage facility.

Project Manager, CSX Transportation, Inc., Corbin, KY, Revision of Facility Response Plan (FRP) and Emergency Response Action Plan (ERAP) for EPA regulated major oil storage facility.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Huntington, WV, 2007 – present

Shaw Environmental, Poca, WV, 2004 – 2007

USFilter/Chester Engineers, Huntington, WV, 1996 – 2004

West Virginia Department of Transportation, Charleston, WV, 1995 – 1996

REPRESENTATIVE PUBLICATIONS

Hayes, K. M., and Houlihan, M. F. (2011), “Practical Approaches to Meeting the Pending Steam Electric Power Effluent Guidelines for CCB Landfill Leachate”, *Proceedings of Sessions of World of Coal Ash 2011*, Denver, Colorado, May 9 - 12.

Mark W. Sutton, PE

Hydrology & Hydraulics

EDUCATION

B.S., Civil Engineering, Ohio University, Athens, OH, 2001

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer, Ohio, [REDACTED]

Professional Engineer, Kentucky, [REDACTED]

Professional Engineer, West Virginia, [REDACTED]

40 Hour HAZWOPER

CAREER SUMMARY

Mr. Sutton is a Professional Engineer with 14 years' experience in civil engineering. Work has included project management and engineering experience in residential and commercial development design, and water, wastewater and storm water management, Brownfield redevelopment, pumping systems and pumping stations. Specific project management tasks include; proposal/contract preparation, budget estimating, project quality assurance, project quality control reviews. Specific engineering experience includes; hydraulic design (storm sewer design, culvert design, and sanitary sewer design), hydrologic studies (storm water management reports), retention/detention basin design, storm water quality calculations, BMP (Best Management Practices) and SWPPP (Storm Water Pollution Prevention Plans) for construction activities, roadway design, site grading and earthwork volume calculations, quantity take-offs, and cost estimates.

Environmental Remediation/ Site Redevelopment

Project Engineer, Boeing Corporate Real Estate, Boeing Building 10, Long Beach, California. Prepared detailed design drawings and specification documentation for the conveyance piping and controls for the groundwater remediation at the former Boeing Building 10 site in Long Beach, California.

Project Engineer, Boeing Corporate Real Estate, Boeing Douglas Park, Long Beach, California. Prepared detailed design drawings and specification documentation for the conveyance piping and controls for the groundwater remediation at the former Boeing Douglas Park site in Long Beach, California.

Project Engineer, The Boeing Company, Boeing Northwest Quadrant Contingency Pipeline Project, Long Beach, California. Prepared detailed design drawings and specification documentation for the conveyance piping and controls for the groundwater remediation at the former Boeing Douglas Park site in Long Beach, California.

Project Engineer, Dual Site Groundwater Operable Unit, Montrose Chemical and Del Amo Superfund Sites, Torrance, California. Prepared preliminary design drawings and preliminary cost estimates for the conveyance piping and controls for the groundwater remediation project. The project includes over 10 miles of extraction and injection piping, 15 extraction wells and 6 injection wells and an 800-gpm treatment system.

Project Engineer, City of El Monte, El Monte, California. Designs of groundwater conveyance and treatment systems, including piping, pump stations, Wastewater Treatment Facility (WWTF), and controls. Role included preparation of detailed design drawings and specification documentation.

Project Engineer, Operating Industries, Inc. (OII), Monterey Park, California. Preparation of detailed design drawings and specification documentation for the conveyance piping, pumping facilities, and storage tank for the Central Perimeter Liquid control (PLC) at the Operating Industries, Inc. (OII) landfill.

Project Engineer, Nammo Talley, Plant No. 3, Perchlorate Source Area Groundwater Treatment System, Mesa, AZ. Provided civil design of groundwater extraction and treatment system. Included detailed engineering design for the extraction and effluent piping installation, CAD services, and technical specification preparation.

Civil, Water, Wastewater, and Stormwater

Project Engineer, CSX Transportation, Inc., Toledo, Ohio. Preparation of design drawings and specification documentation for the addition of an emergency generator and sludge handling improvements at the Stanley Yard WWTF. Sludge handling improvements included design of a modified oil pit, new 3,000 gallon used oil tank, and WWTF effluent outfall relocation and design. Also included in the project was the design of improvements to the dike of a 900,000 gallon diesel fuel storage tank.

Project Engineer, CSX Transportation, Inc., Baltimore, Maryland. Preparation of design drawings and specification documentation for the relocation of a waterline for the dust suppression system for coal pier stockpiles.

Project Engineer, CSX Transportation, Inc., Columbus, Ohio. Preparation of design information, coordination, and record drawings for a design build project, including the installation of water services and toilet drops for locomotives and a maintenance building.

Project Engineer, CSX Transportation, Inc., Russell, Kentucky. Preparation of design drawings and specification documentation, and construction observation for improvements to an existing stormwater lagoon including interconnection gravity piping for equalization connection and equalization of another stormwater lagoon.

Project Engineer, CSX Transportation, Inc., Huntington, West Virginia. Preparation of design drawings and specification documentation for improvements to a used oil transfer system, and improvements to an existing WWTF including the installation of a new used oil tank and a backup emergency generator.

Project Engineer, CSX Transportation, Inc., Willard, Ohio. Field observation services for the draining and closure of a 300 acre-foot pond. Included permit submittals to the Ohio Department of Natural Resources, coordination on site with the contractor, daily observation reports, and record and as built drawing preparation and field report submittal.

Project Engineer, NAES Corporation, Sandy Creek Energy Station, Under Drain Return System, Riesel, Texas. Provided civil design of two lift station return systems and conveyance forcemains for the under drain piping system of two existing cooling water storage ponds. Included the detailed engineering design and CAD services, and technical specification preparation.

Project Engineer, Republic Services, 623 Landfill, West End Transfer Station Lift Station, Rockville, Virginia. Provided civil design of a sanitary sewer lift station and force main connection. Included the detailed engineering design and CAD services, and technical specification preparation.

Project Engineer, CSXT Transportation, Inc., Baltimore, Maryland. Preparation of design drawings and specification documentation on a 7 million gallon storm water pond retrofit and treatment system improvement including installation of a new 700 gallon per minute horizontal sand filter.

Project Engineer, CSXT Transportation, Inc., Clifton Forge, Virginia. Preparation of design drawings and specification documentation on a new 100 gallon per minute waste water treatment facility including a 250,000 gallon post-tensioned concrete equalization tank, gravity influent and discharge piping, and influent pump system.

Site Development

Project Manager/Project Engineer, T&R Properties, General Castings, City of Delaware, Ohio. Design of a 100-acre development including single family, multi-

family, institutional, and commercial style development. Duties included the hydrologic analysis of the site and design of the hydrologic infrastructure including retention basin design and storm sewer design used for stormwater management of the development. Responsible for the overall site grading and earthwork plan with the requirement of earthwork cut/fill balance. Responsible for the design and oversight of plan production on the site improvement plans.

Project Manager/Project Engineer, Homewood Corporation, Summerwood Lakes, Delaware County, Ohio. Design of an 80-acre, 100 lot single family subdivision. Duties included the hydrologic analysis of the site and design of the hydrologic infrastructure including retention basin design and storm sewer design used for stormwater management and water quality treatment. Responsible for overall site grading and earthwork plan with the requirement of earthwork cut/fill balance. Responsible for the design and oversight of plan production on the site improvement plans. Responsible for all regulatory permitting, including permits through the Ohio Environmental Protection Agency and the Delaware County Engineer's office.

Project Manager/Project Engineer, Floyd Browne Group, Floyd Browne Corporate Complex, City of Delaware, Ohio. Site/Civil design of a 30,000 square foot office building. Duties included the hydrologic analysis and retention basing design for stormwater management. Responsible for overall site grading plan and earthwork calculations. Responsible for all permitting including the Ohio Environmental Protection Agency, the City of Delaware, and the Ohio Department of Transportation.

Roadway Design

Project Manager/Project Engineer, Charlie Vince Properties, Africa Road Left Turn Lane Improvement Plan, Delaware County, Ohio. Design of a turn lane improvement plan as supplement to a 60 acre single family subdivision. Duties included the horizontal and vertical geometric design to the standards of the Ohio Department of Transportation, and for the relocation design of all existing utility infrastructure due to the turn lane improvements.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Huntington, West Virginia, 2007-Present
Eastham & Associates, Chesapeake, Ohio, 2006-2007
Floyd Browne Group, Delaware, Ohio, 2001-2006

Steven R. Layman, Ph.D.

Aquatic Ecology and Fisheries Biology
Environmental Permitting and Compliance
National Environmental Policy Act (NEPA) Assessment
Hydropower Licensing and Compliance
Rare, Threatened, and Endangered Species

EDUCATION

Ph.D., Biological Sciences, University of Alabama, Tuscaloosa, 1994

M.S., Ecology, University of Tennessee, Knoxville, 1984

B.S., Biology, Bucknell University, Lewisburg, PA, 1981

CAREER SUMMARY

Dr. Layman is a technology leader in applying fish biology, aquatic ecology, and ecosystem management principles to water resource projects in eastern North America. He has 24 years' experience leading ecological assessments and managing project delivery for Clean Water Act permitting, National Environmental Policy Act review, facility siting and permitting, Federal Energy Regulatory Commission hydropower licensing, and Endangered Species Act compliance. He works collaboratively with integrated teams of client personnel, engineers, biologists, planners, and attorneys to achieve compliance objectives in a cost-effective manner while minimizing risks and meeting the expectations of regulatory agencies.

Supplemental Environmental Impact Statement (SEIS), Mississippi Barrier Island Restoration, U.S. Army Corps of Engineers, Mobile District. Managed the preparation of the preliminary draft SEIS for the U.S. Army Corps of Engineers (Corps) Mobile District to support the Mississippi Coastal Improvements Program Comprehensive Barrier Island Restoration. The proposed restoration activities involved the placement of 22 million cubic yards of sandy material along the barrier islands of Mississippi Sound within the National Park Service's (NPS') Gulf Islands National Seashore. Development of the preliminary draft SEIS involved close coordination NPS scientists and NEPA specialists. The SEIS will serve as the basis for evaluating the Corps' plans to implement the authorized construction action and to ensure compliance with NEPA.

Environmental Assessment (EA), Birmingham Regional Intermodal Facility, Norfolk Southern Railway Company, Birmingham, Alabama. Led NEPA coordination with cooperating agencies and the development of key analyses in the preparation of an EA for the proposed Birmingham Regional Intermodal Facility in Alabama. Coordinated NEPA documentation with Federal Highway Administration and Alabama Department of Transportation, managed subcontractors conducting aquatic protected species

surveys, consulted with the U.S. Fish and Wildlife Service on protected species issues, prepared the alternatives analysis and aquatic resources sections of the EA, and developed and presented information in three public meetings. The project was approved and construction began in April 2011.

FERC Licensing, Morgan Falls Project, Georgia Power, Atlanta, Georgia. Led development of one of the first license applications in the nation under the Federal Energy Regulatory Commission's Integrated Licensing Process (ILP) for Georgia Power's 16.8-MW Morgan Falls Project in metropolitan Atlanta. The project was located in the Chattahoochee River National Recreation Area managed by NPS. Participated in NEPA scoping. Managed implementation and delivery of seven resource studies, including water resources; reservoir dredging feasibility evaluation; fisheries and fish entrainment; recreation surveys; wildlife and botanical resources and invasive species; wetlands and riparian habitat; and rare, threatened, and endangered species. Supported successful negotiations with the Department of the Interior to address mandatory conditioning authorities of NPS and the U.S. Fish and Wildlife Service. Led preparation of Exhibit E, the Environmental Report, of the license application, which was written in the form of an applicant-prepared environmental assessment and served as the basis of FERC's environmental assessment pursuant to NEPA.

FERC Licensing, Bartletts Ferry Project, Georgia Power, Georgia and Alabama. Managed comprehensive environmental resource studies, consultation, and documentation supporting FERC relicensing of Georgia Power's 173-MW Bartletts Ferry Project on the Chattahoochee River along the Georgia/Alabama border. Participated in NEPA scoping. Led preparation of the Pre-Application Document, FERC-approved Study Plan, eight resource study reports, and Exhibit E of the license application, which was written as an applicant-prepared environmental assessment to facilitate NEPA compliance. Activities included consultation with a diverse interstate group of resource agencies and stakeholders, participation in site visits and scoping, analysis of resource issues, key presentations in Study Results Meetings and Preliminary Licensing Proposal Meetings, and development of environmental enhancement proposals for Exhibit E.

Tri-State Water Allocation Environmental Impact Statements, U.S. Army Corps of Engineers, Mobile District, Georgia, Alabama, Florida. Served as biological task lead for NEPA review of interstate water allocation agreements being negotiated for the Apalachicola-Chattahoochee-Flint and Alabama-Coosa-Tallapoosa river basins. Coordinated with the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service in preparing the fisheries and aquatic resource sections of the Draft Environmental Impact Statements (EISs) for both basins.

Chattahoochee River Aquatic Ecosystem Restoration, U.S. Army Corps of Engineers, Mobile District, Georgia and Alabama. In support of U.S. Army Corps of Engineers aquatic ecosystem restoration of the Chattahoochee River in Georgia and Alabama, scoped the environmental permitting requirements and associated costs. The project would involve breaching two FERC-licensed dams to restore 2.3 miles of unimpounded river for the purposes of riverine habitat restoration and ancillary whitewater boating improvements. Key permitting elements included FERC license surrender and NEPA review.

Tri-State Water Allocation Biological Assessment, U.S. Army Corps of Engineers, Mobile District, Georgia, Alabama, Florida. Led preparation of the supporting information for the Biological Assessments (BAs) being prepared by the Corps for ACF and ACT basin water allocation under the Endangered Species Act (ESA). Evaluated current and historical distribution for Federally-listed species to identify the species most likely to be affected by changes in water management, and assessed the potential for impacts to these species to assist the U.S. Fish and Wildlife Service in making final determinations of potential effect.

Arkansas River Corridor Master Plan, Tulsa County, Oklahoma. As part of a master plan for the Arkansas River Corridor, assisted Tulsa County in identifying and evaluating potential environmental constraints related to the construction of low-head dams for the purposes of increasing connectivity between the river and surrounding communities, improving habitat for the federally endangered Interior Least Tern, improving the function of the river, and improving recreational opportunities. Led the evaluation of potential project effects to Interior Least Tern nesting and foraging habitat and upstream and downstream passage of highly migratory fish species of interest.

EA's and EIS's, FERC, Multiple States. Assisted FERC staff in preparing EAs and multiple-project EISs for 16 hydroelectric projects in Wisconsin, Michigan, New York, South Carolina, and Georgia. Assessed complex fisheries' issues related to turbine-induced mortality, downstream fish protection, upstream passage, and instream flow needs. Participated in NEPA scoping and resource agency 10(j) negotiations.

Ludington Pump Storage Project, Lake Michigan. Assessed fish entrainment and the effectiveness of using a 2.5-mile-long barrier net at the 1,872-MW Ludington Pumped Storage Project (Lake Michigan) for FERC using site-specific data and literature review. The analysis was part of an EA evaluating a settlement agreement for proposed permanent fish protection measures at the facility.

GLENN J. RIX, Ph.D.

**Risk Assessment
Dam Safety**

EDUCATION

PhD, Civil Engineering, University of Texas at Austin, Austin, Texas 1988
MS, Civil Engineering, University of Texas at Austin, Austin, Texas 1984
BS, Civil Engineering, Purdue University, West Lafayette, Indiana, 1982

CAREER SUMMARY

Dr. Glenn J. Rix joined Geosyntec in 2013 after a distinguished 24-year career as a Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology specializing in Geotechnical and Earthquake Engineering. At Geosyntec, Dr. Rix is focused on the areas of geotechnical earthquake engineering and engineering seismology (particularly for the eastern and central U.S.), seismic hazard assessment and risk mitigation for civil infrastructure at both the component and system scales, and advanced near-surface geophysics investigations and interpretations across a range of applications.

REPRESENTATIVE PROJECTS AND GRANTS

Geohazard/Earthquake Characterization and Mitigation

Seismic Deformation Analysis of Blue Ridge Hydroelectric Plant, Tennessee Valley Authority. Evaluating the liquefaction potential, post-earthquake stability, and permanent deformations of a semi-hydraulic fill dam owned and operated by the Tennessee Valley Authority in Fannin County, Georgia for a suite of design ground motions.

Seismic Hazard Evaluation, Gulf LNG Liquefaction Project, Gulf LNG Liquefaction Company, LLC. Performing a seismic hazard evaluation for the pre-FEED phase of the proposed expansion of the client's LNG terminal in Pascagoula, MS. Specific tasks include a site-specific probabilistic seismic hazard analysis (PSHA) and site response analysis to develop design response spectra for a variety of return periods and an evaluation of the potential for liquefaction triggering and resulting ground deformation.

Comprehensive Services, CERCLA Investigation and Remediation, Paducah Gaseous Diffusion Plant, U.S. Department of Energy, Provided guidance on seismic hazard issues for the Waste Disposal Alternatives project at the 3,550-acre PGDP site, which contains an active uranium enrichment facility and support facilities. Key tasks included providing guidance on selection of scenario earthquakes for conceptual design for a potential on-site disposal facility and providing information for the Community Advisory Board and public information sessions.

Technical Review of Liquefaction Potential for FLEX Dome Storage Buildings and Travel Paths, Enercon Services, Inc. Performed technical review of calculations to evaluate the liquefaction potential of soils supporting the FLEX dome storage buildings and related travel paths for the Farley, St. Lucie, and Vogtle Nuclear Power Plants.

Technical Review of Probabilistic Seismic Hazard Analysis, Mozambique LNG Project, Anadarko Petroleum Corporation, Performed technical review of probabilistic seismic hazard analysis by Fugro Consultants, Inc. and Arup Texas, Inc. to provide design ground motions for near-shore and onshore facilities.

Comprehensive Characterization of the Santee Formation and Its Implications for Engineering Behavior at the Savannah River Site, U.S. Department of Energy. Performed a series of geotechnical studies undertaken at the U.S. Department of Energy's Savannah River Site (SRS) to better quantify dissolution processes present at SRS, and assess how these processes have affected and/or altered the conditions of the overlying soil column of interbedded sands and clays. The comprehensive study facilitated an improved understanding of the development of the geological profile at SRS, which in turn will support the development of more cost effective engineering solutions for critical structures at the site.

Site Response in the Upper Mississippi Embayment, National Science Foundation Mid-America Earthquake Center. Developed site amplification factors and a suite of earthquake ground motions for the Upper Mississippi Embayment using a numerical wave propagation formulation that includes the effects of epistemic and aleatory uncertainties in the earthquake source, path, and site processes; non-linear soil behavior; and the geometry of the Embayment.

Liquefaction Susceptibility Mapping in Memphis/Shelby County, Tennessee, U.S. Geological Survey. Developed liquefaction hazard maps for the Memphis and Shelby County area using available standard penetration test and cone penetration test data based on surface geology and liquefaction potential index.

Seismic Hazard Analysis, Ardaman & Associates. Conducted technical review of site-specific seismic hazard analyses and site response calculations for additions to Point Lisas Desalination Plant in Trinidad & Tobago.

Post-Earthquake Damage Reconnaissance, Earthquake Engineering Research Institute and Geotechnical Extreme Events Reconnaissance Association. Evaluated geotechnical aspects of damage resulting from the 12 January 2010 Haiti and the 26 February 2011 Christchurch, New Zealand earthquakes.

Seismic Risk Mitigation for Port Systems, National Science Foundation. Led a multi-disciplinary research team with expertise in geotechnical and structural engineering, logistics, and risk and decision analysis to develop a framework for seismic risk analysis of containerized port systems.

Seismic Performance Assessment of the Wharf and Pier at the Port de Port-au-Prince, National Science Foundation. Performed a geotechnical site investigation to evaluate subsurface conditions at the Port de Port-au-Prince and subsequent analyses to evaluate liquefaction triggering and permanent deformations associated with the M_w 7.0, 2010 Haiti earthquake.

Geotechnical Infrastructure/Foundation Engineering

Boundary Element Method Adjoint-Based Active Surfaces for Next-Generation Surface Wave Testing, National Science Foundation. Developed a new class of geometric inverse models for full-waveform inversion based on the boundary element method that enables an effective identification of two-dimensional subsurface geometries by directly estimating the shape of laterally varying interfaces from raw measurements.

Blast Vibration Analyses, Multiple Clients, Lee County, Florida. Conducted analyses of the potential impacts of ground-borne and air-borne vibrations on residential structures and humans from blasting activities.

Seismic Design Guidelines, Caldwell Tanks, Inc., Louisville, Kentucky. Developed seismic design guidelines for water tank foundations to account for dynamic soil-structure interaction.

Seismic Site Classification, Multiple Clients, Southeastern U.S. Conducted surface wave tests to determine site classification for seismic designs of proposed public and private infrastructure improvements.

Forensic Engineering and Testing, McGill-Schnabel, Inc., Atlanta, Georgia. Performed nondestructive tests on damaged and undamaged sections of sheet-pile wall to help identify potential modes of failure of the sheet-pile wall.

Forensic Engineering and Testing, Southern Company Services Inc., Atlanta, Georgia. Performed nondestructive tests on transmission tower foundations to assess damage following severe storms.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Inc., Kennesaw, Georgia, 2013 to present
Principal

Georgia Institute of Technology, School of Civil and Environmental Engineering, Atlanta, Georgia, 1989 to 2013

Associate Chair for Finance and Administration
Professor
Associate Professor
Assistant Professor

Georgia Institute of Technology, Georgia Transportation Institute, Atlanta, Georgia, 1998 to 2005

Director
Associate Director

AWARDS AND RECOGNITIONS

Gold Award, Environmental and Engineering Geophysical Society, 2013.

Engineer of the Year in Education, 2005, Georgia Engineering Alliance.

Outstanding Teacher Award, 2001-2002, Georgia Tech School of Civil and Environmental Engineering.

Outstanding Faculty Service Award, 1995 - 1996, Georgia Tech School of Civil and Environmental Engineering.

Lilly Endowment Teaching Fellowship, 1992 - 1993

Outstanding Faculty Member, 1990 - 1991, American Society of Civil Engineers Georgia Tech Student Chapter

University Fellow, 1982-1985, University of Texas at Austin,

Bachelor of Science Degree with Highest Distinction, 1982, Purdue University

Tau Beta Pi Engineering Honorary Society

Chi Epsilon Civil Engineering Honorary Society

AFFILIATIONS

American Society of Civil Engineers, 1988 to present

American Society of Civil Engineers Geophysics Committee, 1994 to present

American Society of Civil Engineers Soil Dynamics Committee, 1992 to present

American Society of Civil Engineers *Journal of Geotechnical Engineering* Editorial Board, 1992 to 1996

Resident Director, Georgia Section, American Society of Civil Engineers, 1992-1993

Vice-President, Georgia Section, American Society of Civil Engineers, 1993-1994

President, Georgia Section, American Society of Civil Engineers, 1994-1995

Immediate Past President, Georgia Section, American Society of Civil Engineers, 1995-1996

District 14 Council, American Society of Civil Engineers, 1995 to 1997

Transportation Research Board Committee on Strength and Deformation Characteristics of Pavement Sections (A2B05), 1994 to 2003

American Society of Engineering Education, 1995 to 2000

Earthquake Engineering Research Institute, 1990 to present

Seismological Society of America, 1988 to present

Society of Exploration Geophysicists, 1988 to 2000

Environmental and Engineering Geophysical Society, 1993 to present

Vice-President, Environmental and Engineering Geophysical Society, 1995-1996

President, Environmental and Engineering Geophysical Society, 1996-1998

Consortium of Universities for Research in Earthquake Engineering (CUREE), 2001 to 2013

Synthesis Panel on Ground Penetrating Radar for Evaluating Subsurface Conditions for Transportation Facilities, National Cooperative Highway Research Program Project 20-5

Associate Coordinator, Mid-America Earthquake Center Hazards Evaluation Program, 1997 to 1999

Co-Coordinator, Mid-America Earthquake Center Hazards Evaluation Program, 1999 to 2007

Steering Committee, Symposium on the Application of Geophysics to Engineering and Environmental Problems, Arlington, VA, February 2000

Advisory Committee, Advanced National Seismic Systems – Mid-America Region (ANSS-MA), 2000 to 2002

Organizing Committee, Deformation Characteristics of Geomaterials, Lyon, France, September 2003

General Chairman, Symposium on Applications of Geophysics to Engineering and Environmental Problems (SAGEEP), Atlanta, Georgia, April 2005

Site Visit Team, National Science Foundation Network for Earthquake Engineering Simulation (NEES) System Integration Project, January 2004

NEES Consortium, Inc. Site Operations Committee, 2005 to 2009

Chair, NEES Consortium, Inc. Site Operations Committee, 2007 to 2009

NEES Consortium, Inc. Task Group on Shared-Use Partnering Policy, 2006

Earthquake Engineering Research Institute Nominating Committee, 2007

Co-Chair, NEES Consortium, Inc. NEESit User Requirements Committee, 2008 to 2009

Applied Technology Council Project 76-2 Technical Committee, 2009 to 2012

NEEScomm Board of Governance, 2009 to 2014

Vice-Chair, NEEScomm Board of Governance, 2013 to 2014

Geo-engineering Extreme Events Reconnaissance (GEER) team for post-earthquake reconnaissance following the January 12, 2010 Haiti earthquake.

Geo-engineering Extreme Events Reconnaissance (GEER) team for post-earthquake reconnaissance following the February 26, 2011 Christchurch, New Zealand earthquake.

TEACHING EXPERIENCE

Georgia Institute of Technology

Dynamics (undergraduate)

Introduction to Geotechnical Engineering (undergraduate)

Subsurface Characterization (undergraduate)

Dynamic Analyses in Geotechnical Engineering (graduate)

Geotechnical Earthquake Engineering (graduate)

Reliability-Based Design in Geotechnical Engineering (graduate)

REPRESENTATIVE PUBLICATIONS

Stokoe, K. H., II, G. J. Rix, and S. Nazarian, "In Situ Seismic Testing with Surface Waves," *Proceedings, XII International Conference on Soil Mechanics and Foundation Engineering*, A.A. Balkema, Rotterdam, pp. 331-334, 1989.

Baldi, G., M. Jamiolkowski, D.C.F. Lo Presti, G. Manfredini, and G. J. Rix, "Italian Experience in Assessing Shear Wave Velocity from CPT and SPT," *Proceedings, Discussion Section on Influence of Local Soils on Seismic Response, XII International Conference on Soil Mechanics and Foundation Engineering*, 1989.

Rix, G. J. and K. H. Stokoe, II, "Stiffness Profiling of Pavement Subgrades," *In Situ Testing of Soil Properties for Transportation*, Transportation Research Record No. 1235, Transportation Research Board, pp. 1-9, 1990.

Rix, G. J., and E. A. Leipski, "Accuracy and Resolution of Surface Wave Inversion," *Recent Advances in Instrumentation, Data Acquisition, and Testing in Soil Dynamics*, ASCE Geotechnical Special Publication No. 29, S.K. Bhatia and G.W. Blaney, Eds., pp. 17-32, 1991.

Rix, G. J., J. A. Bay, and K. H. Stokoe, II, "Assessing the In Situ Stiffness of Curing Portland Cement Concrete with Seismic Tests," *Cement, Admixtures, and Concrete 1990*, Transportation Research Record No. 1284, Transportation Research Board, pp. 8-15, 1991

Baker, N. C., and G. J. Rix, "Computing in Civil Engineering: Current Trends and Future Directions," *Journal of Professional Issues in Engineering Education and Practice*, ASCE, Vol. 118, No. 2, pp. 139-155, 1992

Brown, D. A., and G. J. Rix, "Geotechnical Investigation Strategies for a Lunar Base," *Journal of Aerospace Engineering*, ASCE, Vol. 5, No. 2, pp. 199-213, 1992.

Mayne, P. W., and G. J. Rix, " $G_{\max} - q_c$ Relationships for Clays," *Geotechnical Testing Journal*, ASTM, Vol. 16, No. 1, pp. 54-60, 1993.

Meier, R. W., and G. J. Rix, "An Initial Study of Surface Wave Inversion Using Artificial Neural Networks," *Geotechnical Testing Journal*, ASTM, Vol. 16, No. 4, pp. 425-431, 1993.

