UNC GREENSBORO
Board *of* Trustees

Finance and Administration Committee
March 22, 2022

Action Item - Approval of Designer Selection

FAC – 1 Campus Chilled Water Infrastructure & Equipment Improvements

Background Information

This project will complete the main campus chilled water loop, allowing for better hydraulics and redundant pathways for delivering chilled water to campus and lowering operating and energy costs. Construction will be phased to limit the overall disruption to the highly visible and occupied portion of the central campus.

The University currently has buildings not tied to the campus chilled water loop. These buildings utilize remote chilled water systems, many of which are at or beyond their useful life. The project will connect a minimum of five (5) of these campus buildings to the chilled water loop to provide redundancy and overall energy savings.

This project will also replace an aging chiller and potentially add capacity to the plant. The new chiller and associated equipment will further enhance our chilled water production and transmission reliability for the next 20-25 years. All work will be fully integrated with the campus Building Automation Systems (BAS).

The request for qualifications and letters of interest for design services for this project was advertised on the University of North Carolina System website. Seven (7) firms submitted letters of interest; none were from Guilford County.

The Designer Pre-Selection Committee reviewed the letters of interest and invited three (3) firms to an interview on March 3, 2022, to present their qualifications. The Committee recommends the following firms in ranking order.

1. RMF Engineering, Inc.
2. Affiliated Engineers, Inc. (AEI)
3. CMTA

The firm, RMF Engineering, Inc., is recommended for the Designer for the following reasons:

1. RMF presented the most client-focused approach. They clearly described the specifics of a collaborative process around decision making, campus and building occupant engagement, and student safety that most resonated with the Committee.

2. Their presentation provided the most detail on mitigating risk and minimizing disruptions to existing conditions on campus.
3. They presented the most thorough quality control, documentation, and survey work approach. The Committee was interested in RMF's new perspective on our infrastructure and is optimistic that it may yield additional efficiencies and overall benefits to campus energy use.

Requested Action

Based on the above information, that the Board of Trustees of the University of North Carolina at Greensboro approves RMF Engineering, Inc. to provide design services for this project and, if agreeable terms cannot be met with the recommended firm, the Board authorizes the administration to negotiate terms with the other firms in ranking order.

Attachment (see below):

RMF Engineering, Inc. Letter of Interest

Robert J. Shea, Jr.
Vice Chancellor for Finance *and*
Administration

UNC GREENSBORO

CAMPUS CHILLED WATER INFRASTRUCTURE AND EQUIPMENT IMPROVEMENTS

JANUARY 27, 2022

RMF Engineering
Reliability. Efficiency. Integrity.

8081 Arco Corporate Drive, Suite 300
Raleigh, NC 27617

01 INFORMATION SHEET

THE UNIVERSITY of NORTH CAROLINA GREENSBORO

Information Sheet

Firm Name	RMF Engineering, Inc.

☐ HUB Certified

If HUB, Specify Type

☐ Female ☐ Disabled ☐ American Indian ☐ Asian-American ☐ Hispanic ☐ Black ☐ Socially & Economically Disadvantaged

Point of Contact	Greg Carnathan, PE, CEM, LEED AP	E-mail Address	greg.carnathan@rmf.com
Street Address	8081 Arco Corporate Drive, Suite 300		
City	Raleigh	State NC / Zip Code 27617 / County	Wake
Phone #	919.941.9876	Fax #	919.941.9957
Type of Firm (e.g. Architectural, Civil Engineering, Surveying, Etc)	MEP Engineering		

Consulting Firms

Architectural:		☐ Check If HUB	Mechanical:		☐ Check If HUB
Electrical:		☐ Check If HUB	Plumbing:		☐ Check If HUB
Structural:		☐ Check If HUB	Civil:		☐ Check If HUB
Landscape:		☐ Check If HUB	Interior Design:		☐ Check If HUB
Other (specify type):		☐ Check If HUB			
Other (specify type):		☐ Check If HUB			

02
LETTER OF INTEREST

RMF Engineering
Reliability. Efficiency. Integrity.

January 27, 2022

Bill Chatfield
UNC Greensboro Facilities Design and Construction
Gray Home Management House
105 Gray Drive
Greensboro, NC 27412

RE: Campus Chilled Water Infrastructure and Equipment Improvements

Mr. Chatfield and Members of the Selection Committee:

We are pleased to have the opportunity to submit one electronic copy of our qualifications for the Campus Chilled Water Infrastructure and Equipment Improvements contract. We are familiar with the UNC Greensboro campus and have enjoyed a twenty-year working relationship with the University. RMF has completed over thirty-seven projects for UNC Greensboro including more recent infrastructure engineering for steam distribution, chiller replacements and steam plant engineering.

The proposed team is dedicated to prime infrastructure projects and has successfully completed large scale campus chilled water generation and distribution designs for colleges and universities in the state of North Carolina and all over the southeastern United States. What sets RMF apart from our competition is the combination of technical excellence, document quality and project management coupled with a collaborative attitude.