- Rix, G. J., L. J. Jacobs, and C. D. Reichert, "Evaluation of Nondestructive Test Methods for Length, Diameter, and Stiffness Measurements on Drilled Shafts," *Field Performance of Structures and Nondestructive Evaluation of Subsurface Infrastructure*, Transportation Research Record No. 1415, Transportation Research Board, pp. 69-77, 1993.
- Rix, G. J. and J. S. Indridason, "Liquefaction During the 1886 Charleston Earthquake," *Proceedings, XIII International Conference on Soil Mechanics and Foundation Engineering*, A.A. Balkema, Rotterdam, pp. 1321-1324, 1994.
- Rix, G. J., "Tomographic Inversion Using Artificial Neural Networks," *Dynamic Geotechnical Testing II*, Special Technical Publication 1213, ASTM, pp. 101-117, 1994.
- Sutterer, K. G., and G. J. Rix, "WAK and Full-Scale Load Tests on Granular Fill," *Vertical and Horizontal Deformations of Foundations and Embankments*, ASCE Geotechnical Special Publication No. 40, A.T. Yeung and G.Y. Felio, Eds., pp. 153-163, 1994.
- Mayne, P. W., and G. J. Rix, "Correlation between Shear Wave Velocity and Cone Tip Resistance in Natural Clays," *Soils and Foundations*, Vol. 35, No. 2, pp. 107-110, 1995.
- Meier, R. W., and G. J. Rix, "Backcalculation of Flexible Pavement Moduli Using Artificial Neural Networks," *Strength and Deformation Characteristics of Pavement Sections*, Transportation Research Record No. 1448, Transportation Research Board, pp. 75-82, 1995.
- Meier, R. W., and G. J. Rix, "Backcalculation of Flexible Pavement Moduli From Dynamic Deflection Basins Using Artificial Neural Networks," *Strength and Deformation Characteristics of Pavement Sections and Pavement Rehabilitation*, Transportation Research Record No. 1473, Transportation Research Board, pp. 72-81, 1995.
- Rix, G. J. and A. W. Spang, "In Situ Damping Ratio Measurements Using Surface Waves," *Proceedings, Xth Pan American Conference on Soil Mechanics and Foundation Engineering*, Guadalajara, Mexico, Vol. 3, pp. 1831-1842, 1995.
- Rix, G. J. and A. W. Spang, "Measurement of In Situ Damping Ratio Using Surface Waves," *Proceedings, First International Conference on Earthquake Geotechnical Engineering*, K. Ishihara, Ed., A.A. Balkema, Rotterdam, Vol. 1, 345-350, 1995.
- Meier, R. W., and G. J. Rix, "Chapter 7 - Backcalculation of Flexible Pavement Moduli From Falling Weight Deflectometer Data Using Artificial Neural Networks," *Artificial Neural Networks for Civil Engineers: Advanced Features and Applications*, I. Flood and N. Kartam, Eds., American Society of Civil Engineers, pp. 162-190, 1998.
- Rix, G. J., C. G. Lai, S. Foti, and D. Zywicki, "Surface Wave Tests in Landfills and Embankments," *Geotechnical Earthquake Engineering and Soil Dynamics III*, ASCE Geotechnical Special Publication No. 75, Dakoulas, P., Yegian, M., and Holtz, R.D., Eds., pp. 1008-1019, 1998.
- Lai, C. G., and G. J. Rix, "Inversion of Multi-Mode Effective Dispersion Curves," *Pre-Failure Deformation Characteristics of Geomaterials*, Jamiolkowski, M., Lancellotta, R., and Lo Presti, D., Eds., A.A. Balkema, Rotterdam, Vol. 1, pp. 411-418, 1999.
- Schneider, J. A., L. Hoyos, P. W. Mayne, E. J. Macari, and G. J. Rix, "Field and Laboratory Measurements of Dynamic Shear Modulus of Piedmont Residual Soils," *Behavioral Characteristics of Residual Soils*, ASCE Geotechnical Special Publication No. 92, pp. 12-25, 1999.

Rix, G. J., C. G. Lai, and A. W. Spang, "In Situ Measurement of Damping Ratio Using Surface Waves," *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 126(5), pp. 472-480, 2000.

Romero, S., and G. J. Rix, "Seismic Zonation in the New Madrid Seismic Zone," *Soil Dynamics and Liquefaction 2000*, ASCE Geotechnical Special Publication No. 107, Pak, R.Y.S. and Yamamura, J., Eds., pp. 163-177, 2000.

Schneider, J. A., P. W. Mayne, and G. J. Rix, "Ground Improvement Assessment Using SCPTu and Crosshole Data," *Innovations and Applications in Geotechnical Site Characterization*, ASCE Geotechnical Special Publication No. 97, Mayne, P.W. and Hryciw, R., Eds., pp. 169-180, 2000.

Lo Presti, D.C.F., S. Shibuya, and G. J. Rix, "Innovation in Soil Testing," *Pre-Failure Deformation Characteristics of Geomaterials*, Jamiolkowski, M., Lancellotta, R., and Lo Presti, D., Eds., Swets and Zeitlinger, Lisse, Vol. 2, pp. 1027-1076, 2001.

Romero, S., G. J. Rix, and S. P. French, "Transportation Routes in Soils Susceptible to Ground Failure: New Madrid Seismic Zone," *Soil Mechanics 2000*, Transportation Research Record No. 1736, Transportation Research Board, pp. 127-133, 2001.

Rix, G. J., C. G. Lai, M. C. Orozco, G. L. Hebel, and V. Roma, "Recent Advances in Surface Wave Methods for Geotechnical Site Characterization," *Proceedings, XV International Conference on Soil Mechanics and Geotechnical Engineering*, A.A. Balkema, Lisse, pp. 499-502, 2001.

Romero, S., and G. J. Rix, "Regional Variations in Near-Surface Shear Wave Velocity in the Greater Memphis Area," *Engineering Geology*, Vol. 62, pp. 137-158, 2001.

Schneider, J. A., P. W. Mayne, and G. J. Rix, "Geotechnical Site Characterization in the Greater Memphis Area Using Cone Penetration Tests," *Engineering Geology*, Vol. 62, pp. 169-184, 2001.

Rix, G. J., C. G. Lai, and S. Foti, "Simultaneous Measurement of Surface Wave Dispersion and Attenuation Curves," *Geotechnical Testing Journal*, Vol. 24, No. 4, pp. 350-358, 2001.

Rix, G. J., G. L. Hebel, and M. C. Orozco, "Near-Surface V_s Profiling in the New Madrid Seismic Zone Using Surface Wave Methods," *Seismological Research Letters*, Vol. 73, No. 3, pp. 380-392, 2002.

Lai, C. G., and G. J. Rix, "Solution of the Rayleigh Eigenproblem in Viscoelastic Media," *Bulletin of the Seismological Society of America*, Vol. 92, No. 6, pp. 2297-2309, 2002.

Lai, C. G., G. J. Rix, S. Foti, and V. Roma, "Simultaneous Measurement and Inversion of Surface Wave Dispersion and Attenuation Curves," *Soil Dynamics and Earthquake Engineering*, Vol. 22, pp. 923-930, 2002.

Meng, J., and G. J. Rix, "Reduction of Equipment-Generated Damping in Resonant Column Measurements," *Géotechnique*, Vol. 53, No. 5, pp. 503-512, 2003.

Meng, J. and G. J. Rix, "Reduction of Equipment-Generated Damping in the Low Frequency Range," *Géotechnique*, Vol. 54, No. 3, pp. 219-221, 2004.

Rix, G. J. "Near-Surface Site Characterization Using Surface Waves," *Surface Waves in Geomechanics: Direct and Inverse Modelling for Soils and Rocks*, C. G. Lai and K. Wilmski, Eds., SpringerWien, New York, pp. 1-46, 2005.

Rix, G. J. and J. Meng, "A Non-Resonance Method for Measuring Dynamic Soil Properties," *Geotechnical Testing Journal*, Vol. 28, No. 1, pp. 1-8, 2005.

Lai, C. G., S. Foti, and G. J. Rix, "Propagation of Data Uncertainty in Surface Wave Inversion," *Journal of Environmental and Engineering Geophysics*, Vol. 10, No. 2, pp. 219-228, 2005.

Zywicki, D. J. and G. J. Rix, "Mitigation of Near-Field Effects for Seismic Surface Wave Velocity Estimation with Cylindrical Beamformers," *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 131, No. 8, pp. 970-977, 2005.

DesRoches, R., J. Hellstrom, N. Pansic, and G. J. Rix, "Louisiana River and Coastal Ports Assessment," *Hurricane Katrina Damage Assessment*, S. A. Curtis, Ed., American Society of Civil Engineers, Reston, Virginia, pp. 97-130, 2007.

Cramer, C. H., G. J. Rix, and K. Tucker, "Probabilistic Liquefaction Hazard Maps for Memphis, Tennessee," *Seismological Research Letters*, Vol. 79, No. 3, pp. 416-423, 2008.

Yoon, S. and G. J. Rix, "Near-Field Effects on Array-Based Surface Wave Methods with Active Sources," *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 135, No. 3, pp. 399-406, 2009.

Taylor, C. E., G. J. Rix, and F. Liu, "Exploring Financial Decision-Making Approaches for Use in Earthquake Risk Decision Processes for Ports," *Journal of Infrastructure Systems*, Vol. 15, No. 4, pp. 406-416, 2009.

Ivey, L. M., G. J. Rix, S. D. Werner, and A. L. Erera, "A Framework for Earthquake Risk Assessment for Container Ports," *Marine Transportation and Port Operations 2010, Transportation Research Record: Journal of the Transportation Research Board*, No. 2166, pp. 116-123, 2010.

Fragaszy, R.J., Santamarina, J.C., Amekudzi, A., Assimaki, D., Bachus, R., Burns, S.E., Cha, M.S., Cho, G.C., Cortes, D.D., Dai, S., Espinoza, D.N., Garrow, L., Huang, H., Jang, J., Jung, J.W., Kim, S.H., Kurtis, K., Lee, C.H., Pasten, C.R., Phadnis, H., Rix, G., Shin, H.S., Torres, M.C., Tsouris, C. "Sustainable Development and Energy Geotechnology: Potential Roles for Geotechnical Engineering," *Journal of Civil Engineering*, Korean Society of Civil Engineering, Vol. 15, No. 4, pp. 611-622, 2011.

DesRoches, R., Comerio, M., Eberhard, M., Mooney, W., and Rix, G.J. "Overview of the 2010 Haiti Earthquake," *Earthquake Spectra*, Vol. 27, No. S1, pp. S1-S21, 2011.

Green, R. A., S. M. Olson, B. M. Cox, G. J. Rix, E. M. Rathje, J. Bachhuber, J. French, S. Lasley, and N. Martin, "Geotechnical Aspects of Failures at Port-au-Prince Seaport during the January 12, 2010 Haiti Earthquake," *Earthquake Spectra*, Vol. 27, No. S1, pp. S43-S65, 2011.

Rathje, E.M., Bachhuber, J., Duhlberg, R., Cox, B.R., Kottke, A., Wood, C., Green, R., Olson, S., Wells, D., and Rix, G.J. (2011). "Damage Patterns in Port-au-Prince during the 2010 Haiti Earthquake," *Earthquake Spectra*, Vol. 27, No. S1, pp. S117-S136, 2011.

Werner, S. D., N. McCullough, W. Bruin, A. Augustine, G. J. Rix, B. Crowder, and J. Tomblin, "Seismic Performance of Port de Port-au-Prince during the Haiti Earthquake and Post-Earthquake Restoration of Cargo Throughput," *Earthquake Spectra*, Vol. 27, No. S1, pp. S387-S410, 2011.

Cubrinovski, M., Bradley, B., Wotherspoon, L., Green, R., Bray, J., Wood, C., Pender, M., Allen, J., Bradshaw, A., Rix, G., Taylor, M., Robinson, K., Henderson, D., Giorgini, S., Ma, K., Winkley, A., Zupan, J., O'Rourke, T., DePascale, G., and Wells, D. "Geotechnical Aspects of the 22 February 2011 Christchurch Earthquake," *Bulletin of the New Zealand Society for Earthquake Engineering*, 44(4), 205-226, 2011

Green, R., Wood, C., Cox, B., Cubrinovski, M., Wotherspoon, L., Bradley, B., Algie, T., Allen, J., Bradshaw, A., and Rix, G. "Use of DCP and SASW Tests to Evaluate Liquefaction Potential: Predictions vs. Observations during the Recent New Zealand Earthquakes," *Seismological Research Letters*, 82(6), 927-938, 2011.

Bignardi, S., Fedele, F., Yezzi, A. J., Rix, G. J., and Santarato, G. "Geometric Seismic-Wave Inversion by the Boundary Element Method," *Bulletin of the Seismological Society of America*, 102(2), 802-811, 2012.

Green, R.A., Cubrinovski, M., Wotherspoon, L., Allen, J., Bradley, B., Bradshaw, A., Bray, J., DePascale, G., Orense, R., O'Rourke, T., Pender, M., Rix, G., Wells, D., Wood, C., Henderson, D., Hogan, L., Kailey, P., Robinson, K., Taylor, M., and Winkley, A. "Geotechnical Aspects of the M_w 6.2 2011 Christchurch, New Zealand Earthquake", *State of the Art and Practice in Geotechnical Engineering* R. Hryciw, A. Athanasopoulos-Zekkos, and N. Yesiller, Eds., ASCE Geotechnical Special Publication 225, 1700-1709, 2012.

Gregory, R., M. Harstone, G. J. Rix, and A. Bostrom, "Seismic Risk Mitigation Decisions at Ports: Multiple Challenges, Multiple Perspectives," *Natural Hazards Review*, 13(1), 88-95, 2012.

Yang, C. S., R. DesRoches, and G. J. Rix, "Numerical Fragility Analysis of Vertical-Pile-Supported Wharves in the Western United States," *Journal of Earthquake Engineering*, 16, 579-594, 2012.

Shafieezadeh, A., R. DesRoches, G. J. Rix, and S. D. Werner. "Seismic Performance of Pile-Supported Wharf Structures Considering Soil-Structure Interaction in Liquefied Soil," *Earthquake Spectra*, 28(2), 729-757, doi: 10.1193/1.4000008, 2013.

Shafieezadeh, A., R. DesRoches, G. J. Rix, and S. D. Werner. "Three-Dimensional Wharf Response to Far-Field and Impulsive Near-Field Ground Motions in Liquefiable Soils," *Journal of Structural Engineering*, 139(8), 1395-1407, doi: 10.1061/(ASCE)ST.1943-541X.0000642, 2013.

Bignardi, S., Fedele, F., Yezzi, A. J., Santarato, G., and Rix, G. J. "Surface Waves in Laterally Heterogeneous Media," *Journal of Engineering Mechanics*, 139(9), 1158-1165, doi: 10.1061/(ASCE)EM.1943-7889.0000566, 2013.

Shafieezadeh, A., R. DesRoches, G. J. Rix, and S. D. Werner. "A Probabilistic Framework for Correlated Seismic Downtime and Repair Cost Estimation of Geo-Structures," *Earthquake Engineering and Structural Dynamics*, 43(5), 739-757, doi: 10.1002/eqe.2369, 2014.

Scharks, T., Bostrom, A., Reimann-Garetson, L., and Rix, G.J. "Risk Decision Making and Seismic Risk Preparedness at North American Seaports: Analysis of a System-Wide Survey," *Earthquake Spectra*, in press.

Lai, C. G., Mangriotis, M.-M., and Rix, G. J. "An Explicit Relation for the Apparent Phase Velocity of Rayleigh-waves in a Vertically Heterogeneous Elastic Half-Space," *Geophysical Journal International*, in press.

INVITED PRESENTATIONS

"In Situ Measurement of Small-Strain Moduli Using Seismic Methods," Law Engineering, Inc., Geotechnical Engineering Seminar, September 7, 1990.

"Use of Geophysical Methods in Geotechnical and Transportation Engineering, Symposium on the Application of Geophysics to Engineering and Environmental Problems, Knoxville, March 11-14, 1991.

"Applications of In Situ Seismic Methods in Geotechnical Engineering," University of California - Berkeley, Geotechnical Engineering Seminar, February 11, 1992.

"Short Course on In Situ Measurements Using Surface Waves," Florida Department of Transportation, September 3-4, 1992.

"Nondestructive Integrity Tests on Cast-In-Place Foundations," ASCE Georgia Section Geotechnical Committee Meeting, November 17, 1992.

"Data Inversion in Engineering Geophysics Using Artificial Neural Networks," Seminar on the Use of Artificial Neural Networks in Civil Engineering, US Army Engineer Waterways Experiment Station, July 29, 1993.

"Nondestructive Test Interpretation Using Artificial Neural Networks," Geotechnical Engineering Seminar, Purdue University, December 6, 1993.

"Geotechnical Aspects of the January 17, 1994 Northridge Earthquake," ASCE Georgia Section Geotechnical Committee Meeting, March 15, 1994.

"Liquefaction Potential Evaluation," 10th European Conference on Earthquake Engineering, Vienna, August 28 - September 2, 1994.

"Site Characterization with Surface Waves," Department of Civil Engineering, University of Waterloo, November 16, 1994.

"Infrastructure Evaluation and Rehabilitation," Annual Conference, Science Teacher's Association of Ontario, Toronto, Ontario, Canada, November 17, 1994.

"Infrastructure Projects in the City of Atlanta," ASCE Georgia Section Geotechnical Committee Meeting, May 16, 1995.

"Infrastructure Management and Maintenance," Workshop on "Roads and Bridges: Rural America's Infrastructure," National Association of Counties, Atlanta, Georgia, July 24, 1995

Rix, G. J., "Interpretation of Nondestructive Test Data Using Artificial Neural Networks," Presentation at the 1996 Transportation Research Board Meeting, Washington, D.C., January 1996.

Site Characterization with Surface Waves, One-day short course offered at the Symposium on the Application of Geophysics to Environmental and Engineering Problems, March 1997 to approximately 40 participants. Co-taught with Dr. J.C. Santamarina.

In Situ Seismic Methods, Four-day short course offered at the Asian Institute of Technology, Bangkok, Thailand, May 1997. Co-taught with Dr. K.H. Stokoe, II, University of Texas at Austin, and Dr. Tom Lunne, Norwegian Geotechnical Institute.

"Measurement and Analysis of Civil Engineering Vibrations," State-of-the-Art Speaker, Fourth International Conference on Case Histories in Geotechnical Engineering, St. Louis, MO, March, 1998.

"Overview of the Georgia Transportation Institute," Institute of Transportation Engineers – Georgia Chapter, May 14, 1998.

"Measurement and Analysis of Civil Engineering Vibrations," ASCE Oregon Section Geotechnical Engineering Committee, Portland, OR, December 2, 1998.

"Mid-America Earthquake Center Hazards Evaluations Program," International Workshop on Earthquake Engineering in Regions of Moderate Seismicity, Hong Kong Polytechnic University, December 7, 1998.

"Site Characterization Using Passive Surface Wave Methods," University of California at Berkeley, March 17, 1999.

"In Situ Seismic Methods," Discussion Session 1B, 2nd International Symposium on Pre-Failure Deformation Properties of Characteristics, Torino, Italy, September 27, 1999.

"Site Characterization with Surface Waves," One-day short course offered at the Symposium on the Application of Geophysics to Environmental and Engineering Problems, February 2000 to approximately 25 participants. Co-taught with Dr. J.C. Santamarina.

"Design Earthquake Ground Motions for IBC2000 in the Southeastern United States," ASCE Georgia Section Geotechnical Committee Meeting, November 13, 2001.

"Site Response and Ground Motions in the Charleston, SC Area," Short course on Geotechnical Earthquake Engineering in Mid-America, Charleston, SC, November 15, 2001.

"Geophysical Methods for Subsurface Utility Identification," Trenchless Technology Seminar, Atlanta, GA, April 16, 2002.

"Geotechnical Site Characterization Using Surface Waves," Weierstrass Institute for Applied Analysis and Stochastics, Berlin, Germany, May 27, 2002.

"Site Response and Ground Motions in the Kansas City, KS Area," Short course on Geotechnical Earthquake Engineering in Mid-America, Kansas City, KS, September 12, 2002.

"Liquefaction," Consequence-Based Engineering Institute, Mid-America Earthquake Center, College Station, TX, January 8, 2003.

"Design Earthquake Ground Motions for IBC2000 in the Southeast United States," *Seismic Design for IBC2000*, Georgia Tech Continuing Education, January 9, 2003.

"Site Response and Ground Motions in Puerto Rico," Short course on Geotechnical Earthquake Engineering in Mid-America, San Juan, PR, May 22, 2003.

"Soil Dynamics and Dynamically Loaded Foundations," Short course offered at University of Reggio Calabria, Reggio Calabria, Italy, May 29-30, 2003.

"Recent Developments in Laboratory and In Situ Characterization of Dynamic Soil Properties," University of Minnesota, Minneapolis, MN, September 12, 2003.

“Recent Developments in Laboratory and In Situ Characterization of Dynamic Soil Properties,” University of Illinois, Urbana, IL, November 6, 2003.

“Site Classification,” Session on International Building Codes Issues, ASCE Civil Engineering Conference and Exposition, Nashville, TN, November 14, 2003.

“Hazard Definition,” Session on Consequence-Based Earthquake Engineering in Mid-America, ASCE Civil Engineering Conference and Exposition, Nashville, TN, November 14, 2003.

“Site Amplification and Liquefaction,” Short Course on Earthquake Ground Motions in Mid-America, Memphis, TN, December 4, 2003.

“Recent Developments in Laboratory and In Situ Characterization of Dynamic Soil Properties,” Massachusetts Institute of Technology, Cambridge, MA, December 9, 2003.

“Earthquake Ground Motions,” S&ME, Inc. 2004 Technical Seminar, Charlotte, NC, January 30, 2004.

“Liquefaction Hazard Mapping in Memphis, Tennessee,” University of Pavia, Pavia, Italy, March 23, 2004.

“Frequency Dependence of Shear Modulus and Damping Ratio,” Technical University of Turin, Turin, Italy, March 26, 2004.

“Frequency-Wavenumber Analysis of Active and Passive Surface Waves,” U.S. Geological Survey, Menlo Park, CA, May 3, 2004.

“Near-Surface Site Characterization Using Surface Waves,” Short Course on Surface Waves in Geomechanics: Direct and Inverse Modelling, International Centre for Mechanical Sciences, Udine, Italy, September 6-7, 2004.

“Geotechnical Earthquake Engineering,” Short Course on Introduction to Structural Dynamics and Earthquake Engineering (CE-129), Georgia Institute of Technology Professional Education, Atlanta, GA, September 14, 2004.

“Vertical Arrays and Deep Wells in the Central and Eastern United States,” International Workshop for Site Selection, Installation, and Operation of Geotechnical Strong-Motion Arrays, University of Southern California, Los Angeles, CA, October 14-15, 2004.

“Liquefaction,” Consequence-Based Engineering Institute, Mid-America Earthquake Center, College Station, TX, January 7, 2005.

“Liquefaction Potential Mapping in Memphis/Shelby County, Tennessee,” ATC-35/USGS Seminar on New Knowledge of Earthquake Hazard in the Central United States and Implications for Building Seismic Design Practice, Memphis, TN, March 3, 2005.

“Site Amplification and Liquefaction,” Short Course on Earthquake Ground Motions in Mid-America, Little Rock, AR, April 28, 2005.

“Seismic Hazard and Site Response Analyses,” Short Course on Seismic Site Characterization and Geotechnical Earthquake Hazards (CE-138), Georgia Institute of Technology Professional Education, Atlanta, GA, May 12, 2005.

“Geotechnical Earthquake Engineering,” Short Course on Introduction to Structural Dynamics and Earthquake Engineering (CE-129), Georgia Institute of Technology Professional Education, Atlanta, GA, September 6, 2005.

“Deterministic and Probabilistic Estimates of Ground Motions in the Central U.S.,” Mid-America Earthquake Center Annual Meeting, Austin, TX, January 20, 2006.

“Hurricane Katrina’s Impact on Louisiana’s Transportation Infrastructure,” Georgia Institute of Technology Library and Information Center’s Faculty Speaker Series, Atlanta, GA, March 28, 2006 (with Dr. Reginald DesRoches).

“Seismic Hazard and Site Response Analyses,” Short Course on Seismic Site Characterization and Geotechnical Earthquake Hazards (CE-138), Georgia Institute of Technology Professional Education, Atlanta, GA, May 8, 2006.

“Geotechnical Earthquake Engineering,” Short Course on Introduction to Structural Dynamics and Earthquake Engineering (CE-129), Georgia Institute of Technology Professional Education, Atlanta, GA, October 10, 2006.

“New Developments in Laboratory and In Situ Measurements of Dynamic Soil Properties,” Drexel University, Philadelphia, PA, November 30, 2006.

“Natural Hazard Risk Mitigation for Ports,” Nanyang Technological University, Singapore, March 21, 2007.

“Impact of Hurricane Katrina on South Louisiana River and Coastal Ports,” Ports 2007, San Diego, CA, March 26, 2007.

“NEESR Grand Challenge: Seismic Risk Management for Port Systems,” 5th NEES Annual Meeting, Snowbird, UT, June 20, 2007.

“Geotechnical Earthquake Engineering,” Short Course on Introduction to Structural Dynamics and Earthquake Engineering (CE-129), Georgia Institute of Technology Professional Education, Atlanta, GA, November 30, 2007.

“Seismic Risk Management for Container Ports,” 6th NEES Annual Meeting, Portland, OR, June 19, 2008.

“Seismic Risk Management for Container Ports,” Port of Long Beach, Long Beach, CA, August 7, 2008.

“Recent Developments in Surface Wave Testing for Engineering Applications,” University of Memphis, Memphis, TN, October 3, 2008.

“Geotechnical Earthquake Engineering,” Short Course on Introduction to Structural Dynamics and Earthquake Engineering (CE-129), Georgia Institute of Technology Professional Education, Atlanta, GA, May 12, 2009.

“Estimation of Earthquake-Induced Losses for Container Ports,” 7th NEES Annual Meeting, Honolulu, HI, June 22, 2009.

“The M_w 7.0 Haiti Earthquake of January 12, 2010,” Georgia Institute of Technology, School of Civil and Environmental Engineering Advisory Board, Atlanta, GA, April 9, 2010.

“Geotechnical Aspects of the M_w 7.0 Haiti Earthquake,” EERI Student Chapter, Georgia Institute of Technology, Atlanta, GA, April 15, 2010.

“Geotechnical and Structural Damage Caused by the M_w 7.0 Haiti Earthquake,” ASCE Georgia Section Geotechnical Committee, Atlanta, GA, April 20, 2010.

“Seismic Design and Risk Analyses for Container Ports,” Short Course at ASCE Ports 2010 Conference, Jacksonville, FL, April 25, 2010.

“Geotechnical Aspects of the M_w 7.0 Haiti Earthquake,” European Centre for Training and Research in Earthquake Engineering, Pavia, Italy, November 11, 2010.

“Geotechnical Aspects of the M_w 7.0 Haiti Earthquake,” Politecnico di Torino, Torino, Italy, November 24, 2010.

“Seismic Risk Assessment for Container Ports,” Studio Geotecnico Italiano, Milan, Italy, November 25, 2010.

“Geotechnical Aspects of the M_w 7.0 Haiti Earthquake,” Studio Geotecnico Italiano, Milan, Italy, December 2, 2010.

“Seismic Risk Assessment for Container Ports,” European Centre for Training and Research in Earthquake Engineering, Pavia, Italy, December 14, 2010.

“The January 12, 2010 M_w 7.0 Haiti Earthquake,” Northeast Florida Engineers Week Banquet, Jacksonville, FL, February 26, 2011.

“The February 22, 2011 M_w 6.3 Christchurch, New Zealand Earthquake,” University of California, Berkeley, March 9, 2011.

“Surface Wave Methods for Near-Surface Site Characterization,” ASCE Georgia Section Geotechnical Committee, Atlanta, GA, September 20, 2011.

“Performance of Container Ports in Recent Earthquakes,” EERI Annual Meeting and National Earthquake Conference, Memphis, TN, April 11, 2012.

“Geotechnical Earthquake Engineering,” Short Course on Introduction to Structural Dynamics and Earthquake Engineering, Georgia Institute of Technology Professional Education, Atlanta, GA, February 26-27, 2013.

“Field Methods for Determining Near-Surface Shear Wave Velocities,” Seminar on Advances in Geotechnical Earthquake Engineering, Oregon State University, Corvallis, OR, March 23, 2013.

THOMAS B. RAMSEY, P.E.

EDUCATION

M.S., Duke University, Environmental Engineering, Durham, North Carolina, 1991
B.S., Dartmouth College, Civil Engineering, Hanover, New Hampshire, 1988
B.A., Dartmouth College, Engineering, Hanover, New Hampshire, 1987

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer, Alabama, [REDACTED]
Professional Engineer, Delaware, [REDACTED]
Professional Engineer, Georgia, [REDACTED]
Professional Engineer, Kentucky, [REDACTED]
Professional Engineer, Maryland, [REDACTED]
Professional Engineer, New Jersey, [REDACTED]
Professional Engineer, North Carolina, [REDACTED]
Professional Engineer, Pennsylvania, [REDACTED]
Professional Engineer, South Carolina, [REDACTED]
Professional Engineer, Tennessee, [REDACTED]
Professional Engineer, Virginia, [REDACTED]
Professional Engineer, West Virginia, [REDACTED]

CAREER SUMMARY

Mr. Ramsey has more than 20 years' experience in the design and construction of waste containment and processing facilities. He also has extensive experience in operations management and economic analyses associated with the solid waste management industry.

Innovative Waste Containment Design

Design and permit innovative technologies such as mechanically stabilized earth walls, leachate recirculation, waste piggybacking over pre-Subtitle D landfills, evapo-transpirative covers, and bioreactors. Perform cost-benefit analysis for various technologies to minimize cost and/or maximize financial return on investment.

LFG Migration Mitigation Plan, Newland Park Landfill, Wicomico County, Maryland. Responsible for successful design of a LFG migration mitigation plan for Newland Park Landfill in Wicomico County, Maryland. The mitigation design included the use of shallow perimeter LFG cut-off trenches in conjunction with LFG collection system improvements to minimize the potential for LFG migration.

Landfill Expansion, Wilmington, Delaware. Project Manager for \$90 million landfill expansion project. Work includes over 2 million yd³ of earthwork, construction of a 1.5 mile long, 60-ft high mechanically stabilized earth (MSE) berm over soft foundation soils, installation of wicks drains, geotechnical instrumentation, directional drilling, stormwater and force main piping, electrical work, transitioning an operating landfill gas (LFG) system to a new header system, and specialty trades. Responsibilities include change order review and dispute resolution between owner and contractor.

Soil-Bentonite Slurry Wall and Geomembrane Cap, Former Drum Disposal Site, Burlington, New Jersey. Designer for project that included approximately 50,000 ft² of slurry wall with depths up to 30 ft. The design had to address potential contingencies for construction should excavation encounter unanticipated debris.

Lanchester Landfill Expansion, Honey Brook, Pennsylvania. Designer for a major landfill expansion. The expansion design includes detailed construction sequencing plans for relocation of major utilities, major modifications to existing LFG system, installation of piggy-back liner, and construction of a 4,000-ft. long MSE berm with heights up to 70 ft.

CERCLA Site Closure, Confidential Client, Pennsylvania. Responsible for design and construction certification. The project included an innovative closure cap using evapotranspirative tree cover instead of traditional geosynthetics and LFG venting and perimeter controls to address LFG migration.

Municipal Solid Waste Landfill Expansion, Ashland, Kentucky. Prepared Notice-of-Intent to Permit design documents for a 260-acre lateral expansion for a municipal solid waste landfill in Ashland, Kentucky.