We sincerely appreciate your consideration of RMF for this project and look forward to a continued successful relationship with UNC Greensoboro. If you should need any additional information, please contact me at 919.941.9876 or greg.carnathan@rmf.com.

Sincerely,

Greg Carnathan, PE, CEM, LEED AP
Principal in Charge / Director
RMF Engineering, Inc.

8081 Arco Corporate Drive, Suite 300 | **RALEIGH**, NC 27617
OFFICE 919.941.9876 WEB www.rmf.com

03
PROJECT TEAM ORGANIZATION CHART

Resumes provided are for our Key Personnel only. Additional support staff resumes can by provided upon request. RMF's full time staff is composed of over 70 licensed professional engineers and more than 125 engineering college graduates.

Adequate Staff and Proposed Design or Consultant Team and Their Relevant Project Experience

Our proposed team, led by Principal in Charge Greg Carnathan, PE, CEM, LEED AP and Project Manager Jonathan Eveleth, PE, CEM, LEED AP and based out of our Raleigh, North Carolina office is backed by nearly 300 employees in 11 offices. RMF is 100 percent employee owned with 23 actively working partners. Our team has adequate workload and support to carry out projects from this contract successfully.

CLH - Women-Owned Small Business
CLH design, p.a. (CLH) provides collaborative landscape architecture and civil engineering services throughout NC.

UNC GREENSBORO

RMF Engineering

PRINCIPAL IN CHARGE
GREG CARNATHAN, PE, CEM, LEED AP

MEP PROJECT MANAGER / LEAD MECHANICAL ENGINEER
JONATHAN EVELETH, PE, CEM, LEED AP

LEAD CIVIL ENGINEER
MATTHEW BOATWRIGHT, PE

LEAD ELECTRICAL ENGINEER
MARK DEMANA, PE

STRUCTURAL ENGINEER
JIM RICHES, PE

CLH DESIGN

LANDSCAPE DESIGN
HEATHER RHYMES

ADDITIONAL NORTH CAROLINA SUPPORT STAFF

MIKE MCCLENATHAN, PE
CHRIS SKILLESTAD, PE
CHASE DAVIS, PE, CEM
GREGORY RILEY, PE
MARK BERTAGNA, PE
MIKE WILKINS, PE
KIRSTIE NUGENT, PE
DANIEL MCKNIGHT
ELIJAH LOWDER
DANIEL CRAIG
TANNER COMPTON
VITALIS OKAFOR
LUKE MCCARN
ROBERT CURRY
THOMAS GOREVESKI
FRANKIE THOMPSON
GABRIELLE TOPALIN
GREGORY JOHNSON

RMF ENGINEERING | PROJECT TEAM

GREG CARNATHAN, PE, CEM, LEED AP

PRINCIPAL IN CHARGE

Mr. Carnathan is a mechanical engineer with extensive experience planning, analyzing and designing thermal infrastructure systems. Specific knowledge areas include steam, hot water and chilled water systems in direct buried, trenched or tunnel installations. His responsibilities regularly include quality control, project management, strategic planning, energy modeling, economic analysis, multi-discipline coordination, pipe and material system selection, stress and deflection analysis, condensate management, operational safety,

» YEARS EXPERIENCE

With Current Firm: 21

Total: 23

» REGISTRATIONS

Professional Engineer, NC # 028322

LEED Accredited Professional

Certified Energy Manager

» EDUCATION

BS, Mechanical Engineering / 1998
Messiah College

RELEVANT PROJECT EXPERIENCE

Steam Distribution System Replacement
UNC Greensboro

Health and Human Performance Facility Chiller Replacement
UNC Greensboro

Centennial Campus Thermal Utilities Infrastructure
North Carolina State University

Thermal Utilities to Partners II and Toxicology
North Carolina State University

Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings
East Carolina University

Medium Voltage Power Distribution Grid Modernization
North Carolina State University

Centennial Campus Chilled Water Thermal Energy Storage Tank
North Carolina State University

North Chiller Plant Transformation
Wake Forest University

Holland Plant Chilled Water System Modernization and Expansion
Georgia Institute of Technology

District Energy Plant 2 - Expansion Phase I
University of Georgia

Wagoner Chiller Plant Transformation
UNC Wilmington

Brooks Hall Chiller Replacement
University of Georgia

RMF ENGINEERING | PROJECT TEAM

JONATHAN EVELETH, PE, CEM, LEED AP

MEP PROJECT MANAGER / LEAD MECHANICAL ENGINEER

Mr. Eveleth is a mechanical engineer who specializes in the analysis, design, and construction of building and infrastructure systems serving educational, industrial, healthcare, and commercial facilities. He is most knowledgeable in the areas of campus utilities (steam, chilled water). His background as a design-build contractor gives him a unique perspective on the need for high quality documents with a focus on constructability.