Landfill Design And Permitting, Various Locations. Successfully managed design and permitting of lateral and/or vertical expansions at Springhill Landfill, Graceland, Florida (2001), Pine Bluff Landfill, Ball Ground, Georgia (2001), Oakwood Landfill, Ridgeland, South Carolina (2001), TNT Landfill, Elgin, South Carolina (2000), Chastang Landfill, Chastang, Alabama, (2000) Hickory Hill Landfill, Ridgeland, South Carolina (1999), Richland County Landfill, Elgin, South Carolina (1998), Live Oak Landfill, Conley, Georgia (1998), West Kentucky Landfill, Mayfield, Kentucky (1997), Button-Gwinnett Landfill, Lawrenceville, Georgia (1996), Bolton Road Landfill, Atlanta, Georgia (1997), Richland County Landfill, Elgin, South Carolina (1997), Oakdale Road Landfill, Smyrna, Georgia (1996), Maplewood Landfill, Amelia, Virginia (1994), and Charles City County Landfill, Charles City, Virginia (1993). Of these facilities, three were Greenfield developments, five involved piggybacking over old closed landfills, and four involved the use of mechanically stabilized earth walls for disposal volume maximization.

Odor Management Systems, Various Locations. Designed and reviewed odor management systems at Palmetto Landfill, Spartanburg, South Carolina (1998-2002), Pine Bluff Landfill, Ballground, Georgia (2001), Live Oak Landfill, Conley, Georgia (1998-2001), and Richland County Landfill, Elgin, South Carolina (1998).

Approval of Alternative Liner Systems, Various Locations. Responsible for the approval of alternative liner systems to prescriptive Subtitle D requirements at Bolton Road Landfill, Atlanta Georgia (1997), Charles City County Landfill, Charles City County, Virginia (1993), Maplewood Landfill, Amelia County, Virginia (1994).

Demonstration Study for a Vegetative Evapotransporative (i.e., Phyto-) Cap, Various Locations. Responsible for the approval of a demonstration study for a vegetative evapotransporative (i.e., phyto-) cap in lieu of typical landfill cover system at a Confidential CERCLA site in Pennsylvania (2004) and Charles City County Landfill, Charles City County, Virginia (1994).

Leachate Recirculation System, Charles City County Landfill, Virginia. Responsible for approval at Charles City County Landfill of one of the first leachate recirculation system in the Commonwealth of Virginia following implementation of federal Subtitle D regulations.

Synthetic Final Cap Stability, New Milford Landfill, New Milford, Connecticut. Conducted engineering studies reviewing synthetic final cap stability at New Milford Landfill in New Milford, Connecticut. This project was the first geosynthetic membrane final capping construction in Waste Management's corporate history.

New Facilities Development

Project management, siting studies, and design for landfills, landfill gas-to-energy projects, transfer stations, material recovery facilities (MRFs), and trucking maintenance facilities. Perform fatal flaw analyses, apply siting criteria to area surveys, address compliance and/or regulatory issues, direct engineering design and permitting activities, manage real estate acquisitions, negotiate contracts, and prepare project pro forma for management review.

LFGTE Project, Newland Park Landfill, Wicomico County, Maryland. Provided consulting support to Wicomico County, Maryland in the successful development of a LFGTE project for Newland Park Landfill. The project involved the preparation of a formal RFP, identification of qualified vendors, and support to Wicomico County in negotiations with the selected LFGTE developer.

Material Recovery Facility, Lorton, Virginia. Responsible for design and permitting for a 2,000 ton per day material recovery facility for construction and demolition debris in Lorton, Virginia.

Waste Processing Facility, Leesburg, Virginia. Responsible for design, permitting, and construction support for a new \$4 million waste processing facility in Leesburg, Virginia. Work included preparation of detailed construction documents and oversight during construction. Critical to the design is staging construction so that existing transfer operations are not interrupted during construction of the new facility.

Potential Landfill Sites, Halifax County, North Carolina. Identified and screened potential landfill sites for privatized landfill development in Halifax County, North Carolina. Siting review included screening available land for development, proximity to major highways and nearby residents, and critical watershed avoidance. Following identification of the most suitable site, the developer could not finalize contract negotiations with the host community and the project was abandoned.

Greenfield Landfill Development, Columbus County, North Carolina. Supported third-party development of Greenfield landfill development in Columbus County, North Carolina. Work included siting review based on available land for development, avoidance of sensitive habitats, distance to nearest residents, and access to population centers.

Design Review and Analysis of MRFS, Various Locations. Responsible for design review and analysis of MRFs with capacities up to 300 tons per day in Leesburg, Virginia (2003), Forsyth County, Georgia (1998), and Newport News, Virginia (1994).

Permitting, Design, and Construction, Solid Waste Transfer Stations, Various Locations. Responsible for the successful completion of permitting, design, and construction of 1000+ ton per day solid waste transfer stations in Forest Park, Georgia (1998), Lawrenceville, Georgia (1998), and Charlotte, North Carolina (1996). Additional transfer stations with capacities between 100 and 500 tons per day have been completed in Fairfield, South Carolina (1994), Norfolk, Virginia (1994), Newport News, Virginia (1994), and Goochland, Virginia (1993).

Construction Management and Engineering Support

Construction management and engineering support for over 50 environmental infrastructure projects. Experience includes hundreds of acres of CERCLA and CERCLIS liner and closure construction, landfill gas systems, MRFs and transfer stations, and administrative facilities. Work includes constructability reviews, construction document preparation, engineering cost estimates, resident-project-representative support, claims prevention and resolution.

Construction Document Preparation, Truck Maintenance Facility, White Plains, Maryland. Responsible for construction document preparation for a 5,000 ft² addition to a truck maintenance facility in White Plains, Maryland. Work included geotechnical investigation and design as well as coordination with architectural and mechanical/electrical design subcontractors.

Superfund Site Closure, Northern New Jersey. Project Manager for a \$9 million, 35 acre Superfund site closure in northern New Jersey. Work included approximately 80,000 yd³ of waste relocation, 25 acres of capping, and 4 acres of wetland mitigation construction.

Construction Quality Assurance, Lanchester Landfill, Honey Brook, Pennsylvania. Certifying Engineer of construction quality assurance activities for \$10 million landfill cell construction project at Lanchester Landfill in Honey Brook, Pennsylvania. The project included a 25-acre closure, 8-acre cell construction and over 3,000 ft. of mechanically-stabilize earth (MSE) berm and specialty trades. Facilitated a negotiated settlement between the project owner and contractor over approximately \$500,000 in claims related to imprecise contract documents.

Expert Report and Trial Testimony Drinking Water Reservoir, Newark, Delaware. Provided expert report and trial testimony for veneer soil stability over geosynthetics in the construction of a 60-acre drinking water reservoir in Newark, Delaware (*Donald M. Durkin Contracting, Inc. vs. the City of Newark, Federal District Court of Wilmington, Delaware, 2006*). Testimony included opinions regarding constructability and design issues directly related to performance of the work.

Litigation Support for Landfill Construction-Related Claim, Confidential Client. Provided litigation support to a confidential client in a construction-related claim stemming from termination of the contractor during closure construction of a landfill. Support work included preparation of an expert report regarding constructability and design issues directly related to performance of the work.

Construction Quality Assurance Activities for Landfill Cell Construction and Closure Capping, Various Locations. Certifying Engineer of construction quality assurance activities at landfill cell construction and closure capping totaling over 200 acres at Garrett County Landfill, Oakland, Maryland (2005-2006), Piedmont Landfill, Kernersville, North Carolina (2003-2004), Sandy Hill Landfill, Bowie, Maryland (2003-2004), PST Reclamation Landfill, Davidsonville, Maryland (2003-2004), and IP Industrial Landfill in Franklin, Virginia (2003).

Construction Oversight of MSE Retaining Walls, Various Locations. Responsible for construction oversight of MSE retaining walls at Richland County Landfill, Elgin, South Carolina (2002), Live Oak Landfill, Conley, Georgia (2000), Bolton Road

Landfill, Atlanta Georgia (1998), Button-Gwinnett Landfill, Lawrenceville, Georgia (1998), and R&B Landfill, Homer, Georgia (1997).

Strategic Planning and Optimization of Field Operations

Review local market conditions and operations for solid waste facilities in order to identify additional business opportunities and reduce operating costs. Common market review issues include identification of competitors, comparison of competing waste management technologies, economic and political barriers to entry, and logistics. Operational economics typically include long-haul options, heavy equipment maintenance, construction budgeting and planning, and operations staffing.

Expert Report and Trial Testimony Regarding Transfer Station and Landfill Permitting, Philadelphia, Pennsylvania. Responsible for expert report and trial testimony regarding transfer station and landfill permitting in Philadelphia, Pennsylvania in a dispute over the value of condemned property which had been used for solid waste purposes (*Down Under vs. the City of Philadelphia RDA, Court of Common Pleas, Philadelphia County, Pennsylvania, 2005*).

Economic and Design Review of Aerobic and Anaerobic Landfill Bioreactor Projects, Various Locations. Responsible for economic and design review of aerobic and anaerobic landfill bioreactor projects at Hickory Hill Landfill, Ridgeland, South Carolina (2002), and Live Oak Landfill, Conley, Georgia (1998). Projects involved permitting research projects designed to review the environmental and economic costs and benefits associated with purposeful acceleration of biodegradation processes within landfills.

Direct Pipeline Sale of Landfill Gas, Spartanburg, South Carolina. Responsible for identification, pre-qualification of vendors and negotiating development of direct pipeline sale of landfill gas to BMW's Spartanburg, South Carolina assembly plant.

Failure Analysis and Repair Design, Solid Waste Transfer Stations, Various Locations. Responsible for failure analysis and repair design for weigh scales, tipping floors, leachate management, and loading pits at solid waste transfer stations in Gastonia, North Carolina (2001), Pendleton, South Carolina (2001), Florence, South Carolina (2001), Raleigh, North Carolina (2000), Sanford, North Carolina (2000), Siler City, North Carolina (2000), Theodore, Alabama (2000), Phenix City, Alabama (2000), and Atlanta, Georgia (1998).

Transfer Station Replacement, Atlanta, Georgia. Reviewed design alternatives, community impacts, construction budget, and financial performance for the replacement of a substandard 1,500 ton per day transfer station in Atlanta, Georgia.

Market Reviews, Various Locations. Integrated collection and disposal market reviews providing in-depth detail of company and competitor facilities, market share, waste flows, and pricing, in Myrtle Beach, South Carolina (2002), Birmingham, Alabama (2001), Charlotte, North Carolina (2001), and Atlanta, Georgia (2000). The purpose of these market reviews is to optimize collection and disposal operations as well as identify long-term business strategy within a specific marketplace.

Environmental and Operational Due Diligence for Major Acquisitions, Various Locations. Conducted environmental and operational due diligence for major acquisitions involving multiple facilities including four confidential solid waste transfer and landfill acquisitions (2003-2004); a confidential hazardous waste disposal acquisition (2002), the Waste Management/USA Waste Services merger (1998), the USA Waste bankruptcy purchase of Mid-American Waste Services (1997), the USA Waste/United Waste merger (1997), The USA Waste/Sanifill merger (1996) and the USA Waste/Western Waste Services merger (1996). Additional due diligence services performed for regional acquisitions including Trash Hunters (1997) and TransAmerican Waste (1997) as well as numerous small, one-location companies and numerous small, one-location companies.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Columbia, Maryland, 2002/present
Waste Management, Inc., Atlanta, Georgia, 1998/2002
USA Waste Services, Inc., Atlanta, Georgia, 1991/1998
Duke University, Durham, North Carolina, 1990/1991
Waste Management or North America, Inc., Wakefield, Massachusetts, 1988/1990

AFFILIATIONS

American Academy of Environmental Engineers
American Society of Civil Engineers
Solid Waste Association of North America (SWANA), mid-Atlantic Chapter

REPRESENTATIVE PUBLICATIONS

- 10-01 Espinoza, R.D, Germain, A.M., Kocenko, L.B., Ramsey, T.B., "Design and Construction Considerations for a Vertical Landfill Expansion over Extremely Compressible Soils" *Proceedings of WasteCon, Solid Waste Association of North America*, Boston, MA, 2010.
- 03-01 Ramsey, T.B, Gaffigan, W.J., "Where Does All the Garbage Go? Basic Landfill Economics Driving Waste Flow in Private Industry" *Proceedings of the*

SWANA's Eighth Annual Landfill Symposium and Solid Waste Managers,
Atlantic City, NJ, 2003.

- 98-01 Othman, Majdi, Beech, J.F, Ramsey, T.B., "Preliminary Results of Blast
Densification Pilot Program," *Geotechnical News*, 1998, Vol. 16, No. 4, pp. 43-
47.
- 95-01 Vesilind, P.A., Ramsey, T.B., "Effect of Drying Temperature on the Fuel Value
of Wastewater Sludge," *Waste Management and Research*, 1995.
- 93-01 Ramsey, T.B., Urrutia, J.L., Pearson, R., Karanjac, J., "Comparing Solid Waste
Liner System Performance for Liner Variance Applications" *Proceedings of the
Ninth International Conference on Solid Waste and Management*, Philadelphia,
PA, 1993.

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person. Limit one page per person)

16. NAME SMITH, A.J., PE	17. ROLE IN THIS CONTRACT HYDRAULIC AND HYDROLOGIC (H&H) ENGINEER	18. YEARS EXPERIENCE	
		a. TOTAL 13	b. WITH CURRENT FIRM 2
19. FIRM NAME AND LOCATION (City and State) HULL & ASSOCIATES, INC St. Clairsville, Ohio	20. EDUCATION (Degree and Specialization) MS, Civil Engineering Specializing in Geotechnical Engineering, The Ohio State University, 2009	21. CURRENT OH PROF REGISTRATIONS (List Discipline) Professional Engineer (OH, WV, PA, KY) Certified Floodplain Manager (CFM), CPESC, CESSWI	

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

Affiliations:

Association of State Dam Safety Officials (ASDSO)
 Association of State Floodplain Managers (ASFM)
 American Society of Civil Engineers (ASCE) Central Ohio Section, 1st Vice President

23. RELEVANT PROJECTS (Up to a maximum of 5 samples)

(1) Title, Client & Location (City, State)	(2) Building Type, Size & Project Cost / Performance	(3) Type of Construction, Delivery Model & Services	(4) Date Completed		(5) Example Project Key No.
			Design	Construction	
a. Columbus Upground Reservoir City of Columbus Delaware County, Ohio	Upground Reservoir \$1M	New Design	2010	2013	
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Design Engineer for the 9.3 billion gallon upground reservoir. Responsible for the construction drawings related to design of the earthen embankment and geomembrane liner. Calculated cut and fill volumes (4 MCY), grading and water storage volumes to meet the needs of the City. The design included erosion and sediment control and a dewatering system. Assisted in geotechnical exploration for reservoir footprint, spillway structure, pump station and pipeline. The reservoir had a construction cost of over \$75M.					
b. Statewide Dam Safety & Design ODNR Div. of Eng. Various Counties, Ohio	Dams and Locks ~\$100,000	Repair Design	2009	209	
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Design Engineer for many of the over 20 dams and locks investigated under this contract. Mr. Smith has performed hydraulic & hydrologic calculations, dam breach analyses, siphon lake drain design, quantity take-offs, prepared plans, specifications, construction cost estimates, and performed construction observation & materials testing (COMT) for these projects.					
c. Dam Investigation and Improvement Jefferson Lake State Park Jefferson County, Ohio	Dam ~\$50,000	Repair Design	2011	2014	
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Project Manager for the investigation and overtopping design for the state-owned Class I dam. Directed the hydrologic and hydraulic routing of the design storm event, spillway modeling, geotechnical investigation, stability analysis, design of new siphon lake drain system, RCC overtopping protection and remedial repairs.					
d. Design of Various Freshwater Impoundments & Dams Shale Operations Eastern Ohio	Dams and Impoundments \$100,000	New Construction	2013	2015	
(6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Project Manager for design, permitting, and construction of various above-ground lined impoundment and proposed dams. The impoundments and dams are designed for the purpose of supplying water to the shale oil and gas industry. The new dams include two proposed Class I dams storing about 50M gal each.					
Lake Crum Dam Repairs Recreation Unlimited Delaware County, Ohio	Levees \$25,000	Repair Design	2014	2015	
(6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Project Manager for the analysis and design of repair options to the existing Class III dam. Several alternatives for repair were presented with cost estimates for each. H&H analyses were performed, including a dam break analysis to determine the impacts to a public road and bridge downstream. Hull plans to present the results of the analyses and bathymetric survey to ODNR for possible reclassification of the dam.					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT
 (Complete one Section E for each key person. Limit one page per person)

15. NAME ADAM WEINANDY, PE, CESSWI, CPESC	17. ROLE IN THIS CONTRACT PROJECT ENGINEER	18. YEARS EXPERIENCE	
		a. TOTAL 7	b. WITH CURRENT FIRM 3
19. FIRM NAME AND LOCATION (City and State) HULL & ASSOCIATES, INC. Dublin, Ohio	20. EDUCATION (Degree and Specialization) Bachelor of Science, Civil Engineering, University of Dayton	21. CURRENT OH PROF REGISTRATIONS (List Discipline) Registered Professional Engineer: Ohio, Pennsylvania, & West Virginia CPESC Certification (2012) CESSWI Certification (2010) CPR Certified (2014)	

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

TRAINING: OSHA 40-Hour Hazardous Waste Site Activities (2012) and Annual 8-Hour Refresher Courses; SafeLandUSA/PEC Basic Orientation Course (2013)

23. RELEVANT PROJECTS (Up to a maximum of 5 samples)

(1) Title, Client & Location (City, State)	(2) Building Type, Size & Project Cost / Performance	(3) Type of Construction, Delivery Model & Services	(4) Date Completed		(5) Example Project Key No.
			Design	Construction	
Jefferson Lake Dam Improvements Richmond, Ohio	Design and Hydraulic Analysis	Civil Site Design	2011	2014	
a. (6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Design and hydraulic analysis for a siphon lake drain spillway structure and emergency spillway among other dam improvements. Design of emergency spillway channels and overflow structures for dam.					
Gorsuch Landfill Washington County, Ohio	Design	Civil Site Design	2012	N/A	
b. (6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Design for closure of the Gorsuch Landfill including drainage features for storm water such as open channels, culverts, and outlet protection.					
Beckjord Ash Pond Clermont County, Ohio	Construction Inspection	Civil Site Design	2011	2011	
c. (6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Construction Inspection of ash pond lift station at the Beckjord facility. Modelling stage storage and outfall flows for linked fly ash pond network.					
Conesville Facility	Capacity Analysis	Civil Site Design	2012	N/A	
d. (6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Ash pond H&H capacity analysis and design of ash pond embankment at the Conesville Facility. Utilized various H&H tools including HEC RAS, HEC 1, AutoCadd Civil 3D Hydraflow Extensions, ODOT CDSS, and customized spreadsheets based on accepted engineering principles.					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT
 (Complete one Section E for each key person. Limit one page per person)

16. NAME KELSEY HUNTER	17. ROLE IN THIS CONTRACT ENGINEERING	18. YEARS EXPERIENCE	
		a. TOTAL 2	b. WITH CURRENT FIRM 2
19. FIRM NAME AND LOCATION (City and State) HULL & ASSOCIATES, INC. Dublin, Ohio	20. EDUCATION (Degree and Specialization) Bachelor of Science in Environmental and Ecological Engineering, Purdue University	21. CURRENT OH PROF REGISTRATIONS (List Discipline) Currently an EIT.	

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

TRAINING: SafeLandUSA/PEC Basic Orientation Course (2013); OSHA 1910.120, 40-Hour OSHA Hazardous Waste Site Course (2013); HAZWOPER, 8-Hour Refresher Course (2014); CPR, First Aid and AED Course (October 2013)

AFFILIATIONS: Engineers Without Borders; Purdue Women In Engineering Program

23. RELEVANT PROJECTS (Up to a maximum of 5 samples)

(1) Title, Client & Location (City, State)	(2) Building Type, Size & Project Cost / Performance	(3) Type of Construction, Delivery Model & Services	(4) Date Completed		(5) Example Project Key No.
			Design	Construction	
Lugli Family Ltd. Partnership Lorain County, Ohio	Hydrologic and Hydraulic Modeling	Civil Engineering	2015	N/A	
a. (6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Modeled hydrologic and hydraulic analyses for the Lake Haven Dam utilizing the Hydrologic Engineering Center HEC-1 Flood Hydrograph Package program to design principal and emergency spillways given the hydrologic parameters of the site.					
Robert A. Shugert Guernsey County, Ohio	Hydrologic and Hydraulic Modeling	Civil Engineering	2015	N/A	
b. (6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Modeled hydrologic and hydraulic analyses for the Shugert Lane Road Dam utilizing the Hydrologic Engineering Centers River Analysis System (HEC-RAS) and Hydrologic Engineering Center HEC-1 Flood Hydrograph Package programs to design principal and emergency spillways given the hydrologic parameters of the site.					
Pilkington North America, Inc. LaSalle County, Illinois	Hydraulic Design	Civil Engineering	2014	N/A	
c. (6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Modeled hydrological and hydraulic stream patterns during critical storm events utilizing the Hydrologic Engineering Centers River Analysis System (HEC-RAS) program.					
Ohio-West Virginia Excavating Powhatan Point, Ohio	SWPPP	Civil Engineering	2015	2015	
d. (6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Wrote the Stormwater Pollution Prevention Plans (SWPPP) for issues related to fly ash removal and remedial excavation.					
Cardinal Aggregate, Inc. Perrysburg, Ohio	SWPPP	Civil Engineering	2014	2014	
e. (6) Role (Benefit / Value to Client) <input checked="" type="checkbox"/> Check if project performed with current firm Wrote the Stormwater Pollution Prevention Plans (SWPPP) for issues related to stream mitigation.					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person. Limit one page per person)

16. NAME HARTMAN, DOYLE, PE	17. ROLE IN THIS CONTRACT ENGINEER	18. YEARS EXPERIENCE	
		a. TOTAL 38	b. WITH CURRENT FIRM 23
19. FIRM NAME AND LOCATION (City and State) HARTMAN ENGINEERING DELAWARE, OHIO	20. EDUCATION (Degree and Specialization) BS, CIVIL ENGINEERING, THE OHIO STATE UNIVERSITY MS, THE OHIO STATE UNIVERSITY	21. CURRENT OH PROF REGISTRATIONS (List Discipline) Professional Engineer (OH)	

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

Professional Associations:

Water Management Association of Ohio
American Society of Civil Engineers
Association of State Dam Safety Officials

23. RELEVANT PROJECTS (Up to a maximum of 5 samples)

	(1) Title, Client & Location (City, State)	(2) Building Type, Size & Project Cost / Performance	(3) Type of Construction, Delivery Model & Services	(4) Date Completed		(5) Example Project Key No.
				Design	Construction	
a.	Private Dams, Sub consultant to Hull & Associates Eastern Ohio		Analyses			
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Project engineer for hydrologic and hydraulic analyses for the design of spillways and stilling basins for two private dams, along with dam failure analyses used to determine State classification of dams and for emergency action plans, as a subconsultant to Hull & Associates.						
b.	Miscellaneous Private Dams Buckeye Engineering Ohio		Peer Review & Hydraulic Analyses			
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Provided peer reviews for Buckeye Engineering for hydrologic and hydraulic analyses associated with required upgrades to several Ohio dams to meet current ODNR criteria.						
c.	Pine Lake Dam Repairs, Sub consultant for BBC&M Engineering Columbiana, Ohio	Dam	Repair Design			
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Project engineer for hydrologic, hydraulic and dam failure analyses required for design of spillway repairs as a subconsultant to BBC&M Engineering for the Ohio Department of Natural Resources.						
d.	Harrison Lake Dam Repairs, Sub consultant to BBC&M Engineering Fayette, Ohio	Dam	Analyses			
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Project engineer for hydrologic, hydraulic and dam failure analyses required for assessment of additional spillway capacity requirements as a subconsultant to BBC&M Engineering for the Ohio Department of Natural Resources.						
e.	Buckeye Lake, Ohio Department of Natural Resources Ohio		Analyses			
(6) Role (Benefit / Value to Client) <input type="checkbox"/> Check if project performed with current firm Project Manager for the analysis and design of repair options to the existing Class III dam. Several alternatives for repair were presented with cost estimates for each. H&H analyses were performed, including a dam break analysis to determine the impacts to a public road and bridge downstream. Hull plans to present the results of the analyses and bathymetric survey to ODNR for possible reclassification of the dam.						

Appendix C – SF330

ARCHITECT – ENGINEER QUALIFICATIONS

PART I – CONTRACT-SPECIFIC QUALIFICATIONS

A. CONTRACT INFORMATION

1. TITLE AND LOCATION (CITY AND STATE)

Development of a Geospatial Data Management System for the Bluestone Dam Safety Assurance Project, Hinton, WV

2. PUBLIC NOTICE DATE

10 December 2014

3. SOLICITATION OR PROJECT NUMBER

W91237-15-R-0003

B. ARCHITECT-ENGINEER POINT OF CONTACT

4. NAME AND TITLE

J. Gregory Menniti, PE, PS, Principal

5. NAME OF FIRM

Geosyntec Consultants, Inc.

6. TELEPHONE NUMBER

304.526.0080

7. FAX NUMBER

304.522.0434

8. E-MAIL ADDRESS

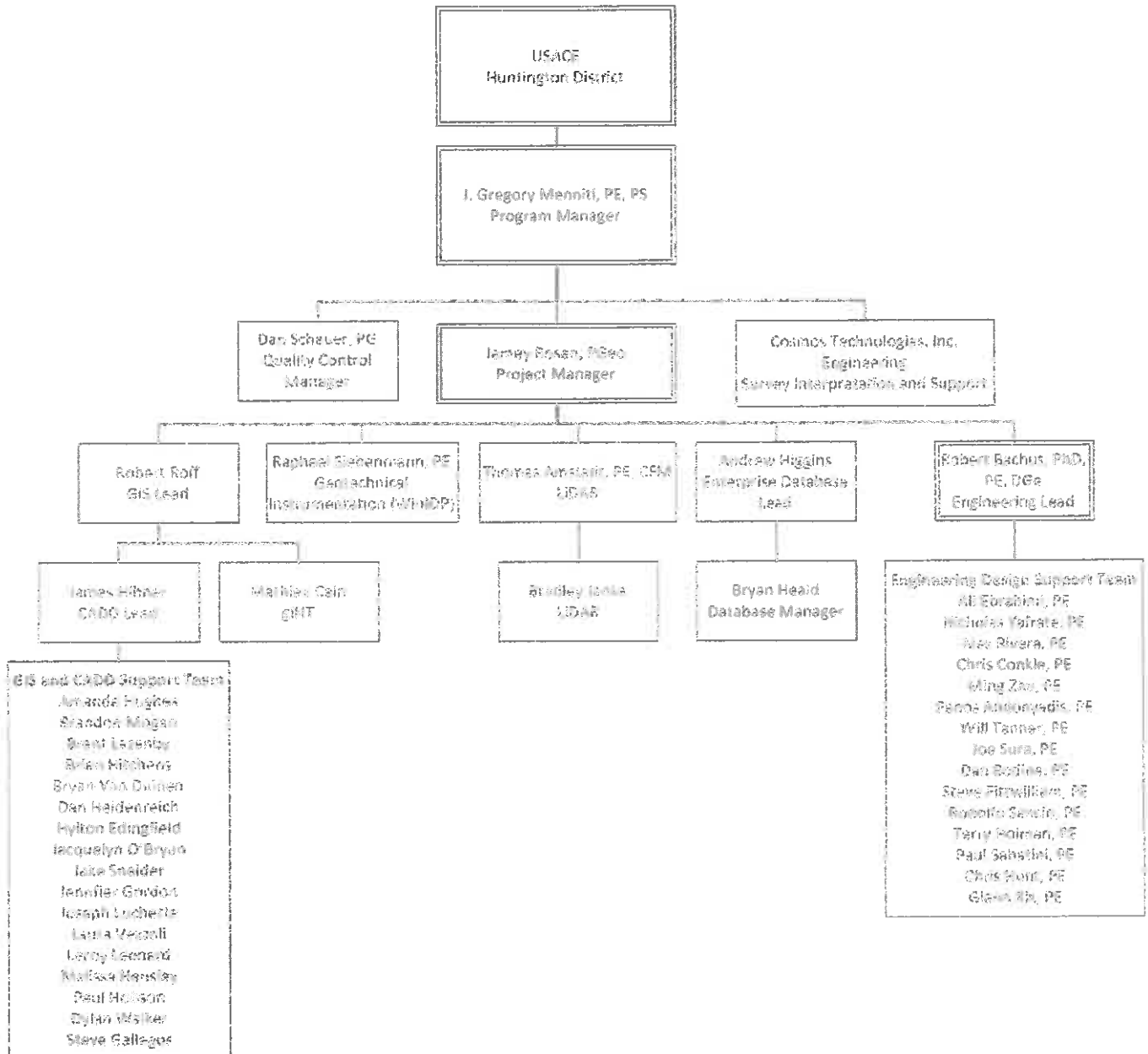
gmenniti@geosyntec.com

C. PROPOSED TEAM

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

	(Check)			9. FIRM NAME <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	10. ADDRESS	11. ROLE IN THIS CONTACT
	PRIME	J-V PARTNER	SUBCONTRACTOR			
a.	<input checked="" type="checkbox"/>			Geosyntec Consultants, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	1108 3 rd Avenue, Suite 600 Huntington, WV 25701	<ul style="list-style-type: none"> ▪ Program Management ▪ CADD Lead
b.	<input checked="" type="checkbox"/>			Geosyntec Consultants, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	1255 Roberts Blvd, NW, Suite 200, Kennesaw, GA 30144	<ul style="list-style-type: none"> ▪ Geotechnical Instrumentation ▪ Engineering Management and Support
c.	<input checked="" type="checkbox"/>			Geosyntec Consultants, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	900 Broken Sound Pkwy NW, Suite 200 Boca Raton, FL 33487	<ul style="list-style-type: none"> ▪ LiDAR ▪ Engineering Support ▪ Subcontract Management
d.	<input checked="" type="checkbox"/>			Geosyntec Consultants, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	1111 Broadway Street, 6th Floor, Oakland, CA 94607	<ul style="list-style-type: none"> ▪ LiDAR
e.	<input checked="" type="checkbox"/>			Geosyntec Consultants, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	130 Research Lane, Suite 2, Guelph, ON N1G 5G3	<ul style="list-style-type: none"> ▪ Geospatial Data Management ▪ Project Management ▪ Database Management
f.	<input checked="" type="checkbox"/>			Geosyntec Consultants, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	289 Great Road, Suite 105 Acton, MA 01720	<ul style="list-style-type: none"> ▪ Database Management
g.			<input checked="" type="checkbox"/>	Cosmos Technologies, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	700 River Avenue, Suite 412 Pittsburgh, PA 15212	<ul style="list-style-type: none"> ▪ Survey Interpretation and Support

D. ORGANIZATIONAL CHART OF PROPOSED TEAM



E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME	13 ROLE IN THIS CONTRACT	14 YEARS EXPERIENCE	
J. Gregory Menniti, P.E., P.S.	Program Manager	a TOTAL	b WITH CURRENT FIRM
		38	9

15 FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc., Huntington, WV

16 EDUCATION (DEGREE AND SPECIALIZATION)	17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
BS, Civil Engineering	Professional Engineer, West Virginia Professional Engineer, Ohio Professional Engineer, Pennsylvania Professional Surveyor, West Virginia

18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Mr. Menniti has completed numerous engineering projects for the USACE incorporating all aspects of engineering design, project management and construction management services. Projects include: design, permitting, construction and operation services of secondary and advanced secondary wastewater treatment plants; design, construction and operation services for sewage sludge dewatering and incineration systems; design and construction services of underground utilities, pump stations and urban infrastructure renewal; certificates of convenience and necessity preparation and expert testimony presentation; wetland mitigation design and consultation services; municipal solid waste landfill permitting, design and operation services. In addition to the engineering project services provided to municipal and government clients, he also provided utility management and general consultation services and served as the Acting General Superintendent for the Huntington, WV Sanitary Board for ten years (1986 to 1996) and was an active member and past president of the Ohio River Valley Water Sanitation Commission's (ORSANCO) POTW advisory committee.