» YEARS EXPERIENCE

With Current Firm: 7

Total: 14

» REGISTRATIONS

Professional Engineer, NC # 041582

Certified Energy Manager

LEED Accredited Professional

» EDUCATION

BS, Mechanical Engineering / 2007
Georgia Institute of Technology

RELEVANT PROJECT EXPERIENCE

Health and Human Performance Facility Chiller Replacement
UNC Greensboro

Centennial Campus Thermal Utilities Infrastructure
North Carolina State University

Thermal Utilities to Partners II and Toxicology
North Carolina State University

Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings
East Carolina University

Centennial Campus Chilled Water Thermal Energy Storage Tank
North Carolina State University

North Chiller Plant Transformation
Wake Forest University

Holland Plant Chilled Water System Modernization and Expansion
Georgia Institute of Technology

District Energy Plant 2 - Expansion Phase I
University of Georgia

Griffin Chilled Hot Water Analysis
University of Georgia

Wagoner Chiller Plant Transformation
UNC Wilmington

College of Education Chilled Water Study
Georgia Southern University

North Decatur Chiller Replacement
Emory University

RMF ENGINEERING | PROJECT TEAM

MATTHEW BOATWRIGHT, PE

LEAD CIVIL ENGINEER

Mr. Boatwright is a civil engineer with experience in the design of civil utilities and solid knowledge of steam and chilled water distribution systems. His design experience is focused primarily on complex utility installations in congested sites. He also has experience with general site planning, design and permitting involving storm drainage analysis, stream buffer intrusions, site grading and hardscape restorations.

» YEARS EXPERIENCE

With Current Firm: 10

Total: 11

» REGISTRATIONS

Professional Engineer, NC # 041981

» EDUCATION

BS, Civil Engineering / 2011
North Carolina State University

RELEVANT PROJECT EXPERIENCE

Steam Distribution System Replacement
UNC Greensboro

Centennial Campus Thermal Utilities Infrastructure
North Carolina State University

Thermal Utilities to Partners II and Toxicology
North Carolina State University

Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings
East Carolina University

Medium Voltage Power Distribution Grid Modernization
North Carolina State University

Centennial Campus Chilled Water Thermal Energy Storage Tank
North Carolina State University

North Chiller Plant Transformation
Wake Forest University

Holland Plant Chilled Water System Modernization and Expansion
Georgia Institute of Technology

Chilled Water Distributions Extensions
University of Georgia

North Energy Plant Expansion and Chilled Water Loop Extension
University of South Carolina

Duke West Chilled Water
Duke University

Chilled Hot Water Distributions
Winston-Salem State University

RMF ENGINEERING | PROJECT TEAM

MARK DEMANA, PE

LEAD ELECTRICAL ENGINEER

Mr. Demana is an electrical engineer with over 36 years of experience in electrical design and project management. Coming from a diverse background, Mr. Demana spent the first 15 years of his career as a plant manager for large companies such as General Electric and Gould, Inc. He has experience in the service, installation and operation of power distribution and transmission equipment. He has extensive experience in the design of power generation, distribution, utility infrastructure, lighting, controls, energy plants, voice/data systems and security systems.

» YEARS EXPERIENCE

With Current Firm: 11

Total: 36

» REGISTRATIONS

Professional Engineer, NC # 036625

» EDUCATION

BS, Mechanical Engineering / 2002
Ohio University

RELEVANT PROJECT EXPERIENCE

Steam Distribution System Replacement
UNC Greensboro

Health and Human Performance Facility Chiller Replacement
UNC Greensboro

Centennial Campus Thermal Utilities Infrastructure
North Carolina State University

Thermal Utilities to Partners II and Toxicology
North Carolina State University

Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings
East Carolina University

Medium Voltage Power Distribution Grid Modernization
North Carolina State University

Centennial Campus Chilled Water Thermal Energy Storage Tank
North Carolina State University

North Chiller Plant Transformation
Wake Forest University

Holland Plant Chilled Water System Modernization and Expansion
Georgia Institute of Technology

District Energy Plant 2 - Expansion Phase I
University of Georgia

Underground Steam Chilled Water Line to Blair Hall
Winston-Salem State University

North Decatur Chiller Replacement
Emory University

RMF ENGINEERING | PROJECT TEAM

JIM RICHES, PE
STRUCTURAL ENGINEER

Mr. Riches has extensive experience in performing structural and civil engineering for large infrastructure projects and buildings. He has designed steel framed buildings and reinforced concrete structures. These include utility tunnels, underground vaults and chiller and boiler plants with stacks, cranes, and hoists. Multi-discipline coordination is an essential aspect in all of his projects. Structural anchoring and support of various mechanical piping systems and equipment is a common detail in his designs. He has also performed site planning and utility design for underground piping systems and electrical ductbanks and vaults.