19. RELEVANT PROJECTS

a.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Center Hill Dam Foundation Rehabilitation, Smithville, TN	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
		Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm		
CAD Supervisor. Provided review of long term on-site MicroStation and AutoCAD support for a multi-phase dam rehabilitation project focused on the construction of a subsurface concrete barrier wall to stabilize the earthen embankment portion of the aging dam followed by the construction of a continuous concrete barrier wall for long-term stability and seepage prevention through the earthen dam embankment. The vertical seepage barrier wall will extend down over 300 feet beneath the top of the dam and require embedment of over 100 feet into the limestone bedrock. Reviewed construction design, 3D modeling of subsurface structures and geology, and as-built construction drawings. Provided review of detailed submittal drawings to Corps of Engineer drafting standards. \$1.46M			

b.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Wolf Creek Dam Rehabilitation, Jamestown, KY	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
		2014	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm		
CAD Supervisor. Reviewed as-built boring data analysis and detailed section drawings of grout curtain and grout takes. Reviewed quantity take offs (cut/fill volumes, areas, linear features, etc.) for as-built construction documentation. \$630,000			

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME Dan Schauer, PG	13 ROLE IN THIS CONTRACT Quality Control Manager	14 YEARS EXPERIENCE	
		a TOTAL	b WITH CURRENT FIRM
		31	28

15 FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc., Boca Raton, FL

16 EDUCATION (DEGREE AND SPECIALIZATION) BS, Geology	17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE) USACE Construction Quality Management for Contractors INSTEP CIE/LEP #61 Professional Geologist, Florida, Texas, Tennessee
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18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Over 28 years of experience managing construction quality for more than 300 federal and commercial projects; performed construction inspection on heavy civil earthwork for 150 solid waste and liquid impoundments projects (dikes, dams, levees, landfills, reservoirs) located worldwide, including at least 15 USACE affiliated projects; co-authored seven publications on design, construction and geo-instrumentation used for deep seepage barrier cut-off walls in major USACE Dam rehabilitation projects, as well as the use of geosynthetics in containment applications; training: 40-Hour HAZWOPER; 8-hour refresher; 8-Hour HAZWOPER Supervisor, in accordance with 29 CFR 1910.120(e); DOT Hazardous Materials, in accordance with 49 CFR 172.704.

19. RELEVANT PROJECTS

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
Bolivar Dam Seepage Wall, Bolivar, OH	Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
a. Project Director. Directed development of the Bolivar Dam Information Management System (BDIMS) to manage the data associated with seepage barrier wall construction beginning in early 2015. The BDIMS consists of an Enterprise Database, from which raw data are fully accessible to USACE and contractors via a Microsoft Access file (with secure links that pass through the ACE-IT firewall to allow "live" access to data tables), and from which analyzed data are accessible in a variety of web-based reports and a fully editable GIS. \$178,000		
Center Hill Dam Foundation Rehabilitation, Smithville, TN	Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
b. Construction Quality Control System Management (CQCSM) and engineering support. Prepared project submittals, variances, value engineering cost proposals and specifications. Directed procurement and the installation and monitoring of geotechnical instrumentation including piezometers, inclinometers and extensometers during construction of deep cutoff wall to depths in excess of 280 ft. Oversaw the development of the site-specific production and QC database management system (WallTracker). \$1.46M		
WallTracker Implementation during Herbert Hoover Dam Rehabilitation, FL	2011	2011
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
c. Construction Quality Manager. Oversaw geotechnical engineering for the development of various project plans, Construction QC Plan and Environmental Protection Plan, and implementation of the Construction QC Plan for a project involving the construction four reaches (i.e. segments) of deep cutoff wall totaling approximately 10 miles in length to depths of approximately 70 feet using the cutter soil mixing method. Provided geologic and geotechnical analysis of the constructed barrier wall to verify verticality compliance, managed geophysical testing programs, coordinated WallTracker system implementation and interpreted production data. \$599,000		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Jamey Rosen, P.Geo.	Project Manager	a. TOTAL	b. WITH CURRENT FIRM
		18	15

15. FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc. Guelph, Ontario

16. EDUCATION (DEGREE AND SPECIALIZATION) 17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)

MSc, Earth Sciences Professional Geoscientist, Ontario #0601
BSc, Earth Sciences

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

Mr. Rosen has 18 years of experience as a data management specialist in the earth sciences and infrastructure industries, with a focus on data workflow and database design and management, geotechnical instrumentation, and Geographical Information Systems. He designed and developed the "Wolf Creek Information Management System" for the USACE Nashville District used during and after barrier wall construction at Wolf Creek Dam, for which the District won a 2013 USACE Innovation Award. Jamey has managed several data management programs at USACE sires and is the Data Manager for construction projects currently underway at Center Hill and Bolivar Dams. He regularly publishes and presents research on the subject of construction data management.

19. RELEVANT PROJECTS

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Bolivar Dam Seepage Wall, Bolivar, OH	Ongoing	Ongoing

(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Check if project performed with current firm

a. Data Manager. Designed and led the development of the Bolivar Dam Information Management System currently under USACE Review. Mr. Rosen developed database algorithms that: calculate and visualize barrier wall panels in three dimensions based on Koden data in near-real time; populate a web-based interactive GIS in plan and profile view with data from hand-entered forms, data in a gINT database, files on a secure File Transfer Protocol site, and instrumentation data files provided by a contractor; allow instant piezometric surface review and graphing of instrumentation data by clicking on a map or launching a report; and rename photos to a USACE specification and extract their metadata for use in the GIS and database. \$178,000

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Center Hill Dam Foundation Rehabilitation, Smithville, TN	Ongoing	Ongoing

(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Check if project performed with current firm

b. Data Manager. Mr. Rosen envisioned, designed and led the development of the WallTracker System used by USACE and contractors. WallTracker is the single authoritative source for project data, and allows web-based and desktop (synchronized offline) access to barrier wall element data, gINT data, concrete/slurry QC data and statistics, grouting data, and a range of historical data. WallTracker also allows near real-time instrumentation data served from a range of sensors collecting data on up to 15-minute frequency. Mr. Rosen also co-authored a comprehensive Data Management Plan and associated documentation materials, conducted several formal training sessions for USACE and contractor personnel. \$1.46M

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Wolf Creek Dam Rehabilitation, Jamestown, KY	2014	2014

(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Check if project performed with current firm

c. Data Manager. Mr. Rosen was the Data Manager of record and designed and led the development of the Wolf Creek Information Management System (WCIMS) used by USACE and contractors. This system compiled a range of project data and documents all accessible from a single GIS-based "dashboard". This project included the digitization of over 200 boreholes into a comprehensive gINT database that itself was a subcomponent of the project enterprise database, allowing lithological information to be queried in the context of other project data. The database schema used in the WCIMS has been presented to several organizations as a potential database design standard for use in barrier wall analyses. \$630,000

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Chickamauga Lock Replacement, TN	2010	2010
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
d. Data Manager. Mr. Rosen applied GIS principals to the ongoing grouting program at Chickamauga Lock and Dam for The Judy Company, leading to the development of the GroutTracker system. GroutTracker imports data from the grouting instrumentation (Jean Lutz components); verifies the data and compiles it into a relational database; performs geoprocessing routines to convert the raw data into geospatial feature classes, and exposes the geospatial data in an interactive GIS tool that allows access to data in plan and profile views. GroutTracker was also employed to automatically generate a series of reports (both tabular and geospatial) that summarized grout takes and lugen values, displayed as-built construction details, compiles pay items, and more. GroutTracker was implemented both on-site and remotely, allowing grouting contractors to use the system to make on-site decisions regarding grout volumes and new hole placement, and allowing project management in Kansas City to quantitatively and qualitatively track construction progress, material usage, and pay items. \$24,000		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
WallTracker implementation at the Herbert Hoover Dike Rehabilitation, FL	2011	2011
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
e. GIS Manager. Mr. Rosen was the original creator of WallTracker, the interactive GIS-based data management system used to compile, analyze, and visualize the data collected during a barrier wall installation at the Herbert Hoover Dike. WallTracker was used to geoprocess raw excavation rig data into three dimensional geospatial objects, and to display those objects in the same spatial context as geology interpolated from boreholes, slurry data analyzed from samples at various locations, and more. WallTracker was used to frequently and automatically generate as-built drawings that were submitted to the USACE Jacksonville district and for which the contractor (Bauer Foundation Corporation) received a USACE letter of commendation. This was the first implementation of a GIS-based construction tracking system applied at a USACE barrier wall project. \$599,000		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Web-Mapping for an Underground Construction Information Management System, London, UK	2014	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
f. GIS Specialist. Jamey developed geoprocessing routines using ArcGIS routines and Python scripts to automatically generate geospatial data to display and track the position, orientation, and other attributes of Tunnel Boring Machines (TBMs) in operation. He also served as an advisor throughout the project on web-based GIS integration, data management, and program management. \$471,000		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Folsom Dam, Folsom, CA	Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
g. Deputy Project Manager. Mr. Rosen provided support and guidance in the development of data entry and storage tools, integration of CAD data, georeferencing of historical spatial data, and automation of as-built and progress drawings for USACE. Jamey worked with USACE to modify the format of similar drawings used at Wolf Creek Dam to meet the specific needs and input data format of the Folsom Dam grouting. \$41,000		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME	13 ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Robert Bachus, Ph.D., P.E., D.GE	Engineering Lead	a TOTAL	b WITH CURRENT FIRM
		36	22

15 FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc., Kennesaw, GA

16 EDUCATION (DEGREE AND SPECIALIZATION)	17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
PhD, Geotechnical Engineering MS, Civil Engineering BS, Civil Engineering	Professional Engineer, Georgia Professional Engineer, Arkansas Professional Engineer, Mississippi

18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Dr. Bachus has over 10 years of experience performing the design and rehabilitation of earth dams, levee structures, and earth retaining systems, with extensive experience on soil and rock strength characterization and slope stability assessment on federal and commercial projects located across the southeastern U.S. including projects for the USACE. Dr. Bachus has been the project manager for a wide range of projects requiring geotechnical investigation, specialty geotechnical analysis and geotechnical testing. He has more than 20 years' experience in geotechnical engineering.

19. RELEVANT PROJECTS

a.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Center Hill Dam Foundation Rehabilitation, Smithville, TN	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
		Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm		
Geotechnical Engineer. Dr. Bachus performed geotechnical design, installation, and monitoring of extensive performance monitoring systems, including river quality, piezometers, and slope inclinometers. Developed and implemented remote monitoring system for select field instruments. Developed and maintained the Center Hill Information Management System that allows web-based reporting and monitoring. Prepared project submittals and developed tools for automated recording of project quality management. \$1.46M			

b.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Wolf Creek Dam Rehabilitation, Jamestown, KY	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
		2014	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm		
Quality Assurance Engineer. Dr. Bachus serves as a member of project quality assurance team and developed a customized construction data management system for the barrier wall construction and gallery grouting. These systems provided the necessary confirmatory information that allowed the entire risk management team to confirm integrity of the barrier wall system. Generated requisite reports and as-built drawings. For the barrier wall project in the Switchyard, served as engineer of record for design and construction of final component of the Wolf Creek barrier wall. Data compiled was used to reduce the Dam Safety Action Classification of the facility in an unprecedented time. \$630,000			

c.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	WallTracker Implementation During Herbert Hoover Dike Rehabilitation, FL	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
		2011	2011
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm		
Geotechnical Engineer. Dr. Bachus supported the development of the WallTracker data management and visualization system used to synthesize geotechnical instrument data, laboratory and field data associated with the large-scale cut-off wall construction, allowing users to interactively view the data in multiple formats. Participated with USACE assessment of the benefit and potential risks associated with the culvert removal and extension of cutoff wall. Commended by the USACE for the automated generation of real-time analysis tools and as-built drawings. \$599,000			

d.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Chickamauga Lock Replacement, Tennessee	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
		2010	2010
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm	
Geotechnical Engineer. Supported the design and development of the GroutTracker grout data management system and customized it for use at the Chickamauga Lock. Integrated the database with Jean Lutz grouting instrumentation to enhance physical control of the grouting pumps. GroutTracker is used by site personnel to collect, analyze, visualize (using geographical information system (GIS) technology), and create many different reports associated with drilling and grouting data in real-time. GroutTracker manages and automates all data and quality control operations on site, include the facilitation of scheduling, equipment testing, pay item tracking, and data sharing through a file transfer protocol (ftp) system. \$24,000			
e.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Engineering Analysis of By-Product Disposal Facility, Roane County, TN	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
		Ongoing	N/A
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm	
Geotechnical Engineer. Project required geotechnical assessment of subsurface conditions in former coal combustion products (CCBs) disposal site to temporarily store significant quantities of material following the failure of an on-site dredge cell. Work included field and laboratory testing and design of a foundation improvement system to decrease the consolidation time and increase the strength gain under loading by stockpiled materials. Work also included developing and installing an instrumentation network to monitor performance. Project extended into performing real-time monitoring and reporting of the instrumentation network and then into design and monitoring of new sluiced CCB channel immediately adjacent to the CCB stockpiles. \$12M			
f.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Geotechnical Services for the Stabilization and Restoration of a Landslide, Kilbuck, Pennsylvania	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
		2009	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm	
Lead Geotechnical Engineer for the mitigation, stabilization, and restoration of a massive landslide that had occurred at the location of a commercial site that was undergoing development. The landslide impacted a four lane highway and an active major railroad. Provided direct oversight of the assessment and stabilization of the entire project site. An extensive network of geotechnical instrumentation, including slope inclinometers, piezometers, and surface monuments, played in significant role in assessing the cause and extent of the failure and these same instruments were used to guide the stabilization efforts. Worked with other Geosyntec personnel on all phases of the project, including assessment of cause, design of interim and final stabilization strategies, compilation and assessment of geotechnical instrumentation. \$5 million			
g.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	Design and Construction of a MSE Berm, Cherry Island Landfill, Wilmington, Delaware	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
		2012	2012
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm	
Geotechnical Engineer for the design and construction of a mechanically stabilized earth (MSE) berm over extremely soft foundations by the installation of prefabricated vertical drains (PVDs) and high strength geotextiles. Provided feasibility geotechnical evaluation, design, permitting, field exploration (CPTs and SPTs), instrumentation and construction engineering services. Worked with the team to implement a sophisticated geotechnical monitoring system and used the results to place a total of 2 million cubic yards of fill for berm construction. The foundation improvement resulted in \$159 million savings over the initially proposed foundation improvement that consisted of deep soil mixing. The project was selected by the ASCE as a finalist for the 2012 Outstanding Civil Engineering Achievement (OCEA) Award. >\$10 million			

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME	13 ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Robert Roff	GIS Lead	a. TOTAL	b. WITH CURRENT FIRM
		9	8

15 FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc. Guelph, ON

16 EDUCATION (DEGREE AND SPECIALIZATION)
B. Tech, Geographic Information Systems
Adv. Diploma, Geographic Information Systems Associate of Arts, Geography

17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)

18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Mr. Roff has 9 years of experience in Data Management and geospatial analysis, specializing in relational database management, data verification, GIS, and application development. He has supported various environmental remediation and geotechnical engineering projects through data visualization and reporting. His work has focused on presenting site data in 2 and 3 dimensions, and developing automated methods of collecting and reporting data electronically. Mr. Roff has developed field applications for data entry, automated data logging and customized tools for displaying spatial data.

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	Center Hill Dam Foundation Rehabilitation, Smithville, TN	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		Project Manager. Mr. Roff manages the processing, storage and visualization of construction and QC data for the barrier wall rehabilitation at Center Hill Dam using the WallTracker data management system. Data are collected by various means such as via web based forms by field personnel, from digital data outputs of telemetry devices and from automated data streams connected to drill rigs and other instrumentation. Data are uploaded to an enterprise database and processed into statistical reports and spatial data used to populate online and desktop interactive mapping applications for daily decision making support and further analysis during the construction progress. \$1.46M
b.	Wolf Creek Dam Gallery/Plaza Grouting, Jamestown, KY	2014	2014
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		GIS Manager. Mr. Roff customized the GroutTracker system for use at the Wolf Creek Dam. GroutTracker is used to visualize data collected by field personnel and with grouting instrumentation. Services included design and generation of weekly Progress Drawings and analytical reports on grout take, injection pressures, flows, lugeon values and exploratory geology data. The GroutTracker system also facilitates the creation of geographic data and the transfer of data to shared network locations for remote viewing. \$250,000 on this phase only
c.	Folsom Dam, Folsom, CA	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		Project Manager. Mr. Roff is the Project Manager for the data component of this construction. He developed the spatial reference system and base drawings, the project database and an online data entry system and file repository for raw grouting data. These allowed the contractors to quickly produce weekly progress drawings summarizing the drilling, geological logging, water testing and grout injections. The project deliverables included a full GIS and data package delivered to the USACE for advanced mapping analysis. \$40,500

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME		13 ROLE IN THIS CONTRACT		14 YEARS EXPERIENCE	
James Hibner		CADD Lead		a TOTAL	b WITH CURRENT FIRM
				14	8
15 FIRM NAME AND LOCATION (City and State)					
Geosyntec Consultants, Inc. Huntington, West Virginia					
16 EDUCATION (DEGREE AND SPECIALIZATION)			17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)		
Land Surveying Technology Biology					
18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)					
Over 14 years of experience as a CADD technician on projects involving environmental design and construction, and construction inspection; permitting; compliance; proficient in AutoCAD Land Desktop, AutoCAD Civil 3D, MicroStation, and SurvCadd; provided CADD support for at least 11 large scale mapping projects for A/E projects (4 federal projects, 7 commercial projects); training: Civil 3D 2008 Fundamentals; MicroStation Essentials Levels I-II, MicroStation Institute; Bentley AutoPLANT Design V8i:					
19. RELEVANT PROJECTS					
a.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	Center Hill Dam Foundation Rehabilitation, Smithville, TN			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input checked="" type="checkbox"/> Check if project performed with current firm		
Senior CADD Operator. Provided long term on-site MicroStation and AutoCAD support for a multi-phase dam rehabilitation project focused on the construction of a subsurface concrete barrier wall to stabilize the earthen embankment portion of the aging dam followed by the construction of a continuous concrete barrier wall for long-term stability and seepage prevention through the earthen dam embankment. The vertical seepage barrier wall will extend down over 300 feet beneath the top of the dam and require embedment of over 100 feet into the limestone bedrock. Developed and produced construction design, 3D modeling of subsurface structures and geology, and as-built construction drawings. Provide electronic files to surveyor for direct loading into survey grade GPS equipment for expedited construction layout. Produce detailed submittal drawings to Corps of Engineer drafting standards. \$1.46M					
b.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	Wolf Creek Dam Rehabilitation, Jamestown, KY			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				2014	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input checked="" type="checkbox"/> Check if project performed with current firm		
Senior CADD Operator. Assisted with as-built boring data analysis and produce detailed section drawings of grout curtain and grout takes. Perform quantity take offs (cut/fill volumes, areas, linear features, etc.) for as-built construction documentation. \$630,000					
c.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	Montrose Chemical Corp. of California - Superfund Site, EPA, Los Angeles, California			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				2012	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input type="checkbox"/> Check if project performed with current firm		
CADD Operator. Provide a full range of civil, mechanical, groundwater remediation, and process engineering design services that capture design elements in figures, design drawings, and highly detailed construction drawings of the site and treatment system for the Montrose Chemical and Del Amo Superfund Site. The site encompasses approximately 1.3 square miles. \$9M					
d.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	Operating Industries, Inc., Monterey Park, California			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				2008	2009
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input checked="" type="checkbox"/> Check if project performed with current firm		
CADD Operator. Prepared detailed design drawings and specification documentation for 3500 feet of conveyance piping, pumping facilities, and storage tank for the Central Perimeter Liquid control area of the Operating industries, Inc. Superfund landfill remediation site. \$4M					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12. NAME		13. ROLE IN THIS CONTRACT		14. YEARS EXPERIENCE	
Mathieu Cain		gINT		a. TOTAL	b. WITH CURRENT FIRM
				6	4
15. FIRM NAME AND LOCATION (City and State)					
Geosyntec Consultants, Inc. Guelph, Ontario, Canada					
16. EDUCATION (DEGREE AND SPECIALIZATION)				17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)	
GIS Environmental Technologies Advanced Diploma BES, Environment and Resource Studies/Geographic Information Systems					
18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)					
Mr. Cain has over 6 years of experience in geographic information systems (GIS) and data management in the resource management, environmental sciences and infrastructure industries. He is the current GIS and database manager for a number of environmental remediation projects and managed the geoprocessing development at Wolf Creek Dam.					
19. RELEVANT PROJECTS					
a.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	Wolf Creek Dam Rehabilitation, Jamestown, KY			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				2014	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input checked="" type="checkbox"/> Check if project performed with current firm		
GIS Specialist. Mr. Cain developed and maintained geoprocessing algorithms, and visualization tools and construction analysis reports for the comprehensive data management system used to compile, store, visualize, and analyze production data from dam repair operations. Geoprocessed data comprised instrumentation, digital grouting records, and barrier wall construction data, integrating multiple data types, including the use of CAD files. \$630,000					
b.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	WallTracker Implementation During Herbert Hoover Dike Rehabilitation, FL			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				2011	2011
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input checked="" type="checkbox"/> Check if project performed with current firm		
GIS Specialist. Mr. Cain was the data and as-built drawing task manager for the site. He used the WallTracker System, a geotechnical data management system that synthesized geotechnical instrument data, interpolated borehole geology data, concrete laboratory analysis data and other data to automate the frequent production and approval of as-built drawings. \$599,000					
c.	(1) TITLE AND LOCATION (City and State)			(2) YEAR COMPLETED	
	Perchlorate Site Remediation, Industrial Manufacturing Facility, AR			PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
				Ongoing	N/A
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE			<input checked="" type="checkbox"/> Check if project performed with current firm		
Data Manager. Mr. Cain is the database manager and GIS project manager for corrective measures at this industrial site. Historical and ongoing groundwater and soil sample monitoring data are automatically screened, tracked, compiled, stored, analyzed, and displayed in tabular, chart and spatial data reports, and shared through an interactive GIS viewer. Work products have included printed or interactive maps, displaying chemical concentrations, alluvium deposits, potentiometric, plume, and isopach contouring, site layouts, utilities, remediation design systems and analytical data trends. \$255,000					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Raphael Siebenmann, PE	Geotechnical Instrumentation (WinIDP)	a. TOTAL	b. WITH CURRENT FIRM
		12	10

15. FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc. Kennesaw, Georgia

16. EDUCATION (DEGREE AND SPECIALIZATION) **17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)**
BS, Civil Engineering Professional Engineer, Georgia

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Raphael Siebenmann, P.E., is a civil engineer with over 12 years of experience in engineering consulting. His field work and project management responsibilities include designing and maintaining large civil and environmental databases, conducting data analysis, developing 3-dimensional visualizations, and working with geographic information systems (GIS).

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	Center Hill Dam Foundation Rehabilitation, TN	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		
Instrumentation Data Manager. Mr. Siebenmann is the geotechnical instrumentation data manager responsible for the design and maintenance of a real-time reporting and alarm system for a network of over 100 piezometers, inclinometers, extensometers, and survey monitoring points. He maintains and expands of the existing Campbell Scientific-based logging system which includes automated alarms and transfer of data to USACE for use with WinIDP. Instrumentation data and up-to-date alarm status, are made available on plan and profile map views using Geosyntec's GIS-based WallTracker application, allowing users to view instrumentation data in the context of construction activities and available historical information. \$1.46M			
b.	Engineering Analysis of By-Product Disposal Facility, Roane County, TN	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		
Data Manager. Mr. Siebenmann developed a web-based real-time data instrumentation portal designed to remotely monitor water levels and settlement of soil from an array of vibrating wire piezometers. Mr. Siebenmann designed and configured the data center, back-end database architecture, and performed the front-end web programming using a combination of Campbell Scientific Data Logger, MS Access, SQL Server, SQL Server Business Reports, and MS SharePoint technologies. \$12M			
d.	Web-Mapping for an Underground Construction Information Management System, London, UK	2014	2014
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		
Project Manager. Mr. Siebenmann was the project manager and lead developer of a web-mapping interface for a client's existing underground construction information management system (UCIMS) that is being used to monitor tens of thousands of real-time sensors as part of the London Underground expansion project known as Crossrail. The Crossrail project construction works includes underground development including shafts, tunnels and portals. Given the urban environment in which the tunneling is proposed, monitoring of the construction works and the impact on the adjacent structures was a key activity for the project management and engineering teams. The system was designed to provide real-time access to the construction and instrumentation data through an intuitive map-based user interface; showing progress and data locations relative to the surface features and other spatial information. \$471,000			

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME		13 ROLE IN THIS CONTRACT		14 YEARS EXPERIENCE	
Thomas Amstadt, PE, CFM		LIDAR		a TOTAL	b WITH CURRENT FIRM
				11	4
15 FIRM NAME AND LOCATION (City and State)					
Geosyntec Consultants, Inc. Winter Springs, Florida					
16 EDUCATION (DEGREE AND SPECIALIZATION)				17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)	
BS, Civil Engineering, University of Central Florida, 2003 ME, Environmental Engineering Sciences, University of Florida,				Professional Engineer, Florida	
18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)					
Mr. Amstadt has served as Project Engineer / Manager on water resources projects for State, County and City government clients since 2004. He has extensive experience with the use of ArcGIS for spatial analysis, mapping, and data representation and with computer aided design and drafting (CADD) tools for construction plans preparation on stormwater retrofit design projects.					