» YEARS EXPERIENCE

With Current Firm: 27

Total: 27

» REGISTRATIONS

Professional Engineer, NC # 039436

» EDUCATION

BS, Civil and Architectural Engineering / 1993
Drexel University

RELEVANT PROJECT EXPERIENCE

Steam Distribution System Replacement
UNC Greensboro

Centennial Campus Thermal Utilities Infrastructure
North Carolina State University

Centennial Campus Chilled Water Thermal Energy Storage Tank
North Carolina State University

Holland Plant Chilled Water System Modernization and Expansion
Georgia Institute of Technology

District Energy Plant 2 - Expansion Phase I
University of Georgia

Yarbrough Chilled Hot Water Plant Master Plan
North Carolina State University

New Central Chilled Water Plant
Winston-Salem State University

Science Hill Chilled Water Extension
Yale University

Central Ground Chilled Water Plant
University of Virginia

Ping Chilled Water Study
Ohio State University

South Chilled Water Plant Expansion
University of Virginia

Heather Rhymes

Landscape Designer

Heather's interests and strengths include ecologically-sensitive solutions, planting design, and human-centric spaces. She works on a variety of projects at CLH, including K-12, higher education, and municipal projects. Her background in functional ceramics enables her to thoughtfully combine artistry, craft, and practicality in her landscape work.

Education

Master of Landscape Architecture, NC State University, 2013

Bachelor of Arts,

8 years of professional experience

Advanced Career Center, New Construction, Moore County, NC (Design complete, on hold)

Alamance Community College, Advanced Applied Technology Center, Graham, NC (2017)

City of Greensboro, Hester Park Master Plan, Greensboro, NC (2017)

City of Greensboro, Hester Park, Phase I Design, Greensboro, NC (2020)

City of Lexington, Radcliffe Skate Park, Lexington, NC (2020)

City of Raleigh, River Bend Park Master Plan, Raleigh, NC (2016)

City of Raleigh, River Bend Park Phase I Design, Raleigh, NC (2021)

East Carolina University, Clement Residence Hall, Renovations (2018)

East Carolina University, Life Science and Biotechnology Building, Greenville, NC (2021)

Fuller Elementary, Replacement School, Raleigh, NC (2021 – In Construction)

Gateway Nature Preserve, Master Plan, Winston-Salem, NC (2017)

Granite Falls Middle School, New Construction, Granite Falls, NC (2019 – In Construction)

Hawbridge School, New Construction, Saxapahaw, NC (2020 – In Construction)

Hortons Creek Elementary School, New Construction, Cary, NC (2017)

Myrtle Grove Middle School, Renovations, Wilmington, NC (2018)

Neuse River Middle School, Replacement School, Raleigh, NC (2020)

New Hanover County, Health and Human Services Building, Wilmington, NC (2018)

NC State University, Howling Cow Creamery and Environmental Education Center, Raleigh, NC (2019)

NC State University College of Veterinary Medicine, Equine and Farm Animal Veterinary Center Study, Raleigh, NC (2015)

NC State University, Plant Sciences Building, New Construction, Raleigh, NC (2019 – In Construction)

NC State University, Memorial Belltower Restoration, Raleigh, NC (2021)

04
RELEVANT EXPERIENCE & OTHER IMPORTANT FACTORS

FIRM OVERVIEW

Founded in 1983, RMF Engineering (RMF) has been on the forefront of complex Mechanical, Electrical and Plumbing engineering solutions since before terms like efficiency, sustainability, LEED and green requirements were common nomenclature. In our 38 year history, we have become nationally recognized for our quality analysis, planning, design, and commissioning of buildings, as well as campus utility generation and distribution systems.

With over 280 staff in 11 offices, RMF is a client-focused practice routinely ranked as one of the top MEP firms in the country. We are proud of our prompt responsiveness, industry-leading tech savvy and project teams who have extensive history of working together as specialized units. As a result, you can expect to receive the highest quality contract documents, the most intelligent engineering solutions and a team that is known for seeing every project through to completion.

Full Service Engineering

We provide our clients a full range of engineering services to provide maximum energy efficiency and sustainability across their entire operational portfolio. Starting with Energy Master Planning all the way through to Commissioning, our focus is to provide technical expertise and a high level of service that leads to long-lasting relationships.

2021
CSE
MEP GIANTS

RMF ranked 29th out of 100 in CSE's MEP Giants

2021
BD+C
TOP 75

RMF ranked 23rd in BD+C'S Top Engineering Firms

2021
EC&M
TOP 40

RMF ranked 24th out of 40 in EC&M's Electrical Design Firms

OUR FULL RANGE OF SERVICES INCLUDE:

- MECHANICAL ENGINEERING
- ELECTRICAL ENGINEERING
- CIVIL / STRUCTURAL ENGINEERING
- THERMAL UTILITY INFRASTRUCTURE
- COMMISSIONING
- CONTROLS ENGINEERING
- SUSTAINABLE DESIGN
- MASTER PLANNING
- CONSTRUCTION QUALITY MANAGEMENT
- ENERGY ASSESSMENT

280+ EMPLOYEES

11 OFFICES

38 YEAR HISTORY

25+

COMPLETED **CHILLER PLANTS**

OVER THE PAST **5 YEARS**

4.1 - Specialized or Appropriate Expertise in the Type of Project

CHILLED WATER EXPERIENCE

RMF has provided the survey, analysis, planning, design and start-up of chilled water systems including chillers, cooling towers, pumping systems, thermal storage, piping, valving and controls at many facilities. RMF has provided these expertise for 125 major chilled water plants and distribution systems in the last 15 years, with over 90 of these projects occurring in the last five years.

The majority of the original chilled water systems investigated by RMF have had generation deficiencies; however, poor distribution is a major contributing factor to the lack of adequate terminal cooling. RMF utilizes two independent computer programs to hydraulically model chilled water pumping and distribution systems. This modeling is excellent for the analysis and design, and after the design it provides the user with an interactive tool for system operation and future planning efforts.

RMF approaches each chilled water plant as an independent and site-specific application. Concepts that are cost effective at one installation may not be applicable at another. Some concepts that have been effectively utilized include:

- Variable Speed Pumping
- Distributed Pumping
- Non-Electric Prime Movers (Steam Turbine, Gas Engine, Absorption)
- High Efficiency Machines (Low kW Per Ton)
- Free Cooling Utilizing Flat Plate Heat Exchanger Technology
- Control Optimization of Loading Parallel Machines
- Cooling Tower Optimization (WB Selection, Condenser gpm/ton, Fan & Fill Enhancements, VFD's, Pumping, Induced vs. Forced Draft, etc.)
- Interconnection of Multiple District Plants
- Automatic Condenser Cleaning Systems
- Water Treatment Programs
- Thermal Storage (Ice & Chilled Water)

CENTRAL PLANT EXPERIENCE

RMF's core business is focused on the development, rehabilitation and expansion of central utility plants (chilled water, steam, cogeneration, hot water and electric) for colleges, universities, hospitals and institutional campuses. In the past 5 years, RMF has designed significant heating plant upgrades in over 50 heating plants, including boiler upgrades at two Wright Patterson Air Force Base Plants, with capacities of 528 MMBTUH and 549 MMBTUH.

Recent campus chilled water renovation, expansion and new construction projects have been provided for nearly 60 campus systems with total plant capacities up to 60,000 tons.

RMF has provided utility distribution designs including steam, chilled water, domestic water, sewer and storm drain on over 50 campuses in the past five years ranging in size from a 2000 acre campus to a 20 acre campus.

UTILITY DISTRIBUTION CLIENTS

- **UNC Greensboro**
- UNC - Chapel Hill
- UNC Charlotte
- Appalachian State University
- Campbell University
- Duke University
- East Carolina University
- North Carolina State University
- Wake Forest University
- Winston Salem State University
- Yale University
- Connecticut College
- Cornell University
- Dartmouth College
- Emory University
- Georgia Gwinnett College
- Georgia Institute of Technology
- Harvard University
- Massachusetts Institute of Technology
- The Ohio State University
- The University of Connecticut
- University of Alabama at Birmingham
- University of Florida
- University of Georgia
- University of South Carolina
- University of Virginia
- Virginia Tech
- West Virginia University
- Winthrop University

UTILITY DISTRIBUTION EXPERIENCE

Many utility distribution systems have been evaluated, planned and designed by RMF. Computerized hydraulic models of hot water, steam, condensate, chilled water, domestic water, natural gas, sewer and storm water systems are routinely developed. This modeling approach can be used to determine optimum system configurations (loops, radials, etc.) as well as pipe size. A major design issue in utility distribution systems is the configuration of the piping whether to direct bury, install trenches, construct tunnels or install above ground. The firm has developed detailed economic modeling of these various installation techniques to determine the most cost effective site-specific application. RMF has designed new and rehabilitated systems for all types.

RMF has performed condition assessments of the distribution lines for mechanical, electrical and civil utilities. The condition assessments determine deficiencies inclusive of leaks, physical deterioration, prioritization of repair work including immediate notification when serious problems are found and remaining useful life. Assessments include a review of existing documentation and reports, interviews with facility personnel, and field surveys using nondestructive and destructive testing.

STRUCTURAL ENGINEERING EXPERIENCE

RMF specializes in providing customized structural engineering designs for the unique requirements of large educational campuses. RMF's wide range of structural engineering design experience includes new buildings, retrofits, renovations, and structural upgrades. Also included are numerous examples of specialty structural design for utility distribution tunnels, access vaults, transmission duct banks and support requirements for industrial and central power plants. Services encompass designs that range from standard steel frame structures to concrete structures to complicated blast proof manufacturing facilities. RMF's approach to design services includes the coordinated delivery of multi discipline engineering services followed by our experienced construction administration division to assure the project is seamless from beginning to completion.