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	Woodsmere Watershed Management Plan and Stormwater Pump Station Evaluation, Orlando, FL (Orange County Public Works)	2013	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm LiDAR Technician. Mr. Amstadt was the Project Engineer responsible for data collection and evaluation, and watershed model development including digital elevation model (DEM) development from LiDAR data. A LiDAR-derived DEM was generated and an existing conditions hydrologic/hydraulic model was developed within a geodatabase. Several locations in the watershed where development had occurred since the LiDAR flight date were identified. The LiDAR data at these locations was replaced with survey or as-built plans to create a topographically correct DEM surface for the watershed. The model simulation results were utilized to assess level of service (LOS) deficiencies, delineate floodplains, and assess the pump station LOS performance. \$171,000		
b.	H.R. Ash Dam Emergency Action Plan, Escambia County, FL	2013	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm LiDAR Technician. Mr. Amstadt was the Project Engineer responsible for data collection and evaluation, watershed/dam break model development including DEM development from LiDAR data. The project was funded by a grant through the Federal Dam Safety Program. As a result, the project was subject to a short timeline of only approximately 4 weeks from the start of the project to completion of the final product and submittal to the FDEP. \$14,000		
c.	Flood Study to Support FEMA Letter of Map Revision, Romeoville, IL (The Pizzuti Companies)	2011	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm LiDAR Technician. Mr. Amstadt was the Project Engineer responsible for data collection and evaluation, watershed model development including digital elevation model (DEM) development from LiDAR data. The purpose of this project was to perform a flood study of the site to support updating the 100-year floodplains at the development. \$8,250		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME		13 ROLE IN THIS CONTRACT		14 YEARS EXPERIENCE	
Bradley Janke		LIDAR		a TOTAL	b WITH CURRENT FIRM
				14	9
15 FIRM NAME AND LOCATION (City and State) Geosyntec Consultants, Inc. Oakland, California					
16 EDUCATION (DEGREE AND SPECIALIZATION)			17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)		
BS, Environmental Science, University of California at Santa Barbara, 1998 BA, Geography, University of California at Santa Barbara, 1998			Geographic Information Systems Professional (GISP) Number 00066725		
18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards etc.)					
Mr. Janke is an environmental scientist and graphic artist with experience in GIS, CADD, Adobe Illustrator, Adobe Photoshop, and database design and management. As a Project Scientist/GIS Specialist, he supports a variety of site characterization, visualization, monitoring, and remediation projects. Mr. Janke has been responsible for capturing, organizing, and processing large volumes of data from a wide range of sources and formats. Using both GIS and stand-alone database applications, he has facilitated the synthesis and interpretation of these datasets. His project assignments have included development, implementation, and maintenance of multiple GIS, EVS, LIDAR, and database projects.					
19. RELEVANT PROJECTS					
a.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	Waste Management Inc., Various Locations		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)	
			2014	N/A	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
3D Model Project Manager. Coordinated the collection of data from multiple sources/parties to create three dimensional (3D) virtual models depicting the interaction of numerous gas wells within the geometry. Incorporated gas sample data to identify areas of high gas extraction potential. Presented model to large groups within Waste Management and aided the company in new well placement. The model was used in the creation of more efficient well networks. \$90,000					
b.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	LiDAR Modeling for San Francisco Bay Site Closure, Palo Alto, California		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)	
			Ongoing	N/A	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
LiDAR Technician. Acquired and processed LiDAR data to assist in the understanding of salt marsh topography. Classified LiDAR points to obscure vegetation and improve the understanding of elevations at the bay margin for use in determining methods of reconnecting salt marsh partitions to San Francisco Bay. Used LiDAR for calculations of soil volumes and onsite redistribution processes. \$416,000					
c.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	Hydrologic Sewershed Model, Exeter, NH		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)	
			2013	N/A	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
LiDAR Technician. Acquired and processed LiDAR data to help create a hydrologic model of the sewershed for the town of Exeter, NH. Multiple LiDAR datasets were classified for ground surface, down-sampled to appropriate resolutions, and then merged to form one continuous coverage. Assisted in the creation of detailed topographic layers in the form of raster and tin surfaces. Created a large scale topographic contour dataset for various parties of concern. \$76,000					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME	13 ROLE IN THIS CONTRACT	14 YEARS EXPERIENCE	
Andrew Higgins	Enterprise Database Lead	a. TOTAL	b. WITH CURRENT FIRM
		3	1

15 FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc. Guelph, Ontario, Canada

16 EDUCATION (DEGREE AND SPECIALIZATION) **17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)**
BSc, Environmental Sciences
Graduate Certificate GIS Analyst

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Mr. Higgins has 3 years of experience as a data management specialist in the environmental sciences and infrastructure industries, with a focus on data workflow and database design and management, and geographical information systems (GIS). He is the current database manager for the Berry's Creek Study Area Superfund Site, and works on a number of environmental and USACE construction projects including Folsom Dam (Sacramento District) and Bolivar Dam (Huntington District).

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	Bolivar Dam Seepage Wall, Bolivar, OH	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		Geodatabase Developer. Mr. Higgins is part of the development of the Bolivar Dam Information Management System currently under USACE Review. For this project, Mr. Higgins developed SQL Spatial database algorithms that import, reduce, and analyze Koden and Hydromill rig data, and generate reports in near-real time. \$178,000
b.	Folsom Dam, Folsom, CA	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		GIS Specialist. Mr. Higgins assisted in the development of the data management system used in this project and produced automated on-demand grouting progress drawings of barrier wall drillings. He developed an in-house automated tool using SQL, Access, and Python that imports and parses raw construction data uploaded from the field, and creates up-to-date progress figures using GIS. \$40,500
c.	Berry's Creek Study Area, Bergen County, NJ	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm		Database Manager. Mr. Higgins is the Database Manager for this high-profile Remedial Investigation/Feasibility Study. He updated the existing database to conform to USEPA R2 specifications, and handles all day-to-day data management tasks, including appending new data to a client-accessible enterprise database, processing data requests, managing on-line tools including an interactive mapping system, and performing corrections and updates as needed. He also designs and implements SQL based queries and stored procedures to provide up-to-date data to end users in real time. \$4.6M

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

12 NAME	13 ROLE IN THIS CONTRACT	14 YEARS EXPERIENCE	
Bryan Heald	Database Manager	a TOTAL	b WITH CURRENT FIRM
		14	12

15 FIRM NAME AND LOCATION (City and State)
Geosyntec Consultants, Inc., Acton, MA

16 EDUCATION (DEGREE AND SPECIALIZATION) **17 CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)**
BS. Computer Science

18 OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Mr. Heald has a strong background in Computer Science with considerable experience in spatial and environmental data management systems engineering using database applications such as Microsoft Access® and SQL Server, Geographic Information Systems management using ESRI products, and program automation and application integration using Visual Basic for Applications (VBA). He has worked closely with clients to assess their needs for data management systems, and has developed custom solutions tailored to those needs; from relatively small systems designed to support site assessment and characterization, to larger systems built to contain and categorize voluminous amounts of data related to wide ranging environmental litigation cases. Utilizing his background in programming, Mr. Heald has automated many tasks and processes, increasing both the efficiency and quality of Geosyntec's data management systems.

19. RELEVANT PROJECTS

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Bolivar Dam Seepage Wall, Bolivar, OH	Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	

a. Database Developer. Mr. Heald co-developed the Photograph/Video Naming Tool currently in use by USACE and the contractor team at Bolivar Dam. The Tool allows users to batch rename one or more photograph and/or video files contained in user-selected files. The Tool allows users to rename files to USACE specifications by interactively select or apply file details (photograph location, construction element, etc.), and extract photograph geotag information (position and orientation) all for compilation in the enterprise database. The Tool also facilitates uploading selected files to the project sFTP site, and allows users to access the renamed files via hyperlinks from the Tool or the various GIS access points. Bryan is also performing various SQL administration and develop tasks on the project. \$178,000

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
International Stormwater BMP Database, Water Environment Research Foundation	2010	N/A
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	

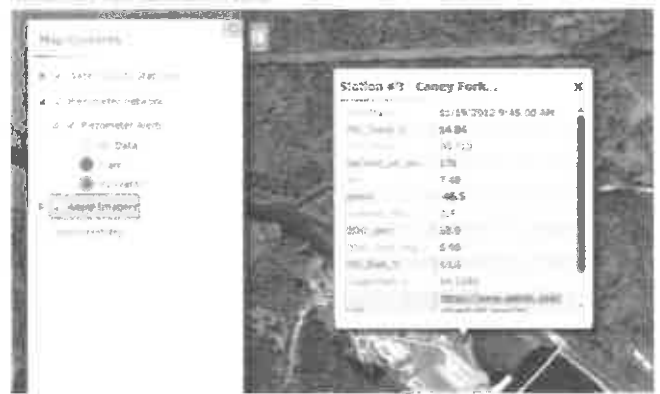
b. Database Administrator. Mr. Heald served as the webmaster and online database administrator for www.BMPDatabase.org, which features a database of over 400 BMP (Best Management Practice) studies, performance analysis results, tools for use in BMP performance studies, monitoring guidance and other study-related publications. The overall purpose of the site is to provide scientifically sound information to improve the design, selection and performance of BMPs. Using tools developed by Mr. Heald, the website provides users the ability to interactively select BMPs relative to their needs via an interactive webmap, or by filling in a simple questionnaire. The questionnaire gives users instantaneous access to BMP performance studies and pre-processed statistical analysis reports. Additionally, users can perform their own statistical analysis on user-defined datasets through a similar online interface that combines the ease of client-side input with the power of server-side processing to produce a downloadable PDF report detailing the specified analysis. \$151,000

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		20. EXAMPLE PROJECT KEY NUMBER	
21. TITLE AND LOCATION (<i>City and State</i>) Center Hill Dam Foundation Rehabilitation, Smithville, TN		22. YEAR COMPLETED	
		PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (<i>if applicable</i>) Ongoing
23. PROJECT OWNER'S INFORMATION			
a. PROJECT OWNER USACE, Nashville District	b. POINT OF CONTACT NAME Vanessa Bateman, Chief, Geology Section	c. POINT OF CONTACT TELEPHONE NUMBER (615) 736-7906	

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

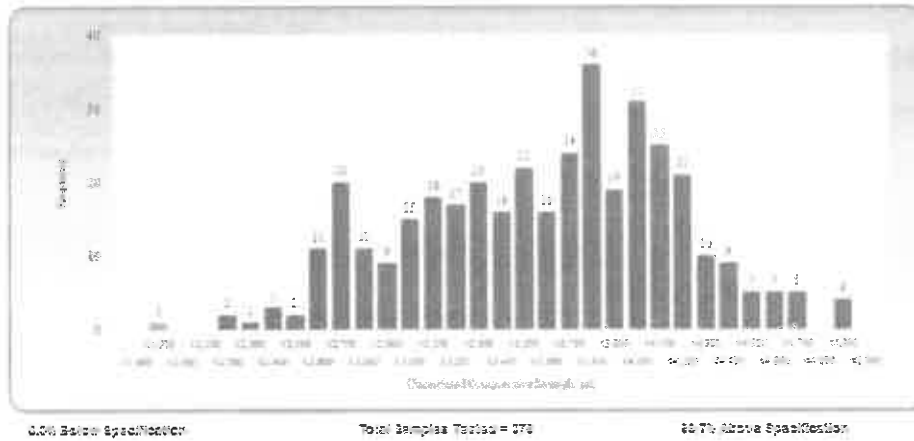
Geosyntec is providing engineering, construction management, and data management services to the nearly-completed barrier wall installation at Center Hill Dam. Data management is facilitated with the WallTracker system, a collection of database and GIS tools used to visualize data associated with many elements of construction.

WallTracker includes a web-based GIS viewer that allows interactive plan and profile access to several data visualizations. Data visualized in these viewers includes geometric representations of barrier wall elements with calculated overlaps, wall thicknesses, twist, and other interpretations of verticality in the context of other geospatial data (geological interpolations, concrete laboratory analyses, etc.) to ensure barrier wall quality. WallTracker includes several near or real-time elements, including a visualization of the current position and depth of drill rigs, and of instruments color-coded by their current alarm status. Users can also "click" on an instrument image and view a series of interactive graphs of data acquired on a 15-minute interval. A desktop (offline) version of the GIS viewers allows a fully editable and customizable "unlocked" GIS environment, with source data automatically updated through a secure file synchronization process.



- Relevant Tasks:**
- ✓ Geotechnical Instrumentation
 - ✓ Real-time Data Visualization
 - ✓ Automated Web-based Reporting

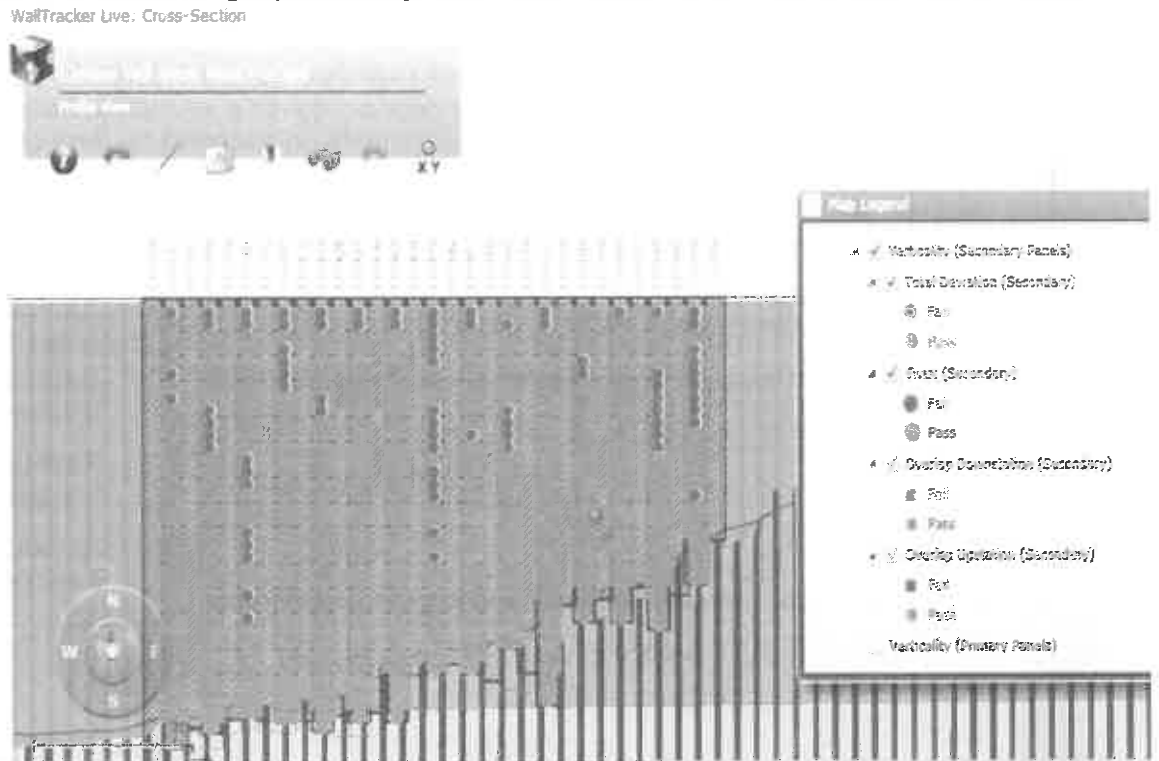
Distribution of Unconfined Compressive Strength (28 day) in Concrete Samples



- Key Personnel**
- J. Gregory Menniti
 - Jamey Rosen
 - Dan Schauer
 - Robert Bachus
 - Robert Roff
 - Mathieu Cain
 - James Hibner
 - Raphael Siebenmann
 - Andrew Higgins
 - Bryan Heald

Data are compiled in the enterprise database that powers WaliTracker from a variety of sources, including data hand-entered into web-based spreadsheets (which minimizes manual error through drop-down menus, date pickers, and data verification); data imported automatically from datalog files uploaded to the FTP site; data imported from an instrument Automated Data Acquisition System; and pre-construction CAD and GIS files provided by USACE. All these data are analyzed and served to the GIS via a series of SQL code in the database networked to a series of geoprocessing tools (built using ESRI ArcGIS and Python tools). The resulting vector

(geodatabase and shapefile) and raster (base map) data are pushed to the FTP site for offline synchronization, and to a GIS webservice consumed by the web maps. Project cost: \$1,460,000.



25 FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a. Geosyntec Consultants, Inc.	Huntington, WV; Kennesaw, GA; Knoxville, TN; Guelph, ON; Acton, MA	Data Management, Geotechnical Instrumentation

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT	20. EXAMPLE PROJECT KEY NUMBER 2
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21. TITLE AND LOCATION (City and State) Wolf Creek Dam Rehabilitation, Jamestown, KY	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES 2014	CONSTRUCTION (if applicable) 2014

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER USACE, Nashville District	b. POINT OF CONTACT NAME Vanessa Bateman, Chief, Geology Section	c. POINT OF CONTACT TELEPHONE NUMBER (615) 736-7906

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

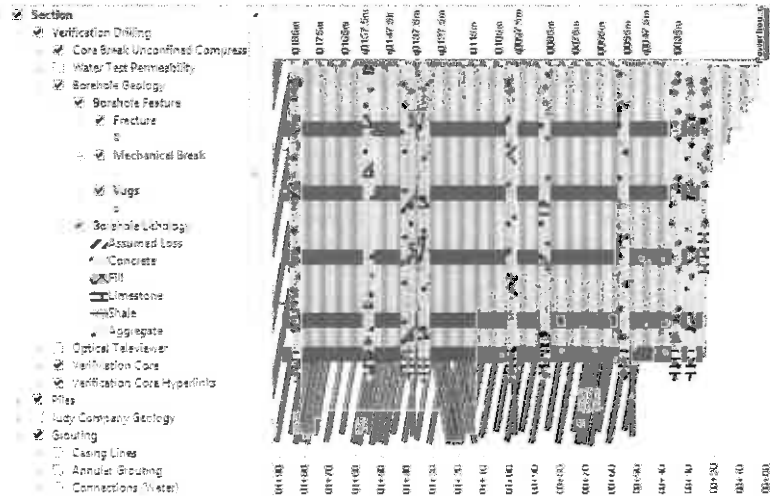
Geosyntec developed a system to compile, manage, visualize, and analyze the data collected prior to and during construction of a secant pile barrier wall and grout curtain. The Wolf Creek Information Management System (WCIMS) developed to meet this need included an enterprise database (EDB), a collection of desktop and web-based tools to verify, validate, analyze, and populate the EDB, a series of Plan, Profile and 3D GIS Viewers (both read-only for general use and a fully editable ArcGIS environment for detailed use) and web-based reports to visualize the data and analyses.

- Relevant Tasks:**
- ✓ Data Synthesis
 - ✓ Database Workflow Development
 - ✓ Automated Web-based Reporting
 - ✓ 3-D Rendering

The Nashville District Civil Design and Construction Branch received a 2013 USACE Innovation of the Year Award for the WCIMS. The WCIMS has also been described in several industry articles, and several tools, database schema elements and other "lessons learned" from the WCIMS have been applied to other similar projects.

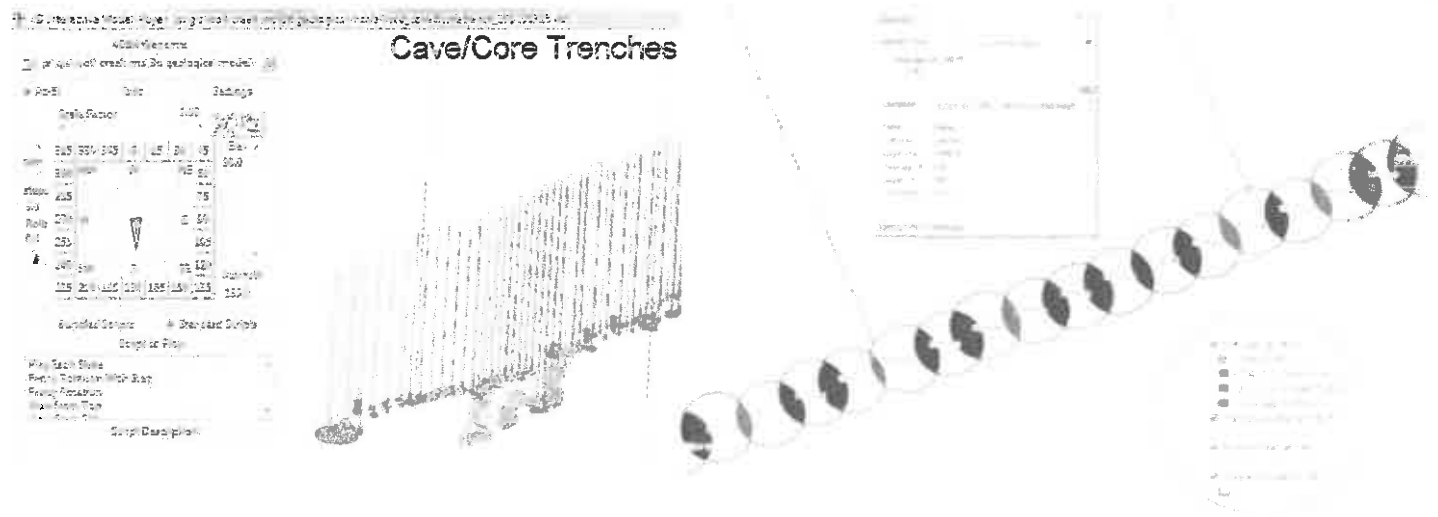
The WCIMS is the first construction GIS workflow that allows the associated EDB to be accessible to USACE as a **direct database connection**, allowing USACE to run existing queries (to analyze, for example, instrumentation data within a certain range of stationing), or to develop and run their own database queries and reports. This secure access was granted by Ace-IT (the USACE information technology) following an administrative process (consisting of a Firewall Action Request and other steps later applied in other districts).

"One key tool for Center Hill - and USACE future projects - is the IT system developed for the Wolf Creek rehabilitation. The computing muscle is described as an innovative GIS-based application that is used to manage and visualise the construction and performance data held in a relational database." Patrick Reynolds, Upgrading Wolf Creek Dam Report in Water Power Magazine



- Key Personnel**
- J. Gregory Menniti
 - Jamey Rosen
 - Dan Schauer
 - Robert Bachus
 - Robert Roff
 - Mathieu Cain
 - James Hibner
 - Raphael Siebenmann
 - Bryan Heald

The WCIMS was documented through a Data Management Plan (DMP) and through several User's Guides distributed to USACE personnel during live and remote training sessions on various tools (i.e., the reports, EDB, and GIS viewers). The DMP contained a large-format Data Flow Diagram that detailed all data sources (inputs) to the WCIMS; showed the method by which each data source was compiled in the EDB and/or GIS; indicated their method of storage (EDB, document library, etc.); described any tools used to process, reduce or analyze the data; and listed all tools that could be used to access the data. This DFD was updated routinely as the project progressed and data sources or tools were added. The EDB and GIS were also documented through a "live" EDB table that stored the name, description, assumptions, data types, etc. for each data source and GIS file.



USACE District personnel used the WCIMS to generate figures and statistics to simplify and document quality assurance practices during construction, and to support their report to the USACE Risk Management Center following construction. Project cost: \$630,000.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a. Geosyntec Consultants, Inc.	Kennesaw, GA; Huntington, WV; Acton, MA; Gueiph, ON	Data Management

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

20. EXAMPLE PROJECT KEY NUMBER
3

21. TITLE AND LOCATION (City and State)
Bolivar Dam Seepage Wall, Bolivar, OH

22. YEAR COMPLETED
PROFESSIONAL SERVICES: **Ongoing**
CONSTRUCTION (if applicable): **Ongoing**

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER USACE, Huntington District	b. POINT OF CONTACT NAME Georgette Hlepas	c. POINT OF CONTACT TELEPHONE NUMBER (304) 399-5792
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24. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

Geosyntec is developing the Bolivar Dam Information Management System (BDIMS) to manage the data associated with seepage barrier wall construction beginning in early 2015. The BDIMS consists of an Enterprise Database, from which raw data are fully accessible to USACE and contractors via a Microsoft Access file (with **secure links that pass through the ACE-IT firewall** to allow "live" access to data tables), and from which analyzed data are accessible in a variety of web-based reports and a fully editable GIS. The GIS interface allows users to view the geospatially accurate position, shape and overlap (as a function of specified limits) of excavated seepage barrier wall panels at a variety of depths. The user can also click on objects to view associated attribute data; to view geotagged photographs; to view geology contained in the gINT database; and to view, graph, and export compiled instrumentation data. Users can also click on several defined cross-sections to view the associated section in profile view with geology along with a current piezometric surface calculated from frequently uploaded data **pulled from the Automated Data Acquisition System into the EDB.**

- Relevant Tasks:**
- ✓ Geospatial Data Management
 - ✓ Wall Continuity Analysis
 - ✓ Historical Data Integration



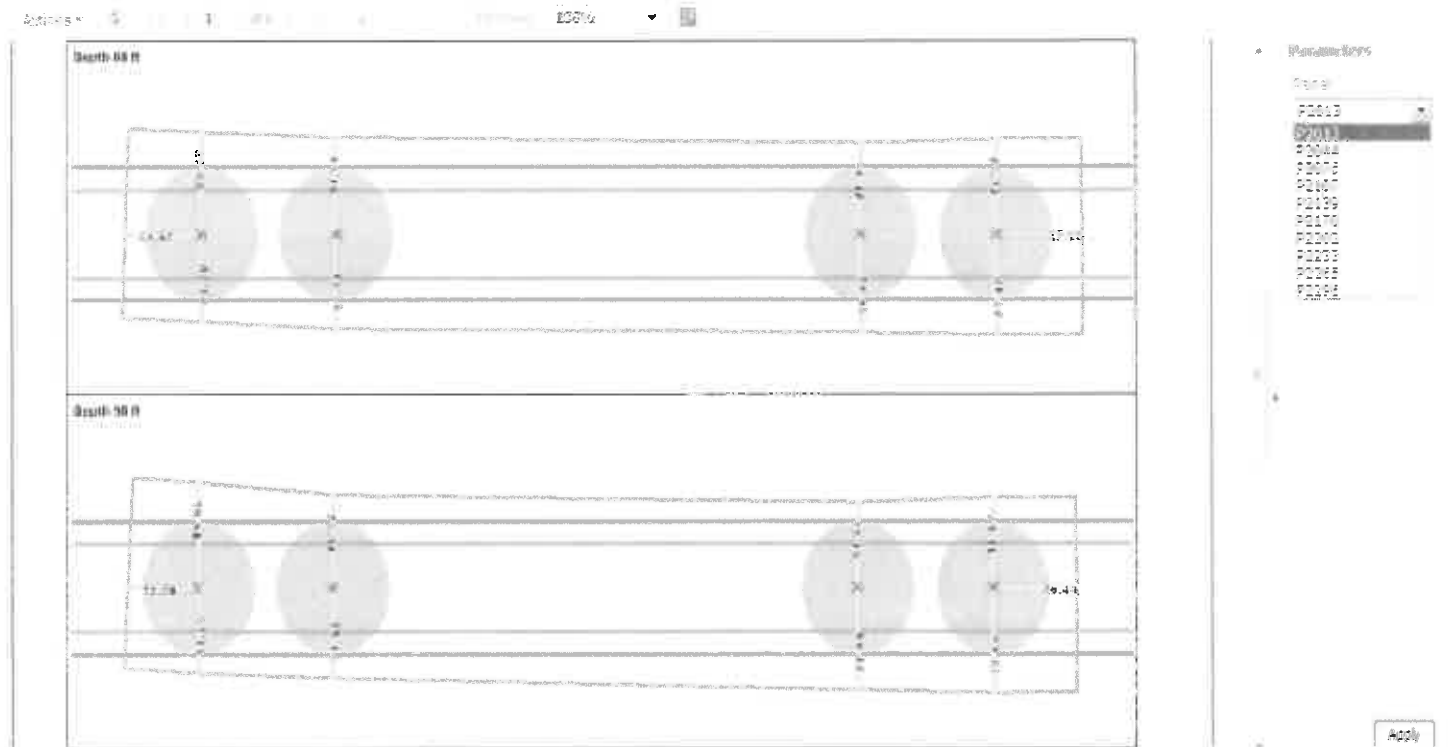
The BDIMS is documented in a Data Management Plan (DMP) updated on a biannual basis. The DMP contains a User's Guide that allows "quick reference" access to website and FTP-s credentials, database methodology, GIS access, etc.; a Data Flow Diagram that summarizes the data sources, upload methodology, storage details, and reporting options; and an Entity Relationship Diagram (ERD) that details the EDB schema (table design, data integrity rules, and table relationships). Additionally, "live" documentation of the EDB is available through documentation tables in the EDB that provide the current details of table and field definitions, assumptions, metadata and more.

Key Personnel
• Jamey Rosen
• Dan Schauer
• Robert Roff
• Mathieu Cain
• Andrew Higgins
• Bryan Heald

Several tools are currently in use that either serve data to the BDIMS EDB. These include:

- the Verticality Tool that allows the contractor to import a series of Kodex and Hydromill data files to instantly view a graphical and tabular summary of any depths that are out of compliance with respect to verticality tolerance or overlap;
- the Photo/Video Naming Tool that allows users to rename one or more files to the USACE naming specification, extract geotag information and other metadata, upload selected files to the FTP-s site, and view geotagged photo and video locations on the GIS Viewers; and
- the gINT importer which allows gINT data to be viewed in the profile GIS, queried with other data in the EDB, while still allowing it to be used as a standalone gINT product

Project cost: \$178,000.



25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	Geosyntec Consultants, Inc.	Kennesaw, GA; Guelph, ON; Acton, MA; Boca Raton, FL	Data Management

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

20. EXAMPLE PROJECT KEY NUMBER
4

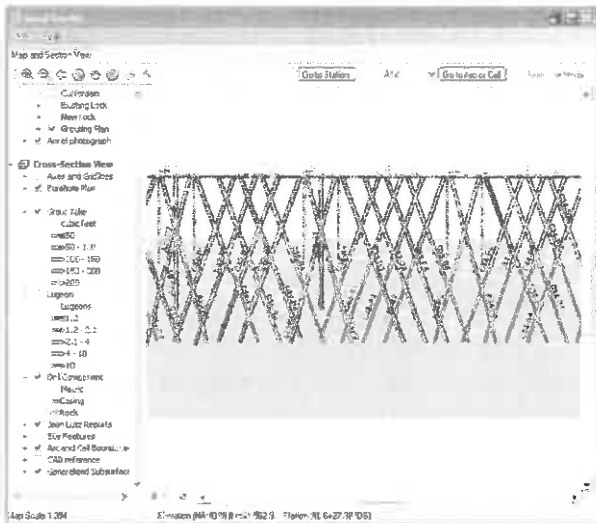
21. TITLE AND LOCATION (City and State) Chickamauga Lock Replacement, TN		22. YEAR COMPLETED	
		PROFESSIONAL SERVICES 2010	CONSTRUCTION (if applicable) 2010
23. PROJECT OWNER'S INFORMATION			
a. PROJECT OWNER USACE, Nashville District	b. POINT OF CONTACT NAME Vanessa Bateman, Chief, Geology Section	c. POINT OF CONTACT TELEPHONE NUMBER (615) 736-7906	

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

The new 110' x 600' Chickamauga Lock was designed and constructed by the Nashville District, U.S. Army Corps of Engineers. Geosyntec constructed a method by which The Judy Company and USACE, can collect, quality-control, and view data as it is collected during the construction of a barrier wall consisting of an angled grout curtain.

The challenge of compiling and viewing the large **quantity and diversity of data** collected for this project required an innovative solution.