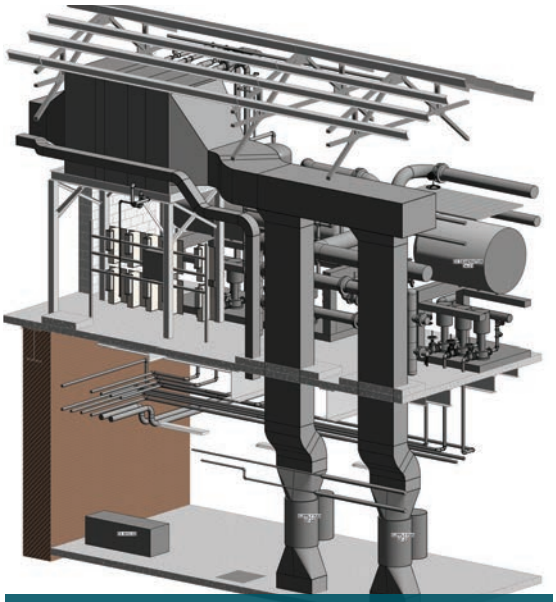
Structural engineering services typically provided to our clients include:

- Retaining Walls
- Building Additions
- Foundation Analysis
- Steel Frame Structures
- Concrete Frame Structures
- Commercial / Institutional Design and Analysis
- Heavy Industrial Building Design
- Pile Supported Foundation
- Cranes
- Underground Utility Trenches and Tunnels

ELECTRICAL ENGINEERING EXPERIENCE

RMF's core business is focused on the development, rehabilitation and expansion of central utility plants (chilled water, steam and electric) for colleges, universities, hospitals, and institutional campuses. RMF's in-house electrical expertise includes planning, designing and supervising construction of the following:

- Medium Voltage Switchgear
- Emergency Generators
- Ductbanks
- Medium Voltage Underground Distribution
- Overhead Distribution
- Cogeneration
- Uninterruptible Power Supplies (UPS)
- Telecommunications
- Central Automation (Power Management and Control Systems)
- High Efficiency Indoor and Outdoor Lighting
- Power Factor Correction
- Arc Flash, Short Circuit and Coordination Studies
- Load Flow and Peak Shaving Studies



East Campus Steam Plant
Duke University

3D MODELING EXPERIENCE

RMF has experience using 3D modeling software since 1995 including Bentley Triforma, AutoCAD MEP and Revit MEP. RMF has been using AutoCAD Civil3D software built for BIM as a tool for design, analysis and simulation of its pipe network (steam, chilled water, storm drain, sanitary sewer, water, gas, electrical/telecom ductbank, etc.) to facilitate project performance. RMF's recent experience with Civil 3D Modeling includes:

- Steam Distribution System, Appalachian State University
- CC Infrastructure Medium Voltage Electrical Distribution, North Carolina State University
- Greek Village Medium Voltage Electrical Distribution & Site Lighting I-III, North Carolina State University
- CC Thermal Utilities & Infrastructure, North Carolina State University
- CC Biomedical Campus Chiller Plant Expansion, North Carolina State University
- CC Power, Steam and Chilled Water, North Carolina State University
- Yarbrough Chiller Plant Utilities, North Carolina State University
- Cates Chiller Plant Utilities, North Carolina State University
- Wolf Village Upperclassman Apartments Utilities, North Carolina State University
- Hunt Library Utilities, North Carolina State University
- Athletics Precinct Utility Infrastructure, Duke University
- Duke Hollows Utility Infrastructure, Duke University
- West Campus Steam Plant, Duke University
- Steam & Condensate Piping Design, Winston-Salem State University
- Northern Wake Campus Regional Plant Expansion, Wake Technical Community College

Duke University West Campus Steam Plant
Renewal & Conversion

CHILLED WATER PLANT CONTROLS

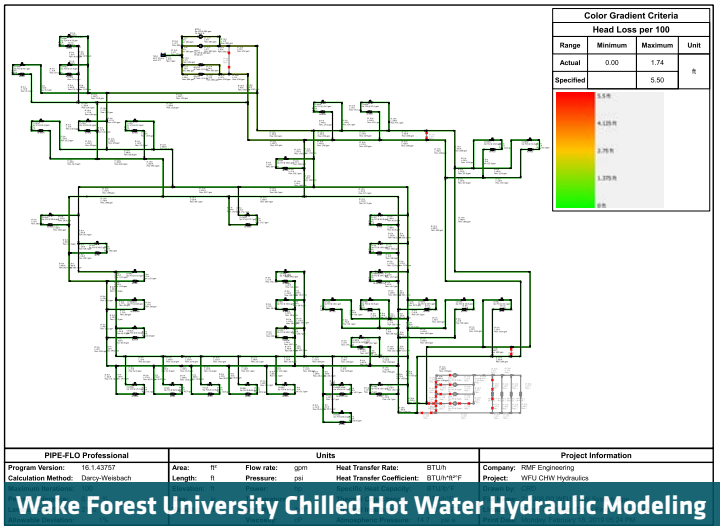
RMF's has designed and / or commissioned new and expanded industrial grade controls systems for energy plants for a variety of client, some of which include:

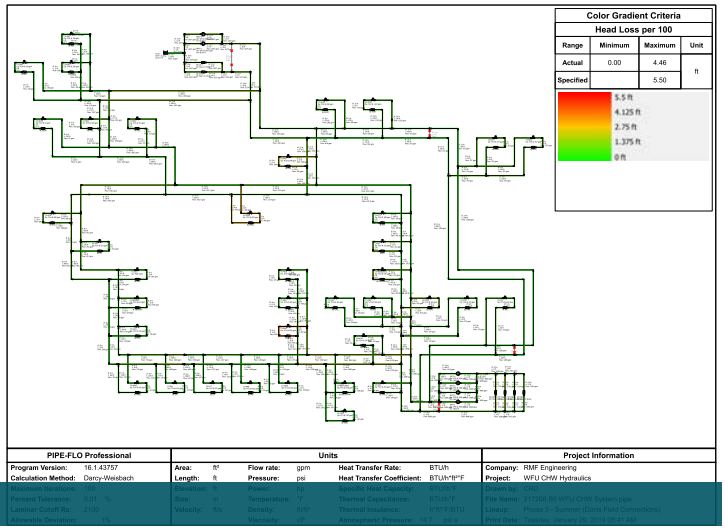
- UNC Chapel Hill Cogen Chiller Plant - Ovation DCS
- UNC Wilmington - Kiltech Chiller Control System operating on a Tridium Backbone
- NCSU Cates, Yarbrough, Centennial Plants - Honeywell HC900 PLCs
- Winston-Salem State University Chiller Plant - Siemens with Tridium Backbone
- University of Georgia Riverbend and Vet Med Loops - Delta Controls
- University of Georgia NW Chiller Plant - ALC Controls
- University of Connecticut - Allen Bradley PLC Based Controls with Intellution Front End and PI Historian. 12,000 tons - York/Allen Bradley Andover PLC Based - DCS
- George Mason University - Siemens DCS For Control And Monitoring Of 10 Chiller Systems (Including Thermal Ice Storage) and 5 High Temperature Hot Water Generator Systems.
- University of Maryland Baltimore County (UMBC) - Siemens DCS for Control and Monitoring of 5 Chiller Systems (Including 1.6 Million Gallon Thermal Storage Tank) and 4 High Temperature Hot Water Generator Systems.

HYDRAULIC MODELING

In order to determine if a heating or cooling distribution pumping and piping system is effectively and efficiently delivering the product, RMF will perform a hydraulic nodal analysis. RMF utilizes this model to simulate the campus piping network, determine the capacity of the existing system, and identify bottlenecks, excessive velocities, and risks. Models are then prepared to determine if a distribution and pumping system can support proposed load growth and different scenarios (Primary variable, etc.) can be applied. The performance of the system is modeled in several ways using different temperature differentials. RMF will perform the necessary hydraulic computer based simulations using Pipe-Flo or KYPipe to optimize the distribution piping.

Each pipe segment is evaluated based upon the flow velocity and pressure loss. The velocity limitation is based upon potential water hammer occurring within the distribution system. The specific pump curves are entered into the model to provide a more accurate energy analysis. The evaluation of the pressure loss within each pipe segment is based upon the required pump size and energy consumption. The modeling can determine if "over-pumping" conditions may be occurring, creating energy inefficiencies. Once a computer based hydraulic model is created, it can be manipulated in several ways to evaluate the effects of new flows associated with new or modified pumps or the extension of branch lines. Iterations of division valve closures can be simulated to determine the effects of outages. New interstitial loops can be modeled to simulate the benefits of improvements.





Wake Forest University Chilled Hot Water Hydraulic Modeling

4.2 - Past Performance

» **COMPLETION DATE**

2020

» **COST**

$1.5 Million

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

Bill Chatfield
336.334.5269
wjchatfi@uncg.edu

STEAM DISTRIBUTION SYSTEM REPLACEMENT

UNC GREENSBORO | GREENSBORO, NC

As part of a multi-phased replacement of deteriorating steam distribution in the heart of their campus, UNC Greensboro contracted RMF to provide design services to replace approximately 600 LF of eight-inch HPS and four-inch PC. Various distribution methodologies were investigated and presented to UNCG during early design planning (direct buried, shallow trench and walkable tunnel). Approximate budgets, schedules and long term comparisons were provided for each methodology, allowing UNCG and RMF to select the system best suited for the project.