- Relevant Tasks:**
- ✓ Development of GroutTracker
 - ✓ GIS Application Development
 - ✓ Cost and Schedule Management



To address the challenge, Geosyntec developed "GroutTracker", a database and Geographical Information Systems (GIS) Application based on a Visual Basic, MS Access and ArcGIS platform. GroutTracker allowed Chickamauga design and grouting data to be viewed in plan and cross-sectional views. Users can navigate around these views, select data to be visualized, and access data at a given location through mouse clicks. In near-real time, users can view the drilling, water testing, and grouting results in accurate locations, and see boreholes color-coded by the grout take and lugeon value measured directly from on-site instrumentation. The system also allowed a series of reports to be generated on demand, including a Daily Report designed for immediate submission to the USACE that tracks pay items; a Materials Usage report that reports the current

mass or volume of grouting mix materials delivered to the site, mixed in the batch plant, injected, backfilled or wasted; and an analysis report that provides detailed statistics for selected holes or regions.

With a streamlined workflow that allowed data to be compiled in an efficient and quality-controlled fashion and viewed in an intuitive interface, project managers and stakeholders were able to track the details and progress of this very involved and time-critical construction. Project cost: \$23,800 for GroutTracker services; Additional engineering design and field installation totaled \$800,000.

Enter / Review Daily Data

- Daily Summary
- Drilling
- Washing
- Water Testing
- Grouting
- Materials
- JL Totalizer

Reports

Daily Report: Select or enter date

- Generate Daily Report
- Generate Analysis Report
- Generate Borehole Details Report
- Generate Material Usage Report
- Generate Quality Control Report

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

a. (1) FIRM NAME Geosyntec Consultants, Inc.	(2) FIRM LOCATION (City and State) Kennesaw, GA; Guelph, ON	(3) ROLE Database Management
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F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

20. EXAMPLE PROJECT NUMBER
5

21. TITLE AND LOCATION (City and State)

WallTracker Implementation during Herbert Hoover Dam Rehabilitation, FL

22. YEAR COMPLETED

PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
2011	2011

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER

USACE, Nashville District

b. POINT OF CONTACT NAME

Airangel Berrios-Perez

c. POINT OF CONTACT TELEPHONE NUMBER

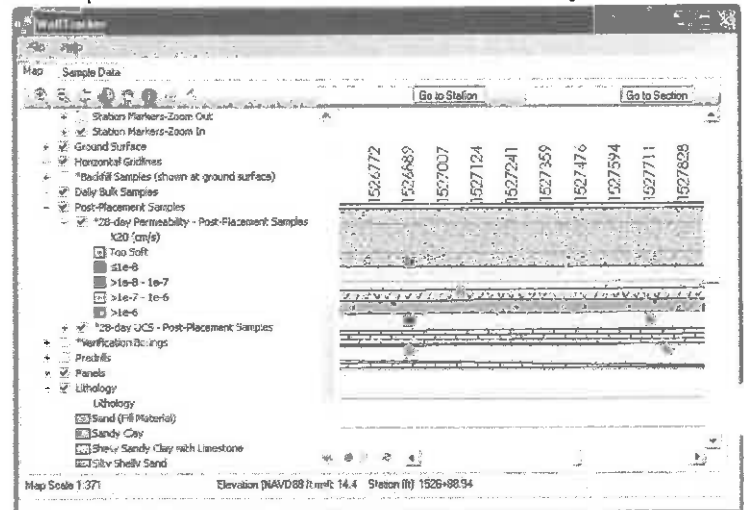
(561) 635-4950

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

The Herbert Hoover Dike (HHD) rehabilitation project is designed to stabilize and secure the aging dike from potentially damaging severe weather events, and protect the numerous residents and businesses on the southeastern rim of Lake Okeechobee. In May 2008 the Jacksonville District selected Bauer Foundation Corp. (BFC) to construct a 3-mile long segment of the planned cutoff wall that runs vertically from the dike crest to a depth of 70 feet in certain locations.

In December 2008 BFC selected Geosyntec to construct a method by which BFC and its client, the USACE, can view the data as it is collected, and interactively look up values and generate reports in an efficient manner.

To address this challenge, Geosyntec developed "WallTracker", a database and GIS Application based on a Visual Basic™, Microsoft® Access™ and ESRI® ArcGIS™ platform. WallTracker was the first comprehensive geospatial system applied to a USACE barrier wall construction program. WallTracker allows HHD data to be viewed in plan and cross-sectional views. Data accessible in the application include: construction quality assurance metrics, pre-drill and panel dimensions, slurry composition data, and downhole imagery. Users can navigate around these views, select data to be visualized, and access data at a given location through mouse clicks. Project managers can approve and annotate data, and automatically send the results of their review to the enterprise database for viewing by other users. Laboratory reports can also be accessed directly from the laboratory's website through clicking on the associated location. The data visualized and accessed is updated (securely and remotely, via the internet) as new data are collected and entered into the system. The system is also used to automatically generate As-Built drawings for approval but the USACE. By routinely meeting all QC objectives coupled with timely reproduction of as-built construction record drawings using the WallTracker™ Information Management System the project team was able to meet all contract submittal milestones and avoid costly schedule delays.



The data visualized and accessed is updated (securely and remotely, via the internet) as new data are collected and entered into the system. The system is also used to automatically generate As-Built drawings for approval but the USACE. By routinely meeting all QC objectives coupled with timely reproduction of as-built construction record drawings using the WallTracker™ Information Management System the project team was able to meet all contract submittal milestones and avoid costly schedule delays.

In late 2009, USACE sent a letter of commendation to BFC describing WallTracker as a "state-of-the-art" application capable of generating very high-quality As-Built drawings. Project cost: \$599,000.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a. Geosyntec Consultants, Inc.	Kennesaw, GA; Boca Raton, FL; Acton, MA; Guelph, ON	Geospatial application, Database Developer

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		20. EXAMPLE PROJECT KEY NUMBER	
		6	
21. TITLE AND LOCATION (<i>City and State</i>) Engineering Analysis of By-Product Disposal Facility, Roane County, TN		22. YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (<i>if applicable</i>)
		Ongoing	N/A
23. PROJECT OWNER'S INFORMATION			
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER	
Tennessee Valley Authority (TVA)	Rachel B. Combs	(423) 751-2827	
24. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (<i>Include scope, size, and cost</i>)			
<p>Geosyntec won the 2014 Grand Award from the American Council of Engineering Companies, Georgia, on the basis of future value to the engineering profession; for TVA Kingston Peninsula Disposal Site work done in Roane County, Tennessee. Since 2004, Geosyntec has provided consulting services to TVA at the Kingston Site totaling over \$12M to date.</p>			

Following a major release of ash from the dredge cells at the Kingston facility in 2008, a team of professionals from Geosyntec assisted in the development of numerous site mitigation efforts. Geosyntec served as Engineer-of-Record of the "Ballfield Area", which was initially prepared on a fast-track basis for the staging, conditioning, and load-out of ash from the recovery efforts and later as a temporary storage area for fly ash actively generated by the power plant. We designed a foundation improvement program that allowed materials to be staged, processed, and loaded for off-site disposal in a former ash pond at the site that currently was underlain by up to 40 feet of saturated ash. We developed materials handling strategies and performed geotechnical monitoring using real-time monitoring instrumentation throughout the construction operations. Ash processing and loading operations were successfully completed in this area, and Geosyntec is currently working on a conceptual design study to evaluate available options for the removal of the stored ash and final-closure of the Ballfield Site.



- | |
|--|
| <p>Relevant Tasks:</p> <ul style="list-style-type: none"> ✓ Real time data instrumentation portal ✓ Geotechnical monitoring ✓ Engineering Design |
|--|

Geosyntec developed the **web-based real-time data instrumentation portal** designed to remotely monitor water levels and settlement of soil from an array of vibrating wire piezometers. The secure portal allows the client to monitor the development and dissipation of pore pressures in the foundation materials, as well as to assess the vertical deformations of the foundation materials in response to the loading imposed by filling within the Site. Geosyntec designed and configured the **datacenter, back-end database architecture**, and performed the **front-end web programming** using a combination of **Campbell Scientific Data Logger, MS Access, SQL Server, SQL Server Business Reports, and MS SharePoint technologies**.

The Site was instrumented and monitored with a focus on the development and dissipation of excess pore pressures and the vertical and horizontal deformations in the foundation materials. This approach helped TVA to manage the fill operations and make adjustments, as necessary, to improve the overall safety of the Site. Project Cost: \$12M to date.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT		
(1) FIRM NAME	(2) FIRM LOCATION (<i>City and State</i>)	(3) ROLE
a. Geosyntec Consultants, Inc.	Chattanooga, TN; Kennesaw, GA; Guelph, ON	Geotechnical Engineering, Instrumentation, Data Management

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

20. EXAMPLE PROJECT NUMBER
7

21. TITLE AND LOCATION (City and State) Web-Mapping for an Underground Construction Information Management System, London, UK	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES 2014	CONSTRUCTION (if applicable) 2014

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER itmsoil	b. POINT OF CONTACT NAME Dr. Hai-Tien Yu	c. POINT OF CONTACT TELEPHONE NUMBER (646) 761-1521
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24. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (include scope, size, and cost)

An underground construction information management system (UCIMS) was developed by itmsoil to monitor construction data from the new east-west rail link across London known as the Crossrail. The Crossrail project construction works, Europe's biggest construction project with projected costs of £15.9 billion (\$24B), include underground development, comprising shafts, tunnels, and portals that extend beneath the already congested London underground. Given the urban environment in which the tunneling and other construction activities are occurring, monitoring of the construction works and the impact on adjacent underground and aboveground structures was a key activity for the project management and engineering teams. The UCIMS monitors **tens of thousands of real-time geotechnical instruments** and structural sensors as well as overall construction progress. In addition to performance monitoring of a host of construction activities, the UCIMS also tracks the progress and performance of Tunnel Boring Machines (TBMs). The UCIMS was designed to provide **real-time access** for all stakeholders to the construction and instrumentation data, and it required an intuitive, **map-based user interface**, showing progress and data locations relative to the surface features and other spatial information.



Crossrail's six tunnel boring machines weigh 1,000 tons each and are being used to expand London's subway system.

The scope of work required that Geosyntec work closely with itmsoil and Crossrail over two years to provide an **instrumentation and construction monitoring system of unprecedented functionality**. The UCIMS is capable of displaying the output records of thousands of sensors at a time and overlaying these sensors over base maps, including CAD drawings, geo-referenced aerial photographs, raster maps, as well as photographs. Among the many features, users are able to pan, zoom, search and filter sensors, store views, measure areas, and click on sensors to produce time trend plots of data. These time trends, coupled with independent and automated alarm levels, provide timely feedback and protection to stakeholders. The functionality incorporated into the UCIMS by Geosyntec facilitates not only information presentation, but importantly, also provides timely information to operators, engineers, and managers who need to react to the output information and make time-critical decisions regarding construction activities.

Relevant Tasks:

- ✓ Open Source Web Map Development
- ✓ MySQL/PHP/Java Script/JQuery Development
- ✓ Instrumentation/Construction Data Management

Geosyntec used open-source web mapping software including MapServer, TileCache, and OpenLayers for the ease of customization and to eliminate long-term software licensing costs (estimated to be over \$100,000 over five years) for the GIS-based components of the system. Project cost: \$471,000

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME a. Geosyntec Consultants, Inc.	(2) FIRM LOCATION (City and State) Kennesaw, GA; Guelph, ON	(3) ROLE Instrumentation and Construction Monitoring System
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F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

20. EXAMPLE PROJECT KEY NUMBER
8

21. TITLE AND LOCATION (City and State) LiDAR Modeling for San Francisco Bay Site Closure, Palo Alto, CA	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (if applicable) N/A

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER City of Palo Alto	b. POINT OF CONTACT NAME Matt Raschke	c. POINT OF CONTACT TELEPHONE NUMBER (650) 496-5937

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

Geosyntec worked closely with the San Francisco Regional Water Quality Control Board (SF RWQCB) to achieve regulatory closure for the inland portion of Palo Alto Bay Site. Geosyntec's work performing environmental assessment, remedial design and **LiDAR modeling** resulted in developing a risk-based proposal for regulatory closure which was accepted.

- | |
|---|
| <p>Relevant Tasks:</p> <ul style="list-style-type: none"> ✓ LiDAR ✓ Regulatory Site Closure ✓ Inundation Modeling Simulation and Inundation Mapping |
|---|

Geosyntec directed environmental assessment and remedial design evaluation of a 13-acre site along the margin of the San Francisco Bay wetlands that is owned by the City of Palo Alto. A portion of the site is a former waste water facility that includes former sludge ponds. Low levels of metals were detected in the soil, sludge and in some of the water samples. Localized areas with low levels of semi-volatile and volatile organic compounds are also present, and a PCE plume in groundwater from a nearby industrial facility borders the Site.

Geosyntec conducted an environmental assessment of the 13 acres site along the margin of the SF Bay wetlands. Geosyntec compiled data, conducted supplementary sampling of soil, shallow soil gas, and groundwater, and developed a risk-based proposal for regulatory closure of the inland portion of the site. Geosyntec also developed a site-specific risk-based conceptual plan for reclamation by capping the impacted soil in conjunction with plans to raise the base grade meet FEMA flooding guidelines, and restoration of wetlands to meet compensatory mitigation requirements.

Geosyntec developed a risk-based proposal for regulatory closure of the inland portion of the site, which was approved by the SF RWQCB. Geosyntec also developed a site-specific risk-based conceptual plan for capping of the impacted soil in conjunction with plans to raise the base grade meet FEMA flooding guidelines, and restoration of wetlands to meet compensatory mitigation requirements, which was conditionally approved by the RWQCB.

Geosyntec determined that previous cost estimates for remediation of the former wastewater sludge ponds, which included excavation and removal of large quantities of soil, were based on outdated EPA 1995 guidelines for "reactive sulfides", which were rescinded by EPA in 1998. The SF RWQCB granted conditional approval of Geosyntec's environmental assessment and cost-effective conceptual plan for reclamation by capping the former sludge ponds and compensatory wetlands restoration.
Project cost: \$416,000

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

a.	(1) FIRM NAME Geosyntec Consultants, Inc.	(2) FIRM LOCATION (City and State) Lake Mary, FL	(3) ROLE Inundation Modeling and Mapping
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F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT 20. EXAMPLE PROJECT NUMBER **9**

21. TITLE AND LOCATION (City and State) Folsom Dam, Folsom, CA		22. YEAR COMPLETED	
		PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (if applicable) N/A
23. PROJECT OWNER'S INFORMATION			
a. PROJECT OWNER USACE Sacramento District	b. POINT OF CONTACT NAME Kylan Kegel, Lead Engineer	c. POINT OF CONTACT TELEPHONE NUMBER (916) 557-7775	

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

Geosyntec is compiling data from grouting activities at Folsom Dam, facilitating quality control of those data, and generating progress and as-built drawings that visualize the grouting data.

These drawings are generated automatically from integrated CAD and GIS data using a series of database and geoprocessing routines. These routines compile raw data generated from grouting instrumentation and uploaded to a web-based document library, CAD basemap data, GIS features, and grout hole construction details entered into web-based forms.

Relevant Tasks:

- ✓ Data Synthesis
- ✓ GIS Workflow Development
- ✓ Drawing Automation

In order to construct the GIS used to generate drawings, Geosyntec georeferenced CAD data (in a non-standard coordinate system), hand-drawings of hole locations, and other details into a standard projected coordinate system to allow for a common spatial reference for all project data. Project cost: \$41,000



25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

a. (1) FIRM NAME Geosyntec Consultants, Inc.	(2) FIRM LOCATION (City and State) Kennesaw, GA; Guelph, ON	(3) ROLE Data Management, Geotechnical Instrumentation
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F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		20. EXAMPLE PROJECT KEY NUMBER 10
21. TITLE AND LOCATION (City and State) Mass Concrete Thermal Analysis at Portugues Dam, Ponce, Puerto Rico		22. YEAR COMPLETED PROFESSIONAL SERVICES: 2011 CONSTRUCTION (if applicable): N/A
23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER USACE Jacksonville District	b. POINT OF CONTACT NAME David Dollar	c. POINT OF CONTACT TELEPHONE NUMBER (904) 232-1992
24. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)		

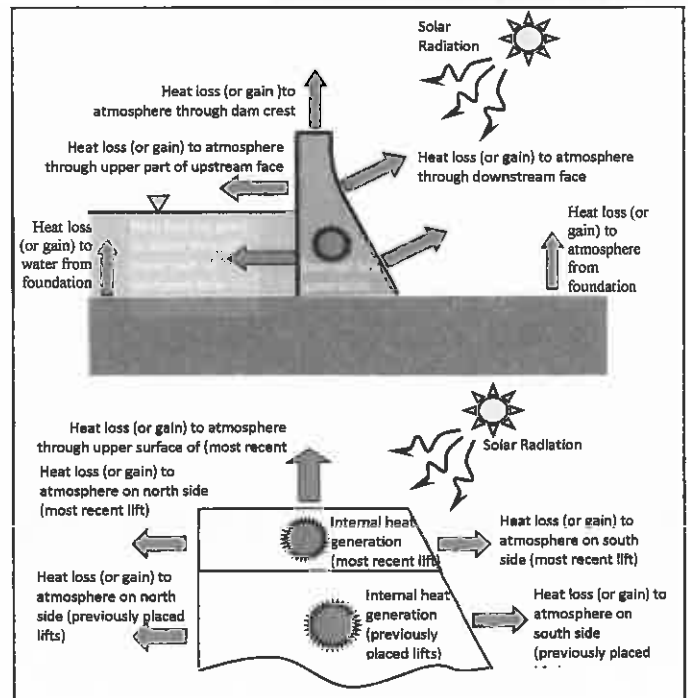
Geosyntec, through our wholly owned subsidiary MMI, provided design consulting services to the U.S. Army Corps of Engineers, Jacksonville District for thermally induced crack control of the Portugues Dam. This work was completed in multiple phases (both in support of the design effort and during construction) to establish safe design methods and to confirm that the potentially serious thermal strains were avoided through the development of proper construction sequencing. The work involved state-of-the-art structural analyses that utilized time history analysis and finite element modeling to determine the thermal response of the dam, and subsequent potential crack development, for a range of construction sequences and ambient temperatures.

- Relevant Tasks:**
- ✓ Experience with components of high dam structures, foundation, construction and performance monitoring
 - ✓ Data Synthesis
 - ✓ GIS Workflow Development
 - ✓ 3-D Modeling Display and Rendering
 - ✓ Very Good ACASS Rating

The Portugues Dam, authorized by the Congress under the Flood Control Act of December 30, 1970, is the first single curvature thick arch dam constructed using roller compacted concrete (RCC) by the

Corps in the U.S. and the Caribbean.

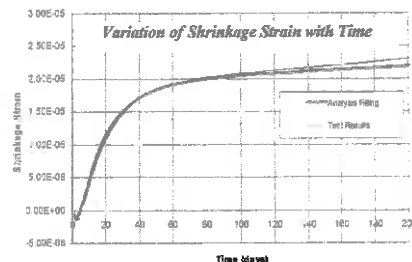
Located in an area of high seismic activity, the dam design required both gravity and arch action to carry seismic loads. Consequently, thermally induced cracking of the dam was a major concern for the design. Following successful work performing a comprehensive nonlinear incremental thermal stress-strain Analysis (NISA) of the dam for USACE, Geosyntec was retained by Jacksonville District to perform verification analysis using thermal recordings that were collected during construction to verify that the thermal stresses that occurred during construction were within tolerable levels. The confirmatory analysis completed by Geosyntec also addressed the consequence of changes to the construction sequence that were proposed to USACE by its contractor.



Hydration of concrete is an exothermic reaction and results in significant heat generation. For mass concrete structures, depending upon their size, it can take up to several years (10 years in case of the Portugues dam) for the structure to reach a stable temperature distribution within the dam which is in equilibrium with the ambient conditions. The volumetric change from thermal effects together with the subsequent cooling and drying shrinkage of concrete induces strains that, when resisted due to internal restraint from hardened concrete or any external restraints, can cause concrete to crack if these strains

exceed the tensile strain capacity of concrete. Geosyntec performed a combination of **2D and 3D analysis** using the NISA methodology to assess the magnitude of thermally induced strain and the potential excessive cracking that could undermine the dam's structural and seismic integrity and to provide design recommendations related to the initial placement temperature and the optimum location of contraction joints to the Corps.

Geosyntec's analysis considered several time-dependent variables including adiabatic temperature rise, initial concrete placement temperature, solar radiation, heat loss through convection, time dependent variation of concrete, nonlinear material properties (creep, shrinkage, modulus of elasticity, and tensile and compressive strengths), and straining of concrete due to thermal and gravity loads. Geosyntec used the nonlinear finite element analysis program ABAQUS, in conjunction with a special concrete material model to include the effects of creep, shrinkage and tensile cracking. The analysis procedure required that the finite element mesh change in time to model the incremental construction process and changes in the boundary conditions and loads. Geosyntec evaluated the actual stresses developed in the dam based on temperature measurements that were taken during construction to confirm that the design methods, and alterations proposed by the contractor, were within design specification.



Control of cracking in a dam is important for many reasons including structural integrity, leak prevention, visual appearance and public confidence. Geosyntec's analyses provided the Corps with assurance that the dam was constructed as intended and should therefore perform as intended. Project cost: \$505,000.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	Geosyntec Consultants, Inc.	Oakland, CA	Project Management and Project Execution

G. KEY PERSONNEL PARTICIPATION IN EXAMPLE PROJECTS

26. NAMES OF KEY PERSONNEL (From Section E Block 12)	27. ROLE IN THIS CONTRACT (From Section E, Block 13)	28. EXAMPLE PROJECTS IN SECTION F (Fill in "Example Projects" section below before completing table. Place "X" under key number for participation in same or similar role.)									
		1	2	3	4	5	6	7	8	9	10
J. Gregory Menniti, PE, PS	Program Manager	X	X								
Jamey Rosen, PGeo	Project Manager	X	X	X	X	X		X		X	
Dan Schauer, PG	QC Manager	X	X	X	X	X				X	
Robert Bachus, PhD, PE, DGe	Engineering Lead	X	X		X	X		X			
Robert Roff	GIS Lead	X	X	X	X	X		X		X	
Mathieu Cain	gINT	X	X	X		X				X	
James Hibner	CADD Lead	X	X								
Raphael Siebenmann, PE	Geotechnical Instrumentation (WinIDP)	X	X		X		X	X		X	
Thomas Amstadt, PE, CFM	LiDAR										
Bradley Janke	LiDAR								X		
Andrew Higgins	Enterprise Database Lead	X		X						X	
Bryan Heald	Database Manager	X	X	X		X					

29. EXAMPLE PROJECTS KEY

NO.	TITLE OF EXAMPLE PROJECT (FROM SECTION F)	NO.	TITLE OF EXAMPLE PROJECT (FROM SECTION F)
1	Center Hill Dam Foundation Rehabilitation, Smithville, TN	6	Engineering Analysis of By-Product Disposal Facility, Roane County, TN
2	Wolf Creek Dam Rehabilitation, Jamestown, KY	7	Web-Mapping for an Underground Construction Information Management System, London, UK
3	Bolivar Dam Seepage Wall, Bolivar, OH	8	LiDAR Modeling for San Francisco Bay Site Closure, Palo Alto, CA
4	Chickamauga Lock Replacement, TN	9	Folsom Dam, Folsom, CA
5	WallTracker Implementation During Herbert Hoover Dam Rehabilitation, FL	10	Mass Concrete Thermal Analysis at Portuguese Dam, Ponce, Puerto Rico

H. ADDITIONAL INFORMATION

INTRODUCTION

Geosyntec Consultants, Inc. (Geosyntec) is a specialized consulting and engineering firm that works with private and public sector clients to address new ventures and complex problems involving the environment, natural resources, and civil infrastructure. Geosyntec has 1,010 employees, including engineers, geologists, scientists, geographers, geomatics specialists, and other technical and project staff located in more than 65 offices throughout the United States and Canada. Geosyntec's dams, dikes, and levees practice creates site-specific solutions using our expertise in geotechnical and geoenvironmental foundation engineering, water resources, information management, construction management and environmental management. Our distinguishing characteristic is our commitment to the idea that technical leadership and client service are the foundations for producing solutions for our clients that are practical, efficient, and sustainable.

A. SPECIALIZED EXPERIENCE AND TECHNICAL COMPETENCE

Geosyntec is recognized as an industry leader in technical innovation, training, and technical information transfer. With over 100 database managers, GIS practitioners, computer modelers, web developers, and other professionals and support staff, Geosyntec has the resources and experience to successfully execute all work elements described in this Solicitation. Our strong understanding of the requisite scientific and engineering needs of this contract is supported by the fact that approximately 80% of our staff have advanced degrees.

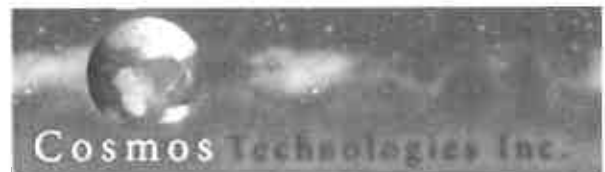


Our experience includes:

- Design, development, implementation and support of Information Management Systems for dam and levee construction and rehabilitation activities;
- Development and customization of geotechnical instrumentation monitoring systems that combine automated and manual measurements; and
- Management and development of geological models using gINT, CAD, LIDAR, and other input data.

Geosyntec has teamed with Cosmos Technologies, Inc. (Cosmos) to support expedited, complex, and unexpected work during the contract period. Cosmos is a progressive and multi-disciplinary firm providing services in geospatial services, civil engineering, construction management and inspection, environmental services. Cosmos' expertise encompasses green infrastructure (GI) design, site infrastructure design, grading design and environmental management. Cosmos will provide services as needed in:

- 3D laser scanning/point cloud feature extraction
- GPS Engineering Surveys
- GIS Geodatabase Design and Population
- Survey Data Transformations, Surface Modeling
- Multi-Source Data Integration



The following addresses Geosyntec's experience related to each area of Specialized Experience and Technical Competence in this Solicitation:

i. The development and implementation of Geospatial Data Management Systems with designs that include system schemas and workflow diagrams describing data sources, storage, and access methods.

Geosyntec is a leader in the design and implementation of Information Management Systems (IMs) for construction, environmental and civil infrastructure projects. Our IMs employ enterprise and desktop database and GIS in two and three-dimensions, web-based tools for sharing files and accessing data, and interface/translation tools to import/export/link these tools to other data management systems (i.e., instrumentation acquisition systems, third-party visualization tools, etc.). These systems are generally composed of a single enterprise database (EDB) to store data, and a collection of geospatial and other tools that comprise the Database Management System (DBMS) to control the input, synthesis, analysis, and output of data.

Geosyntec-designed IMs are focused on data accessibility and interoperability. As such, we provide tools to our users that allow direct connections to raw database files, the ability to download data in a variety of non-proprietary file formats for use in external systems, and make a point of never “holding data hostage” so a user cannot access it. These principles are enumerated in our IM guidelines:

- **Single Source Data** – All information contained in the IM officially “lives” in a single place. All other instances where that information is needed are referenced as links to, or outputs from, that single source. By following this tenet, there is never a question of which is the correct version of any piece of information.
- **Untouched Data** – Once data exist in a digital format, either as an instrument reading or a manual input, the DBMS facilitates any transfer of those data into and out of the EDB, minimizing any manual transcription or other operations on those data.
- **Non-proprietary Data Formats** – Whenever and wherever possible, data tables and file types will be in industry-standard or otherwise universally accessible formats. The EDB will be built in SQL server, or an open-source equivalent like MySQL. Generally IM workflows require data transfers into and out of the EDB to be in Microsoft Office (i.e., Access® or Excel®), database standard (dbf) or ASCII-format files. Similarly, GIS features will be built in file geodatabases that can transfer datasets to industry standard raster (e.g., tif) and vector (e.g., shapefile) formats for use in the largest variety of software, and to ensure the longevity of the files’ readability.
- **Spatial Consistency** – To the extent possible, spatial data are handled in a consistent format and system, regardless of the view (e.g., 3D, plan or cross-sectional). To the extent necessary and depending on the source of the data, conversions of location information will be incorporated to maintain spatial consistency.
- **Remote Usage** – Data in IMs are completely accessible to USACE.
- **Transferability** – IM data and tools can be migrated to other USACE projects with minimal supplemental development expense.

These principles are exhibited in all of our USACE data management projects to date (Wolf Creek Dam, Center Hill Dam, and Chickamauga Lock and Dam for the Nashville District; Folsom Dam for the Sacramento District; Bolivar Dam for the Huntington District; and Herbert Hoover Dike for the Jacksonville District, all described in project descriptions above). Although the IMs developed for these projects in the nature and format of data sources and the style of outputs, they are similar in concept and structure, and they all share the goal of acquiring, synthesizing, visualizing, serving, and reporting data associated with the construction and instrumentation of a barrier wall (consisting of panels, secant piles and/or grouting) installed in an existing high-priority (risk classification) dam.

Schema and Workflow Documentation and Communication

Many of the aforementioned projects were initiated and continuously documented through a Data Management Plan (DMP). A DMP is crucial for the communication of an IMS, especially when data are synthesized from multiple sources.

These DMPs contain several key components:

- **An Enterprise Relationship Diagram (ERD)**, which visualizes EDB tables and their fields, showing primary and foreign key fields and relationships between tables. An ERD is a primary document for EDB users (both on the contractor team and at USACE) to reference in their use of tables, authorship of queries and views, and design of reports and outputs. A detail from an ERD showing gINT tables is below in Section iii.
- **A Data Flow Diagram (DFD)**, which visualizes: (1) data sources; (2) the tools (i.e., components of the DBMS) used to acquire and verify data for import to the EDB; (3) the general structure of the EDB itself for data storage; and, (4) its connections to tools used to access data stored in the EDB. Special consideration is given to raw (“tabular”) data that are used to generate two- and three-dimensional GIS features via geoprocessing or spatial queries within the DBMS. Our DFDs are designed to be printed in large format and displayed on office walls and contain everything a user should know about the structure of the subject IMS. A generic DFD showing the standard component categories, and example details from DFDs maintained on other USAE projects are shown below.

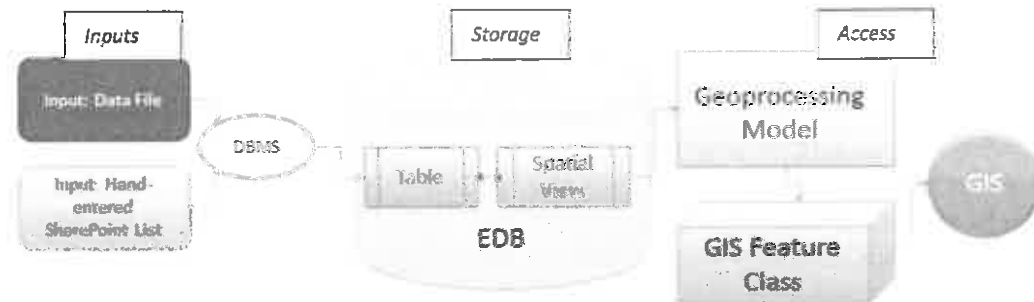


Figure 1. Generalized DFD Showing Components of an Automatically Updating GIS

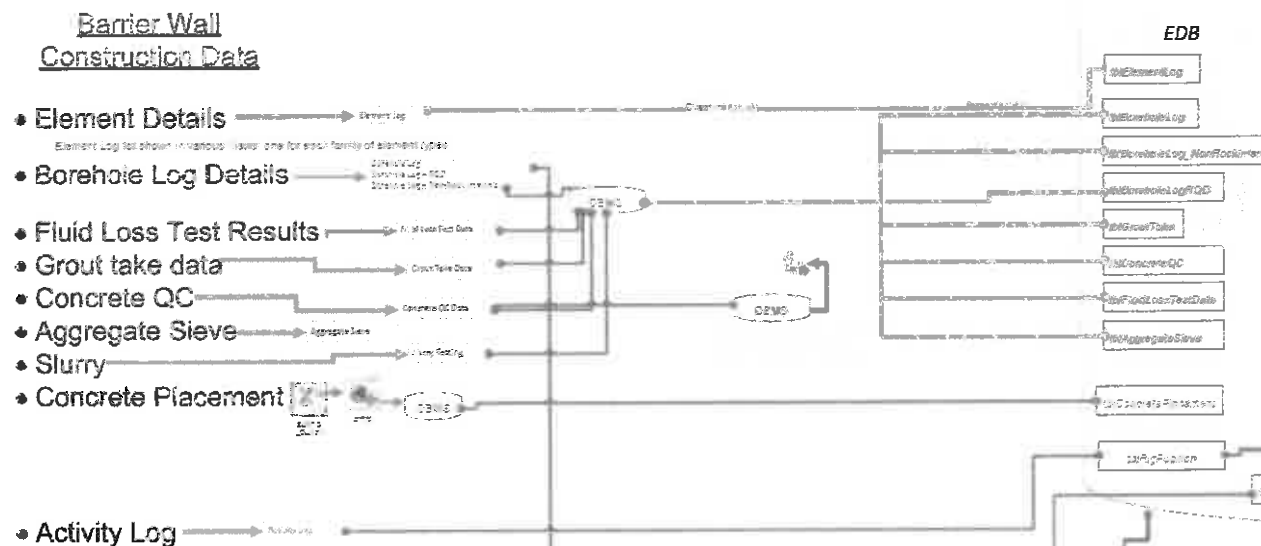


Figure 2. Detail from DFD showing flow of data from digital and hand-entered tables into the EDB.

- A **User's Guide** that contains the instructions for using each IMS tool. For example, our systems frequently employ web-based interactive maps to display GIS data used in, and generated from, the IMS. The User Guide contains a series of screenshots that show how to open the tool, and document each button, many of which are developed specifically for the given project.

ii. The development of 3D models from LiDAR point cloud data, bathymetric survey data, conventional survey data and aerial imagery.

Use of LiDAR technology for 3D model development is rapidly increasing in construction and infrastructure management. Geosyntec's experience with LiDAR includes work at the H.R. Ash Dam in Escambia County, Florida, where we obtained raw LiDAR data from the United States Geological Survey and used it to create a detailed digital elevation model (DEM) of the dam site and the surrounding area. We used this DEM to support the generation of a detailed hydrologic/hydraulic model that simulated the impacts of dam breach failure due to overtopping and pipe seepage failure. We have also used LiDAR point cloud data and associated survey information to generate models at different points in the development of a project for use in change analysis. We employed this technique to support the reincorporation of a salt pond for the San Francisco Bay Site Closure in the city of Palo Alto (PD8; Figure 3). This technique required the import of the LiDAR data into an ESRI geodatabase and the use of geoprocessing models to reduce and analyze the data to produce a meaningful "change" metric.



Figure 3. Use of LiDAR data to evaluate elevation changes over time

Bathymetric and topographic data, aerial imagery (photographic and multi-band), and other base data are crucial components of any GIS-based modeling exercise. Geosyntec's models frequently employ some or all of these components. For example, our sediment remediation practice typically uses multi-beam bathymetric data collected at several different times to monitor dredging operations, or to assign elevation data to sediment sample depths.

iii. The development and implementation of linked database systems using SQL Enterprise Databases, including the integration of both Bentley gINT borehole and WinIDP Instrumentation database systems with GIS systems

Enterprise Databases, generally built in Microsoft SQL Server (hosted by Geosyntec and accessible to USACE and its contractors as described further below), are a core component of our IMSs. The general intent of the EDB is to store and integrate data from a variety (ideally, all) of the site data sources. gINT borehole data tables and instrumentation data collected from an automated tool (i.e., an ADAS) or read manually are common components of these EDBs.

Geosyntec developed and implemented a SQL EDB that included Bentley gINT data for Wolf Creek Dam (PD 2) and is currently doing so at Bolivar Dam (PD 3). Our SQL EDB implementations at both Center Hill Dam (PD 1) and Bolivar Dam include daily imports from WinIDP data files. The goal in both cases is (gINT and WinIDP) to allow data from these technologies to be used in their original standalone applications and to be queried and visualized in the context of other data in the EDB.

gINT Data Integration

gINT software is an industry standard tool for management and visualization of borehole data, and a tool that is very "database friendly." Many of our environmental and construction IMSs are integrated with gINT software in such a way that gINT can still be used for its primary purpose (generation of borehole logs), while the data within the gINT "back end" database can be accessed in the EDB and connected GIS tools. Our EDBs commonly contain tables that exactly mirror the schema of the gINT database tables (POINT, LITHOLOGY, etc.) and automate the import of data such that as soon as each borehole log is created, the EDB is updated with the associated gINT data. Given the spatial nature of the gINT database tables (i.e., presence of X/Y and elevation/depth fields), once entered, the EDB boreholes are immediately available in GIS tools (as points in plan views, vertical or angled lines color-coded with lithology contacts or other details in profile views, or geospatially accurate "tubes" in three dimensions). Finally, we employ spatial hyperlinks that allow GIS users to click on the features and open a PDF format raw (hand-written, scanned) borehole log, and the corresponding borehole log generated in gINT.

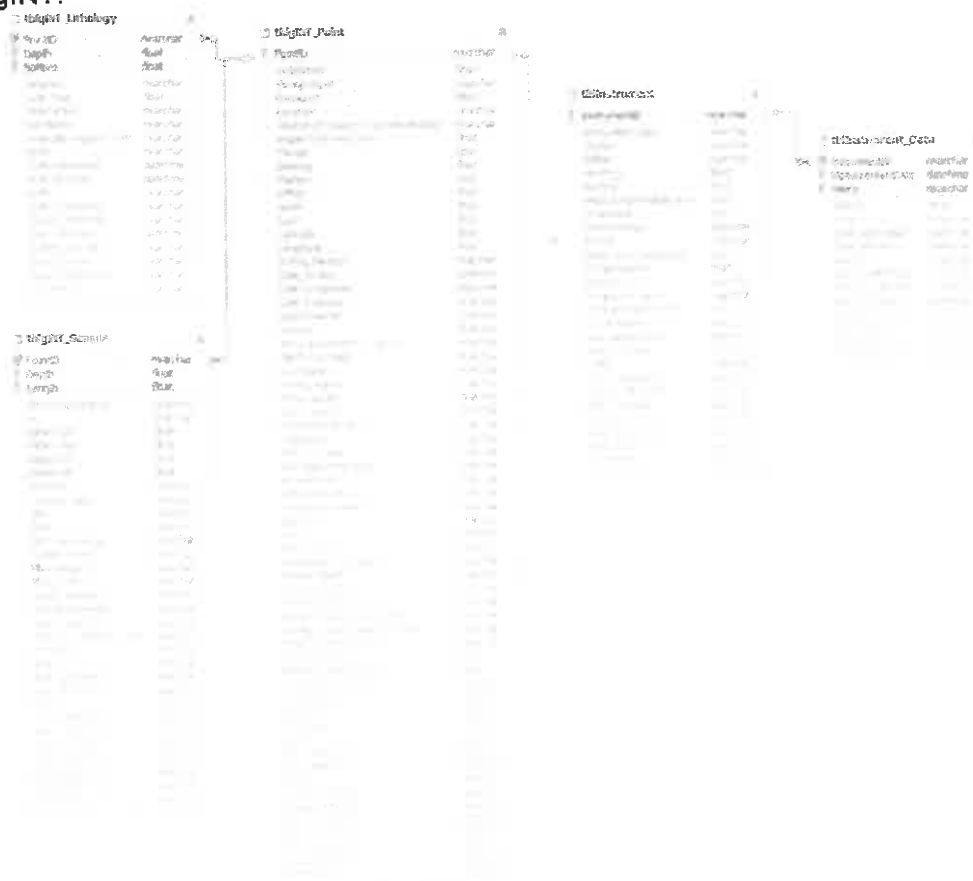


Figure 4. Detail from ERD showing integration of gINT tables with instrumentation tables.

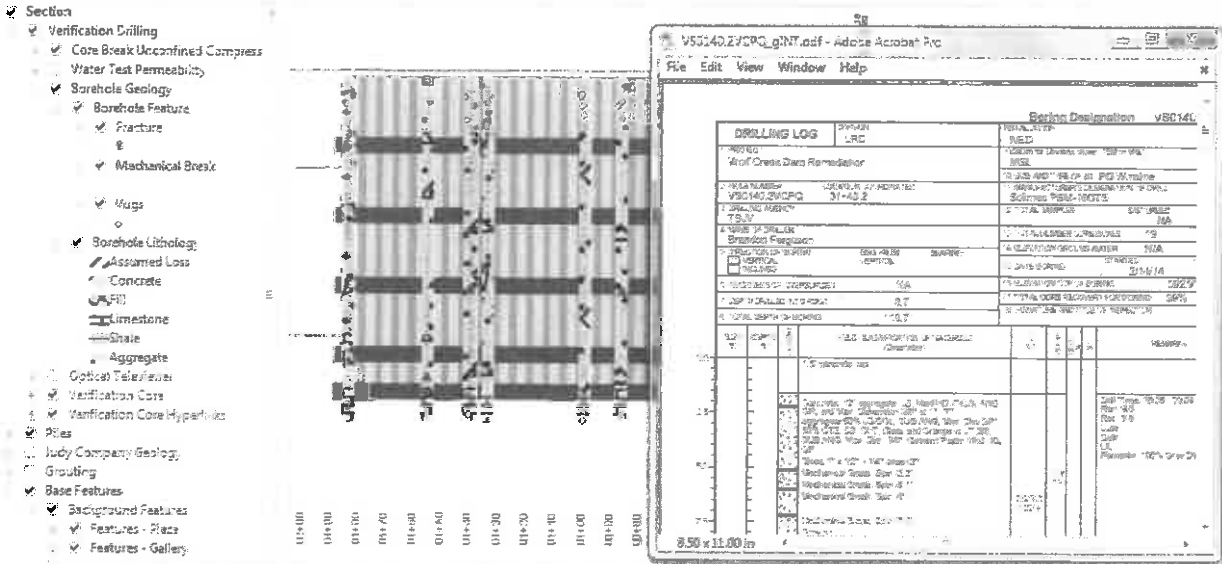


Figure 5. Profile GIS Viewer showing visualization of gINT data and hyperlink to gINT borehole log

Instrumentation Data

Geosyntec has developed several IMS tools that integrate with WinIDP and similar instrumentation databases. While USACE has firewall protection that prevents the type of direct connection between the EDB and WinIDP that would be desirable in these systems, our IMSs contain tools that both import datalog files generated in WinIDP (i.e., allowing WinIDP data to be visualized in tabular (i.e., with statistics), graphical (time trends, alarm status), and map-based formats in web and desktop IMS components), and export data from the EDB in a format suitable for import to WinIDP (i.e., allowing data collected by the contractor to be digitally acquired by USACE).

As with gINT data, the intent is for a single database to be able to relate instrumentation data (i.e., measurements made at specific locations) to other site data (i.e., the geology logged at those locations). This is generally done through developing constrained database table relationships that rely on the name, stationing, or XY position of each instrument.

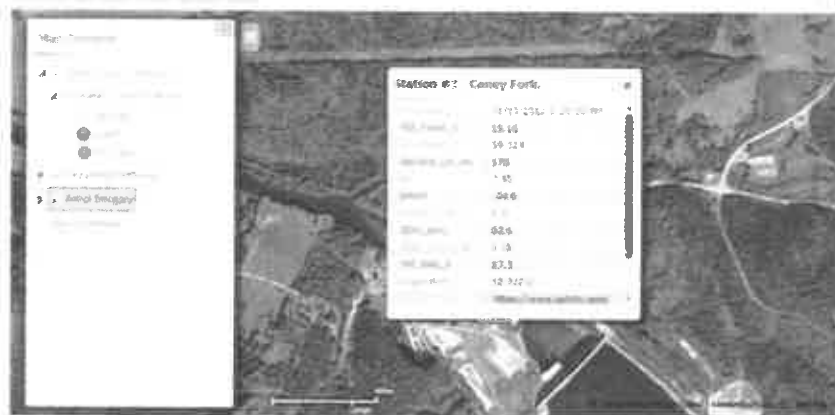


Figure 6. Web-based GIS tool with access to WinIDP data

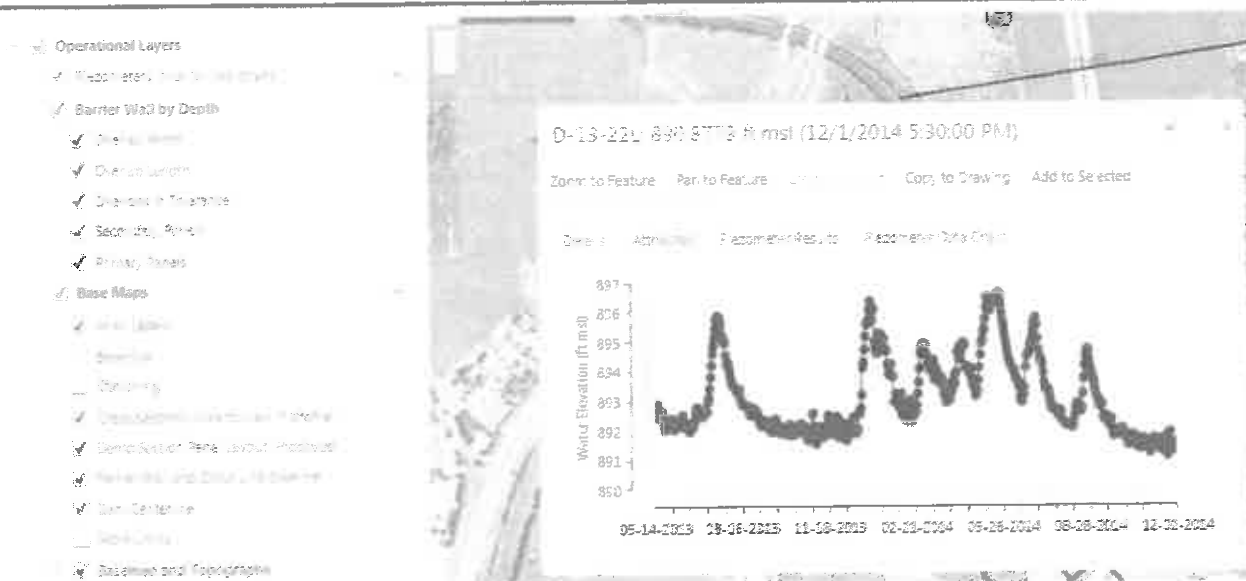


Figure 7. Detail from Web-based GIS Tool with interactive views of historical instrument data.

iv. The development and implementation of multi-level access for users (i.e. read, write, delete access based on user rights assigned)

Multi-level user access is frequently required to facilitate a smoothly functioning IMS. Our systems allow owners and applicable contractors multiple tiers of access to raw and processed data, generally falling into 3 categories:

- **Executive Summaries:** web-based reports that summarize the most crucial high-level information, ideally in a one-screen (or one “phone view”) format. This information might include what percentage of construction is completed, whether any instruments are in an alarm state or the average value of a key performance metric.
- **Detailed Data:** interactive tools, including GIS viewers that allow users to drill down to data, view data analyses and statistics, or view documents associated with data.
- **Raw Data:** complete access to “untouched” fundamental database tables.

Furthermore, the EDBs themselves have permission levels (owner, writer, reader) set either for the entire EDB or for specific tables, views, and tools. This method allows database managers to limit editing or adding data to users who have specific training or to external users who have specific responsibilities for datasets. Assigning user-level permissions also ensures that each database record has an automatic “stamp” with the username (and associated date/time) connected to the creation and editing of that record.

Data managers at Geosyntec have rigorous standards toward gaining complete access to raw database tables, and we share that requirement with our client. From recent project successes as mentioned above we have found that the best practice for sharing data with USACE during construction is to host the EDB as an SQL Server database on Geosyntec’s server, and to deploy a “self-updating” Microsoft Access file to all project team members that contains direct read-only links to tables and views in the EDB. This way database users can “see” data in the database immediately after it is imported, which is especially relevant for data that are added to an EDB on a frequency exceeding daily. Given the small file size and general familiarity with Access software, this method avoids the need for complex installations and frequent file updates.

At routine intervals and at the end of the project, the entire SQL Server file is transferred to USACE, where it can be hosted within the USACE IT infrastructure (i.e., behind the ACE-IT firewall). In this way, the Access files can still be used and there is no further reliance on contractors to access data.

v. The development of displays and renderings of three dimensional models, as well as two dimensional plan, profile, and cut sections views of dam structures, subsurface features and topology utilizing ESRI, and Microstation software platforms.

Geosyntec has developed geospatial models in two and three dimensions for projects in a variety of industries. Many of our projects include geospatial models generated from several disparate data sources, including hand sketches, CAD drawings, LiDAR and raster data, and attribute data geoprocessed into geospatial elements, among others. These models are delivered to clients via web, mobile and desktop interfaces ranging from simple interactive PDF files to full editable GIS environments. Examples of project experience using the subject data sources are described below.

A common geotechnical data management workflow at Geosyntec consists of storing 3D geospatial features in a single database that are accessible in either 3D "oblique" rotatable views, as well as in plan and profile/section cut views. These features are frequently imported from CAD drawing files (Autodesk and Microstation) to ESRI GIS objects, or are GIS objects that are referenced in a GIS that also references CAD objects. An example is our "WallTracker" system deployed at the Herbert Hoover Dike rehabilitation owned by the USACE Jacksonville district (PD 5). In this project, a geospatial database was used to serve data to ESRI ArcReader software that showed barrier wall construction elements and associated slurry strength data visualized on a geospatially referenced CAD profile drawing.



Figure 8. Profile View through Grout Gallery at Folsom Dam, showing grout instrument data on a CAD basemap.

vi. The application of attributes to model features with spatially referenced data with relevant datum, coordinates, geographic projections and metadata.

The GIS tools deployed at the Herbert Hoover Dike rehabilitation (PD 5) are populated through the use of automated geoprocessing scripts. These scripts compile tabular data (originally collected in the field with simple spreadsheets) that describe the location (stationing) and dimensions and several other attributes of barrier wall panels. The scripts then use geometrical calculations to convert the location and dimension information to geodatabase feature classes spatially projected in plan view (state plane coordinate system) and profile view systems, using routines that use spatial projection data and apply the projection details to associated projection files, world files, and embedded metadata. Finally, users are presented with objects that accurately represent the shape and position of the panels, and can "click" on a panel object to view all of the attributes from the field spreadsheet.

Where possible, GIS features are stored in, or linked directly to, the EDB. By this method, attribute data (i.e., data contained in EDB tables and views) are completely and transparently accessible to any application that consumes the GIS feature data. GIS features and spatial data types always include embedded spatial reference data (i.e., projection details in feature classes and Spatial Reference System Identifier (SRIDs) in spatial data types), and associated metadata (i.e., ESRI metadata in feature classes, metadata xml files in shapefiles and other individual files, and embedded comment documentation in spatial views). Our metadata formats follow USACE specifications where applicable,

and always contain information about the data source, author, units, assumptions, limitations, and any other data necessary to use these GIS features beyond just the intended project.

vii. The development and implementation of various user access sites including simplified web-based access to GIS map products as well as complete desktop access using non-locked full scale GIS map documents, Geodatabase and shapefiles.

The IMSs described here (as well as several other systems Geosyntec has developed and deployed for legal, industrial, and government clients) automatically take EDB data and create GIS features, and deploy those features on both web and desktop-based interactive GIS tools. Deploying in both of the web and desktop formats allows users to either access the data in an immediate read-only fashion via a website accessible with a computer or mobile device, or automatically download (synchronize via sFTP) GIS and associated data and interact with it in a fully editable GIS environment (using ArcGIS for Desktop software). This latter method is ideal for users who want to view project GIS data in the context of GIS data not necessarily accessible to the contractor, or to edit or format data for a specific use that doesn't apply to the rest of the contractor team. In several cases we also deploy a read-only desktop GIS viewer using ESRI ArcReader software that allows specific functionality not otherwise available. By allowing client access to the unlocked and editable data, we ensure transparency and integrity of data without limiting its use.

The web-based GIS map products we develop are generally accessible directly through a URL, or accessible via a link from a secure dashboard (e.g., built using Microsoft SharePoint technology). These dashboards also contain links to other reporting tools (tabular and graphical reports that consume data from the EDB) and document libraries (i.e., searchable and annotatable document directories that allow access to documents through a variety of search and sort tools or via hyperlinks from GIS and other tools). Geosyntec developed and implemented various user access sites (including web-based dashboards with links to our GIS web map products) and developed and maintained complete desktop non-locked full scale GIS map documents with associated geodatabases and shapefiles as illustrated below at Center Hill Dam (PD 1) as well as at Wolf Creek Dam (PD 2), Herbert Hoover Dike (PD 5) and currently in development at Bolivar Dam (PD 3).

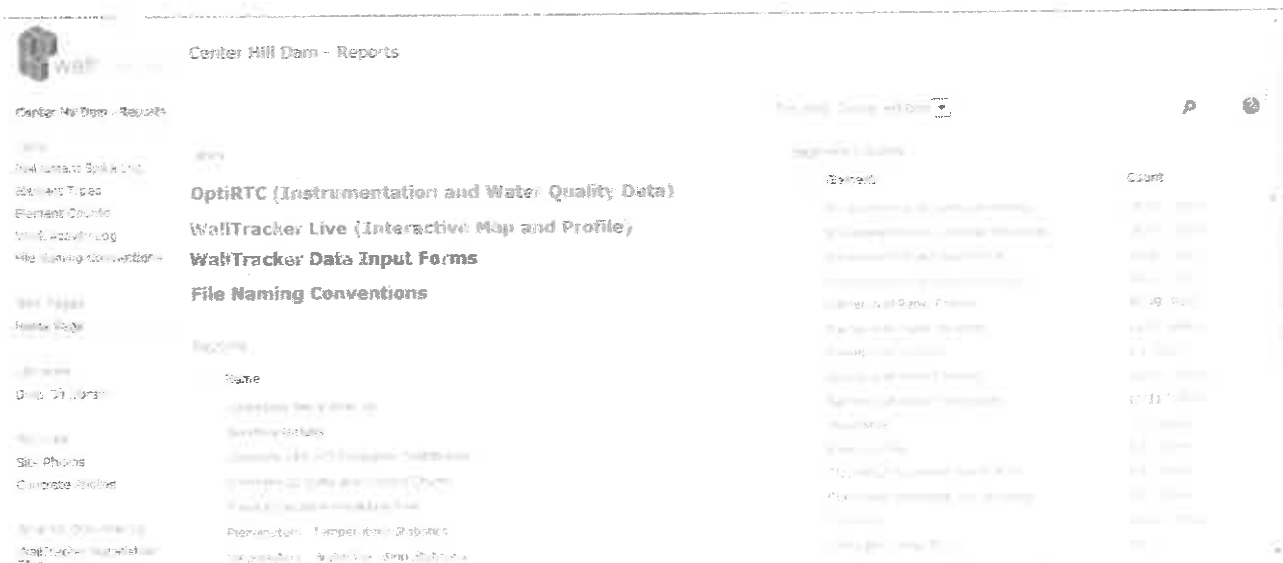


Figure 9. Secure Dashboard for USACE Access to Center Hill Dam GIS and Reports

viii. The development and implementation of automated methods, customized codes and routines in the ESRI ARC-GIS and Bentley Microstation platforms to update GIS models with future additions and modifications.

Automation is necessary for ensuring timely access to data. The reproducibility and in-line documentation facilitated by automation also makes it critical toward ensuring the quality and defensibility of data. Updates to a GIS model include assigning new or edited attributes to existing features, and generating new features. These methods are generally accomplished through geoprocessing, either with ESRI (ArcGIS) or open source geoprocessing tools combined in a model or script, or with functions, procedures and queries in a EDB that make use of spatial data types (see Figure 9 on page 40).

For example, the Bolivar Dam (PD 3) IMS makes use of nightly procedures that:

1. automatically download Koden data files (that contain measurements of excavation size by depth) from a sFTP site;
2. import the data to the EDB;
3. convert depths to elevations correcting for starting points;
4. average data over a certain vertical interval around several "reporting depths";
5. generate polygon spatial features representing the average excavation shape and size at each reporting depth through a series of geometric functions;
6. generate line spatial features representing compliance distances and other values;
7. serve those data and spatial features to a reporting tool for access on the website;
8. serve those spatial features to a GIS web service for direct access via the web GIS viewer;
9. export the GIS web service to geodatabase feature classes for offline use; and
10. upload the updated geodatabase to a sFTP site for USACE and contractor access.

CAD automation, including scripting within Bentley Microstation, is frequently used to both automate and create consistency in CAD drawing production. For example, we use Microstation scripts to position and annotate grout data in profile view sections that also include design drawing CAD data.

In all of these cases, we share these tools with USACE or other applicable users.

ix. The demonstration of an understanding of government firewall and security restriction as related to software, database systems, file transfers and system access with example projects.

Geosyntec has worked extensively with staff in the USACE Nashville and Huntington districts and ACE-IT (USACE's information management contractor) to design and implement systems that comply with USACE's firewall and security restrictions. In collaboration with the Districts we have successfully submitted Firewall Action Request (FAR) forms that were approved, allowing USACE staff to connect directly to Geosyntec's SQL Server EDB. Additionally we have written instruction manuals and developed scripts that allow USACE to securely access files on Geosyntec-managed Secure File Transfer Protocol (sFTP) sites.

x. The demonstration of knowledge and capability of cost and quality control, and compliance with performance schedules for projects in similar scope and size.

Project cost and schedule control begins during task assignment planning and Level-of-Effort preparation and negotiation. During the initial project stages, Geosyntec clearly defines scopes, assumptions, costs, and schedules. Budgets and schedule timelines (with milestones and a critical path) serve as a baseline against which Geosyntec and USACE

Herbert Hoover Dike (PD 5) Resident Office
Resident Engineer C. S. Anderson, III, PE stated
"*Contractor commissioned software called "WallTracker" as a means to create a 3-dimensional electronic model of the cut off wall and the known geologic substrata developed from the SPT test results. This state of the art computer model can also be used to reference all current verification test boring photographic and test data when cued from a specific verification boring location indicated on the electronic model. The "WallTracker" software was used exclusively on this task order at no increased cost to the Government.*" Bauer's DD form 2626 Performance Evaluation by USACE Jacksonville District

personnel can measure cost and schedule performance. If conditions change, Geosyntec adjusts work scopes, budgets, and/or schedules through the change order process.

Geosyntec uses an established Work Breakdown Structure (WBS) management method to track cost and schedule performance. After a technical scope is approved, Geosyntec's Task Manager divides the work into manageable components, or subtasks, and develops the project's WBS. Each subtask is then assigned a baseline budget and schedule, which is integrated into Geosyntec's tracking systems (described below). Geosyntec only modifies baseline budgets and schedules with client approval following a change in scope or other conditions. Geosyntec Task Managers assume day-to-day responsibility for project controls.

Schedules

Geosyntec routinely performs work under strenuous schedules and requirements. Geosyntec has a strong track record of consistently meeting deadlines, which is due to our heavily experienced project managers as well as through the utilization of a multi-office management approach. By combining resources from multiple offices we can best serve our clients with the best people for the job in a timely manner. Our collective expertise enables us to make the best decisions quickly. Geosyntec also ensures we have constant close communication with the appropriate regulators and/or stakeholders to create a strong relationship and facilitate progress.

USACE Chief Karen Pitchford stated "[Geosyntec] MMI was very responsive and their actions prevented COE schedule impacts." – CPARS Rating for Portugues Dam (PD 10) work

Quality Control

Geosyntec's QA/QC program provides the framework for infusing quality throughout all aspects of operations. Our QA/QC process is structured to optimize performance by integrating best practices in project delivery. Our business practices follow ISO-9000 guidance and key government requirements, and have been used to obtain the highest levels of customer satisfaction.

Our Corporate QA/QC Program, as defined in our Quality Management Plan (QMP), consists of plans, procedures, and an organization to execute work that complies with the governing regulations and contract requirements. It provides the process for management review and oversight at the planning, implementation, and execution stages of each Task Order, and addresses the full project life cycle. Our QMP outlines business processes and is supplemented by additional documents, such as our Project Management Manual, Procurement Procedures Manual, Chemical Data QA/QC Manual, and Health & Safety Program Manual. Project procedures and plans (i.e., Work Plan, CQC Plan, SAP, QAPP, APP/SSHP) outline our approach for addressing requirements from our clients and stakeholders.

Examples of Cost Control, Quality of Work, and Compliance with Performance Schedules	
Herbert Hoover Dike Rehabilitation, Reach 1, USACE Jacksonville District	
Cost Control	Quality of Work
As described in the final USACE Performance evaluation for Task No. 2 of this IDIQ Contract, Geosyntec's development of the WallTracker IMS provided near real time geospatial modeling of the seepage barrier wall during construction. The Government praised the "exclusive" use of WallTracker on this Task Order and further positively aided that its development and implementation was "at no increased cost" to the Government	Geosyntec was the original developer of the unique and widely recognized geospatial based "WallTracker" IMS for direct execution of multiple IDIQ Task Orders. The WallTracker IMS allowed the USACE to cross reference verification boring logs, CQC test data, verticality measurements and photographs and submit time sensitive as-built information with project milestone payment applications thereby streamlining Government review and approval.

Compliance with Performance Schedules	
Geosyntec's IMS allowed the Prime Contractor to comply with the Government's major project schedule milestones that required detailed review of extremely large CQC data backup.	
Flood Barrier Feasibility Study for TVA NPG Nuclear Sites, Multiple Locations	
Cost Control	Quality of Work
Geosyntec completed the initial scope of work on time and for a lump sum price. The client (TVA) was so impressed with the 3D visualization that they issued a scope modification to add recently obtained LIDAR data to the model for improved resolution.	TVA's Project Manager stated, "...the quality of work exceeds our expectations and will be used in executive level briefings."
Compliance with Performance Schedules	
Geosyntec commenced work within a day of receipt of the Notice to Proceed and was able to complete the assignments within the requested time-frame, meeting all project milestones.	

xi. Demonstrate the ability to digitally capture, digitally scan, digitize, transcribe historical project data into electronic formats including MS-Excel, MS-Access, ESRI Geodatabase and Microstation DGN files.

Compilation, transcription, and management of historical data are required on most Geosyntec projects. We have frequently mobilized staff to scan documents, review Optical Character Recognition results (where applicable), and transcribe historical data into MS Excel or MS Access forms (generally with on-board quality-control tools including field requirements, error trapping, drop-down menus, etc.) to build historical databases that can be used with modern tools. These activities generally require a spatial component wherein paper maps are scanned, GIS technicians georeference the maps to a known coordinate system, and trace objects (adding attributes where available) following predetermined standards of spatial accuracy, topology rules and more. CAD files (including Microstation DGN files) are generally (but not always) scaled but spatially referenced, so require the creation of world files that store the scaling, rotation, and translation data required to accurately position them in known coordinate systems.

Metadata is of paramount importance when compiling historical data, and Geosyntec applies standards that require every historical data record to be documented in metadata (including metadata fields in tables (e.g., data source, date transcribed, etc.), metadata tables (source and assumption lists), and formal GIS metadata in a variety of standardized schemas. Historical data in our databases can be traced back to their original sources, and those sources are stored in the geospatial databases where possible.

B. PROFESSIONAL QUALIFICATIONS

i. Engineering and technical staff familiar with components of high dam structures, foundations, construction, and performance monitoring technologies (including automated and manual instrumentation systems and visual inspection).

Geosyntec hand selected the project team for this SF 330 response because of their exceptional technical capability and superior past performance on numerous recent projects, including those for the USACE, which clearly demonstrate the firm's leadership in geospatial database management system development and implementation. The resumes (Section E) of our project professionals and corresponding project descriptions (Section F) represent the significant depth of our technical resources and equally significant contributions these individuals have made to USACE high dam structures and DSAC rated dams such as, Wolf Creek Dam, the Herbert Hoover Dike, Bolivar Dam and Center Hill Dam. Personnel selected for our project team are described in more detail below.

Program Manager J. Gregory Menniti P.E., P.S., - Mr. Menniti has lived and worked within the Huntington District for more than two decades and is a registered professional engineer with over 30 years of experience in water, wastewater, and environmental facility design. As the principal in charge of Geosyntec's Huntington, West Virginia office, Mr. Menniti has the authority and expertise to serve as our **primary point-of-contact for this project.** Mr. Menniti's local presence along with his exceptional technical staff provides Geosyntec with the ability to immediately respond to the District's needs and provides the USACE unparalleled accessibility to our team. Mr. Menniti has prior USACE project management experience and is capable of immediately addressing contract administration or other technical and managerial issues to assure the USACE's needs are met at all times during the contract performance period.

Project Manager Jamey Rosen, P. Geo., - Mr. Rosen is the Geosyntec data management practice leader and "wrote the book" on geospatial database management for large scale USACE Dam remediation. Jamey was responsible for the design and management of the original "WallTracker" information management system for the Jacksonville District Herbert Hoover Dike rehabilitation in 2008. Following this successful implementation Jamey and his team were responsible for developing the "Wolf Creek Information Management System" for the USACE Nashville District, for which the District won a 2013 USACE Innovation Award. Jamey has since gone on to successfully develop several other geospatial data management programs and is the Data Manager of Record for USACE construction projects currently underway at the Center Hill and Bolivar Dams. He regularly publishes and presents research on the subject of construction data management. Mr. Rosen has 18 years of experience as a data management specialist in the earth sciences and infrastructure industries, with a focus on data workflow and database design and management, geotechnical instrumentation, and Geographical Information Systems.

Quality Control Manager Dan Schauer P.G., - Dan received his Bachelor of Science Degree in Geology from the University of Florida in 1984 and is a registered Professional Geologist in Florida, Tennessee and Texas. Over his 28 year career with Geosyntec Dan has become **widely regarded for his expertise in construction quality control (CQC)** for large scale civil projects. As a Principal, Branch Manager and National Manager of Geosyntec's Construction Services (CS) Practice, Mr. Schauer was responsible for the conceptual development and successful implementation of the first large scale seepage barrier wall construction IMS known as "WallTracker" for the USACE Jacksonville District's Herbert Hoover Dike rehabilitation. Dan was also responsible for overseeing the CQCSM activities for more than 10 miles of successful barrier wall construction activity and the oversight of routine inspection of more than two dozen dams.

Engineering Lead Robert (Bob) Bachus, Ph. D., P.E., - Bob Bachus is a Principal with Geosyntec Consultants and works from the firm's office in Kennesaw, Georgia. Bob has more than 30 years of engineering analysis and design experience, focusing on a wide range of geotechnical and geoenvironmental engineering problems. Dr. Bachus holds a MSCE in geotechnical engineering from the University of Illinois at Chicago and a Ph.D. in geotechnical engineering from Stanford University. Prior to joining Geosyntec some 24 years ago, he was on the geotechnical engineering faculty at the Georgia Institute of Technology for 11 years. He remains active in teaching and is currently an Adjunct Professor at Georgia Tech. Much of **Bob's recent work has been focused on dam rehabilitation and the geotechnical and construction data management related to large rehabilitation projects.** He often serves as guest lecturer on USACE sponsored training events and has played an active role in developing Geosyntec's expertise as the leader in Information Management Systems (IMSs).

ii. GIS System design personnel must have a minimum of five years successful experience with projects similar in nature using ESRI Geodatabase platform.

Geosyntec has a network of GIS personnel with between 5 and 18 years of experience in infrastructure and construction GIS using the ESRI platform (and other GIS software tools). Our more senior personnel, including Jamey Rosen, Raphael Siebenmann, Robert Roff, Thomas Amstadt, Bryan Heald, and Bradley Janke (described in Section E, above) began using GIS at the ESRI ArcView version 2 or 3 level, and have used almost all the **ESRI software versions and extensions** through to the current ArcGIS Desktop and Server 10.3 level. Our construction projects have used both **personal and file geodatabases** built using ESRI geoprocessing tools and using the ESRI ArcSDE (spatial database engine) tools on Microsoft SQL Server. We have several staff who specialize in integrating geospatial data types in enterprise databases. For example, the verticality, continuity and overlap geometry of the panels at Bolivar Dam are all calculated using the GEOMETRY SQL Server data types (allowing instantaneous and transparent geoprocessing), and used as a direct data source for ArcGIS web map services as well as exported to file geodatabases in a routine automated process for use offline by USACE.

iii. CADD Technician, GIS Technician, Survey Technicians, or other professional staff with a minimum of five years successful experience in converting terrestrial LiDAR survey data into 3D models in CADD or a GIS environment.

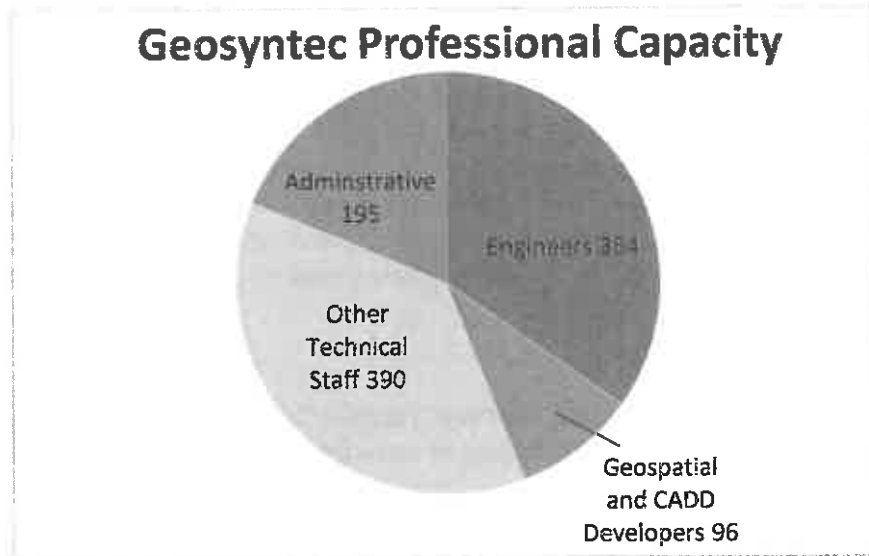
Geosyntec uses LiDAR data in a variety of applications, including 3D model construction and visualization. We have several LiDAR experts with both CAD and GIS experience who regularly review, reduce, and **import LiDAR data into geodatabases** and GIS and/or CAD models for further analysis and visualization. These experts include Bradley Janke (14 years' experience) and Thomas Amstadt (11 years' experience) whose resumes are in Section E above. Furthermore, our project manager (Jamey Rosen), GIS lead (Robert Roff) and instrumentation lead (Raphael Siebenmann) as well as several of our GIS and CAD technicians have over 5 years of experience in LiDAR data import and use in 3D GIS or CAD models. Geosyntec provides a full range of civil, geotechnical, environmental, remediation, landfill gas, landfill, and process engineering design services that capture design elements in figures, as-built (record) drawings, design drawings, construction drawings, three dimensional plans and videos. Our dedicated CAD group is comprised of 20 professionals. We have strategically placed CADD personnel in regional offices for quick response and local geology knowledge.

C. CAPACITY

Geosyntec has over 1,000 personnel throughout the United States with a heavy concentration of offices and personnel in the Southeast region. Relevant to required services for this particular solicitation, Geosyntec has a total of 61 data management professionals (GIS, database, programming and CADD), 220 registered professional engineers, and 75 registered professional geologists. Our Program Manager and single point-of-contact, Greg Menniti of our Huntington office, and our Project Manager, Jamey Rosen, have proven program and project management experience on very complex projects. Additionally, Mark Kessinger of our Huntington office has vast experience in USACE's Project Management Business Process

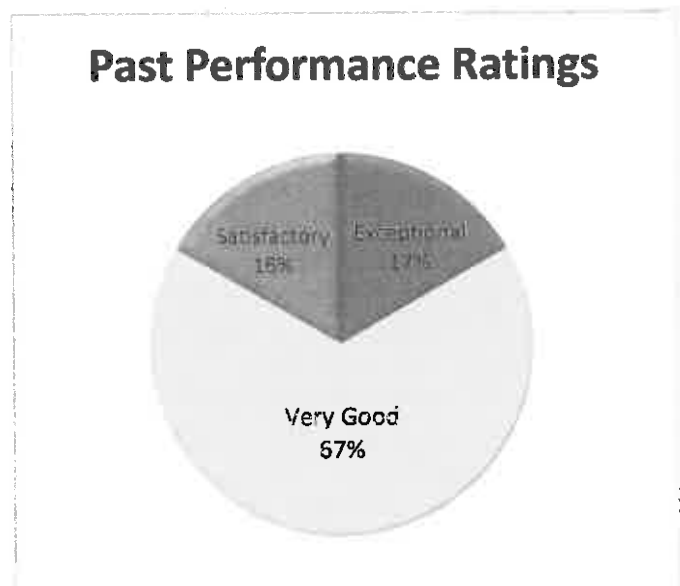
Geosyntec Personnel	
Registered Professional Engineers	220
Registered Professional Geologists	75
Structural Engineers	11
Data Management Professionals	96
Certified Industrial Hygienists	4

for monitoring and managing projects through their duration. For technical support, we will draw upon our staff in the Huntington Office and on our 185 employees within the 10 offices surrounding the Huntington District to assemble a strong, multi-disciplinary team to deliver quality products in a timely manner. The staff in these offices will be available to expedite work and for unexpected work or unforeseen schedule changes. Also, if necessary, we are committed to drawing upon the other 800 employees throughout our offices across the U.S. to meet the District's needs at Bluestone Dam.



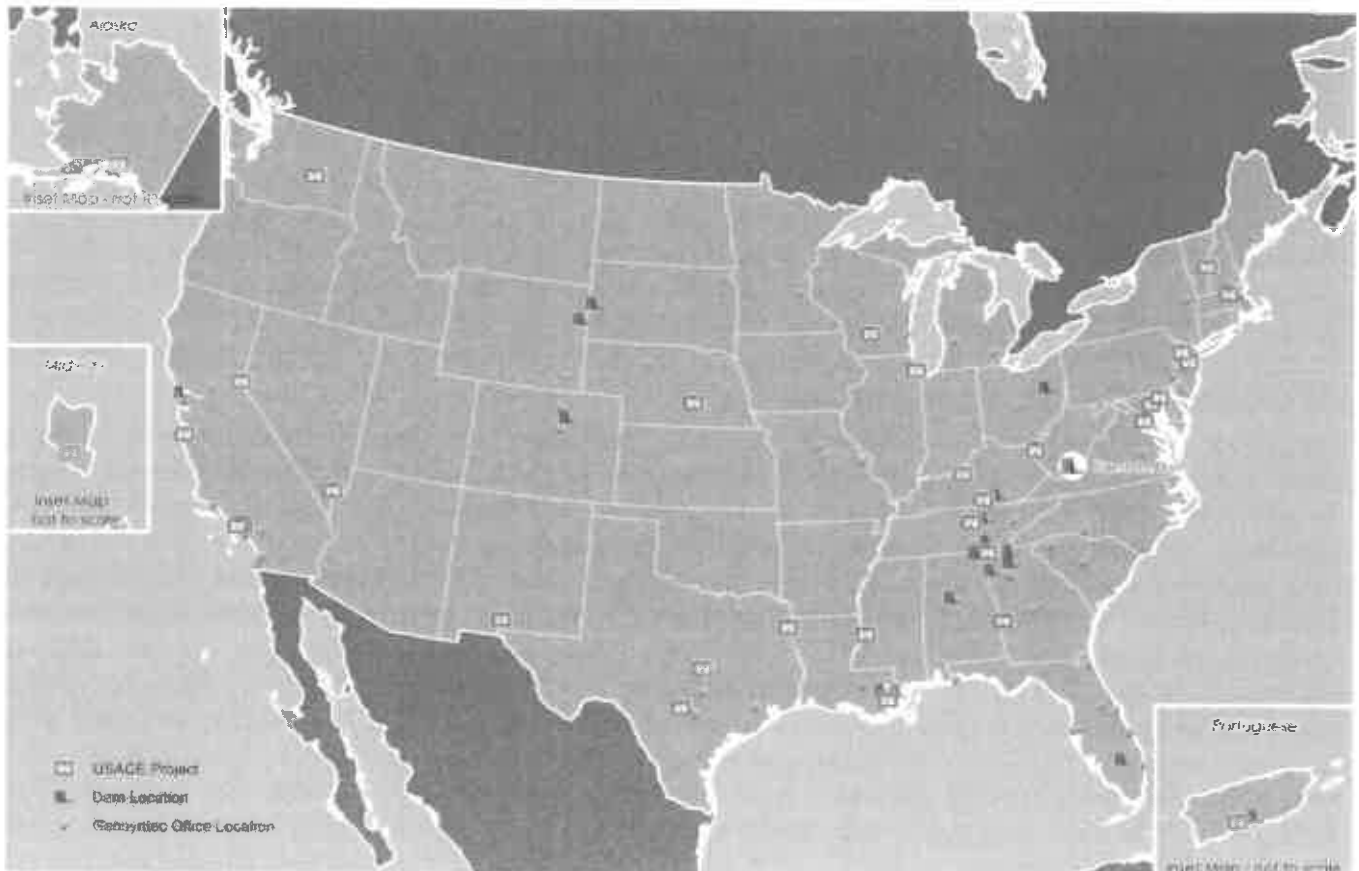
D. PAST PERFORMANCE

Geosyntec has the proven corporate and personnel management experience needed to successfully execute the overall business demands highlighted in this project. We have **provided data management expertise to USACE on 6 dam or levee rehabilitation projects** (Herbert Hoover Dike, Chickamauga Lock and Dam, Wolf Creek Dam, Center Hill Dam, Folsom Dam and Bolivar Dam), all of which included innovative Geospatial techniques. Herbert Hoover Dam was the first USACE project to use profile-view GIS to analyze barrier wall elements, and the Jacksonville district provided the project contractor (Bauer Foundations Corporation) with an "above average" rating on the as-builts, citing the data management system (WallTracker) as their reason for doing so. The Wolf Creek Dam Information Management System (WCIMS) has been praised by several USACE practitioners, including those in the Risk Management Center, especially given its **"significant application in allowing the RMC to approve the barrier wall in only 6 days following the end of construction"**. The Nashville District was notably awarded a **2013 USACE Innovation of the Year Award** for the WCIMS, and it continues to serve as a template for construction data management applications. Our data management applications have provided on-budget and on-schedule results, and we continue to receive high praise from our users for our degree of service and the ease of use of our tools.



Our dam safety and analysis experience extends beyond data management. Geosyntec performed the mass concrete thermal analysis for the Portugues Dam earning a very good ACASS rating. The work was for the thermal stress/strain analysis of the roller compacted concrete thick arch dam at the Portugues dam site. Geosyntec's analyses provided USACE analysis to make informed design decisions related to the initial placement temperature, location and width of contraction joints, delay time for flood pool storage, use of grouted or un-grouted joints and timing of contraction joint grouting for the grouted option. The analysis results also supplied insight into the interaction of phenomena that are necessarily omitted in the simplified analysis--such as the effects of solar radiation and ambient temperature variation on the long term thermal response of the dam.

We provide inspection, licensing, data management, instrumentation, analysis and design services for embankment dams, dikes, and other major earth structures on projects throughout the country. Geosyntec personnel have been actively involved in work at Wolf Creek Dam (Kentucky), Center Hill Dam (Tennessee), Bolivar Dam (Ohio), Folsom Dam (California), Herbert Hoover Dike (Florida), Fly Ash Dam 1 for AEP's Brilliant, Ohio power plant, Lake Petit Dam (Georgia), Walter Bouldin Dam (Alabama), Braidwood Nuclear Power Station (Illinois), Vermillion Power Plant (Illinois), Martins Landing Dam (Georgia), and others. In addition, we have worked on several water supply reservoirs and flood control levees in Florida, Illinois, Indiana, Georgia, Alabama, Delaware, and California. As part of the firm's geoenvironmental engineering practice, we have designed and constructed large stormwater detention basins, over 50 feet high, for projects in Georgia, New York, Virginia, Ohio, and California.



Bluestone Dam, and Army bases and dams where Geosyntec has performed or is currently performing engineering services.

E. SUPERVISION AND ADMINISTRATION

Geosyntec's proposed **Program Manager**, J. Gregory Menniti, P.E., P.S., will manage the program from our Huntington, WV office. This allows the USACE to utilize Geosyntec's Huntington office as a meeting hub for video conferencing with other Geosyntec offices for status and review meetings, minimizing travel and other associated expenses. Personnel from other offices will be assigned tasks as required and as described in the organization chart included in **Section D**. Mr. Menniti will directly oversee all work performed under this contract and serve as the USACE's primary point of contact. He will coordinate with Geosyntec's project managers on staffing, reporting, technical, and project control matters and will review and approve major project deliverables. In addition, to these responsibilities, Mr. Menniti will provide leadership for the project, ensuring that USACE's project management, quality control, and performance objectives are achieved.

Mr. Menniti will be assisted locally by Mark D. Kessinger, PMP. Mr. Kessinger has over 30 years of experience in managing a wide-range of complex projects for the U.S. Army Corps of Engineers, the U.S. Department of Energy and NASA. As a former **Senior Project Manager for USACE**, he is familiar with the design, construction and monitoring of large dams, and with the requirements of USACE's Project Management Business Process for managing projects from start to finish.

F. SMALL BUSINESS PARTICIPATION

Geosyntec is a large business that takes pride in providing work to small businesses on contracts when feasible. We have continued to build relationships with small businesses throughout the United States over the years. We have several subcontractors already in place to work with in achieving an 8% small businesses goal under this USACE contract. Our proposed subconsultant on this contract, **Cosmos Technologies, Inc.** has been carefully selected to deliver technical expertise which is tangible to all selection criteria for this contract.

The subcontracting goals for Small Businesses were developed in response to the types of services identified in the solicitation and our experience in completing the types of projects anticipated. The firm identified was invited to be a part of the Geosyntec team because their experience and expertise complements our talents such that we can provide government with a full service team. We realize additional firms may be added, and we will use active outreach methods to identify, mentor, and utilize the small business community in each project area

Geosyntec is committed to working with local small business firms and collaboration with emerging small business partners. Geosyntec utilizes an ongoing program of Small Business Outreach, vendor search tools, prequalification programs and partnering to facilitate and maximize small business utilization. Beginning with the SBA dynamic small business search tools, formerly CCR and Pronet and now through the SAMs system we are able to identify by NAICS code and practice area local small business firms. Additionally, participates in numerous national, regional and local small business conferences to identify and meet small business vendors and subcontractors to provide services. Geosyntec maintains a vendor database and tracks key performance indicators such as safety metrics and prequalifies small business providers to allow our Project staff readily available screened small business support. In addition to these standing outreach methods, Geosyntec initiated a proactive Mentor-Protégé program with 8A H&S environmental a Woman Owned Small Disadvantage Firm through a formal SBA program to provide an orchestrated three year cooperative effort to assist with the growth and development of H&S. Together we participate in management system training and implementation, accounting and contracting infrastructure and procedures establishment, and

collaborative business development, project management and project execution. Geosyntec and H&S are in a SBA approved mentor-protégé agreement.

Our aggressive outreach into communities to identify elite small business partners and cultivate enduring relationships with high quality, innovative and nimble firms nationwide allows us to provide local best value service to our clients while supporting our communities. Nationally we have formal teaming agreements in place with over 20 small disadvantaged firms, including Service Disabled Veteran owned firms, Women Owned, and Alaskan and Tribally owned firms each providing a market differentiated superior service in their specialty that Geosyntec actively participates to foster and develop and provide access to a broader client base and build robust customer oriented capacity to deliver solutions to our clients.

Geosyntec prepares and implements numerous Small Business Subcontracting plans annually and is fully compliant with ISR and SSR reporting and consistently exceeds our subcontracting plan percentages through effective implementation of our small business outreach programs. Ms. Mylli Fryman will monitor, track, and prepare the ISR and SSR reports for Geosyntec.

Small Business Participation Plan

Geosyntec always seeks to target local small business firms for survey, analytical lab, and geotechnical services, as they often require specialized or local knowledge and resources. Firms utilized will be determined as Task Order, Scope of Work, and location dictate. Wherever possible, Geosyntec seeks to locate and utilize qualified Small Disadvantaged, HUBZone and SDVOSB concerns based on review of their competence, ability, experience and capacity to perform the work via CCR Dynamic Small Business Search, working with the District SADBU Officer, local PTAC / SB Offices and other trade and industry groups. The firm's Small Business Manager (SBM) performs and/or coordinates these activities to develop comprehensive listings of SB and SDB enterprises for potential teaming efforts. The firm's SBM then coordinates the potential teaming partner listings with Geosyntec's program and Project Managers who further research the SBs and SDBs through references, common acquaintances, and commercially available tools such as the Better Business Bureau to determine competence and capability. Findings on potential teaming partner's ability, competence, and experience are shared back by the Program Manager and Project Managers to the SBM who keeps a database of information to assist the firm in future searches for teaming partners.

Geosyntec is experienced in working with minority business enterprises (MBE), women business enterprises (WBE), and disadvantaged business enterprises (DBE) as well as small business enterprises (SBE).

1. Training - During project manager training, Geosyntec includes a training section on the importance of disadvantaged business requirements in contracts, partnering with small businesses and locating qualified small businesses.
2. Forums –Geosyntec participates in workshops, conferences and other events with various federal, state and local agencies to meet with area M/W/DBEs, building a relationship for future partnering opportunities.
3. Database – Geosyntec maintains databases that include a variety of disadvantaged businesses. When project managers or principals begin to formulate teams, they can search the database. In addition, we maintain links to various Internet search mechanisms for disadvantaged businesses. This includes the Small Business Administration client-server based system: Pro-NET.

Geosyntec agrees to include the FAR clause 52.219-8, "Utilization of Small Business Concerns" in all subcontracts that offer further subcontracting opportunities, and will require all subcontractors (except small business concerns) that receive subcontracts in excess of \$650,000 (\$1,500,000 for construction) to adopt a plan that complies with the requirements of the clause at FAR 52.219-9, Small Business

Subcontracting Plan. Our Small Business Program Administrator works diligently with our procurement and project management staff to maximize opportunity and outreach to small business providers.

The Program Administrator Mylli Fryman's general overall responsibility for the Contractor's subcontracting program, i.e., developing, preparing, and executing individual subcontracting plans and monitoring performance relative to this particular plan. Upon selection of Geosyntec for award Ms. Freeman will prepare and submit a compliant Small Business Subcontracting Plan providing Equitable Opportunity for Small Business Enterprises compliant with all aspects of FAR 52.219-9(d)(8) describing our efforts to ensure that small, HUBZone small, small disadvantaged, veteran owned, service-disabled veteran-owned, and women-owned small business concerns will have an equitable opportunity to compete for subcontracts. These duties may include, but are not limited to the following activities.

- A. Developing and promoting company/division policy statements that demonstrate the company's/division's support for awarding contracts and subcontracts to small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business concerns.
- B. Developing and maintaining bidders' lists of small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business concerns from all possible sources.
- C. Ensuring periodic rotation of potential subcontractors on bidders' lists.
- D. Assuring that small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business concerns are included on the bidders' list for every subcontract solicitation for products and services they are capable of providing.
- E. Ensuring that subcontract procurement "packages" are designed to permit the maximum possible participation of small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business concerns.
- F. Reviewing subcontract solicitations to remove statements, clauses, etc., which might tend to restrict or prohibit small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business participation.
- G. Ensuring that the subcontract bid proposal review board documents its reasons for not selecting any low bids submitted by small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business concerns.
- H. Overseeing the establishment and maintenance of contract and subcontract award records.
- I. Attending or arranging for the attendance of company counselors at Business Opportunity Workshops, Minority Business Enterprise Seminars, Trade Fairs, etc.
- J. Directly or indirectly counseling small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, and women-owned small business concerns on subcontracting opportunities and how to prepare bids to the company
- K. Providing notice to subcontractors concerning penalties for misrepresentations of business status as small, HUBZone small, small disadvantaged, veteran-owned, service-disabled veteran-owned, or women-owned small business for the purpose of obtaining a subcontract that is to be included as part or all of a goal contained in the contractor's subcontracting plan.
- L. Conducting or arranging training for purchasing personnel regarding the intent and impact of Public Law 95-907 on purchasing procedures.
- M. Developing and maintaining an incentive program for buyers whom support the subcontracting program.
- N. Monitoring the company's performance and making any adjustments necessary to achieve the subcontract plan goals.
- O. Preparing and submitting timely reports.
- P. Coordinating the company's activities during compliance reviews by Federal agencies.

Small Business Subcontracting Goals: Geosyntec is a Large Business Prime

- Total Proposed Acquisition: \$10M
- Total % to Large Business performance: 85%
- Total % to Small Business performance: 15%

Small Business Subcategory Participation

- Small Disadvantaged Business (SDB): 8%
- Woman Owned Small Business (WOSB): 5%
- Historically Underutilized Business Zone Small Business (HUBZ): 8%
- Service-Disabled Veteran-Owned Small Business (SDVOB): 2%

Geosyntec plans to subcontract services to COSMOS, a small disadvantaged and HUBZONE business. Additionally, Geosyntec will reach out to small disadvantaged, woman owned, HUBZone and Service Disabled Veteran Owned local companies to meet surge capacity with database support, CADD, and GIS and companies providing surveying, geotechnical drilling and testing, local supply and materials vendors as needed to the greatest extent practicable.

G. GEOGRAPHIC PROXIMITY

Geosyntec's Program Manager, Greg Menniti, is in our Huntington office located downtown 0.5 miles from the Huntington District office. Our Huntington office has 11 employees available to support the District and Geosyntec has a total of 10 offices with a staff of 185 within a 300 mile radius working as a team to perform the work necessary at Bluestone Dam. Geosyntec has a total of 1,010 personnel throughout the United States and Canada to provide additional support as needed.

I. AUTHORIZED REPRESENTATIVE The foregoing is a statement of facts.	
31. SIGNATURE	32. DATE 8 January 2015
33. NAME AND TITLE J. Gregory Menniti, P.E., P.S., Principal	