In order to accommodate the University's desired system of shallow trench distribution, RMF developed a phased approach that would provide the necessary flexibility to accommodate the available budget and construction schedule. The two phase approach was coordinated with traffic and pedestrian control requirements, bus routes and available laydown space; working to split the project due to budget and schedule restrictions at an area that would also help minimize impact to campus operations. Pedestrian phasing and traffic control was of high importance as the alignment was located directly adjacent the Elliot University Center, under a busy walkway just south of the Kaplan Commons courtyard. The utility alignment was also laid out to utilize z-bends and loops to avoid utility conflicts and sensitive areas. These features allowed the team to avoid the use of mechanical expansion joints and associated ongoing maintenance.

Multiple temporary service options were investigated and provided for consideration, including temporary electrical hot water heaters, temporary above ground stream distribution, and temporary FO Boilers. UNCG and RMF worked together to implement the most cost effective temporary solution that still met minimum demand requirements by investigating each building's seasonal usage during the estimated construction window.

4.2 - Past Performance

» **COMPLETION DATE**

2017

» **COST**

$820,000

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

Johnny Waterson
910.334.5269
johnny_watterson@uncg.edu

HEALTH AND HUMAN PERFORMANCE FACILITY CHILLER REPLACEMENT

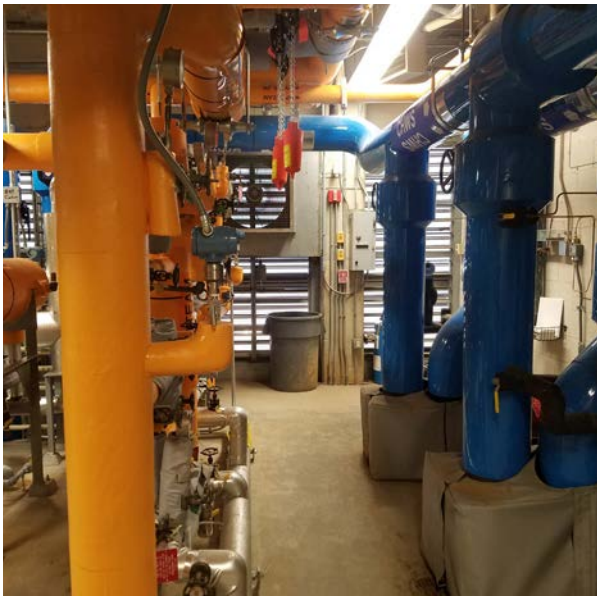
UNC GREENSBORO | GREENSBORO, NC

The Health and Human Performance facility, constructed in 1989, is the largest building on campus of UNC Greensboro. It contains classroom buildings along with two substantial gymnasiums. As the buildings stand-alone chiller plant reached the end of its reliable useful life, RMF was selected to engineer a new cooling solution to improve reliability, and efficiency for the facility.

RMF performed field work to develop an AutoDesk Revit MEP as-built model of the existing chilled water mechanical room and cooling tower areas. Next, load calculations, and energy models were developed based on current and planned building space programming requirements. Equipment selection followed based on life-cycle cost analysis.

Two new chillers were selected along with a new cooling tower, pumps, and modern plant control system. Variable speed centrifugal chillers were installed in 200-ton and 400-ton increments for ideal operation during a wide range of cooling loads. A new refrigerant monitoring system was also installed. Control sequences were modernized to take advantage of cold condenser water relief and new pump variable speed drives.

4.2 - Past Performance



» COMPLETION DATE

2018

» COST

$11 Million

» SERVICES PROVIDED

Mechanical
Electrical
Civil
Structural

» REFERENCE

Jake Terrell
919.513.7874
jmterrell@ncsu.edu

CENTENNIAL CAMPUS THERMAL UTILITIES INFRASTRUCTURE

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

With great reliability and efficiency benefits, the central campus chilled water and steam systems are growing rapidly on NCSU's Centennial Campus. RMF designed thermal utility connections for the College of Textiles Lab, Monteith Research Center, Constructed Facilities Lab and for completion of the main distribution loop.

The AutoDesk Civil 3D design includes more than 3,000 trench feet each of large bore high pressure steam, pumped condensate, high pressure condensate return and chilled water piping in direct-buried cut and cover trench. High pressure steam piping utilizes a class A system with aerogel insulation while chilled water is a fully restrained ductile-iron design. Additionally, mechanical rooms at each building connection are being re-configured using AutoDesk Revit 3D to improve access for maintenance and to allow reception of central utilities and metering.

Installation of the new thermal utility piping required the existing College of Textiles building transformer to be relocated. RMF met with NCSU and building occupants to understand their requirements for a power outage and a custom phasing plan was developed to minimize down time for these critical laboratory facilities. A combination of new ductbank and connecting into existing ductbank allowed for the transformer swap over to occur over a weekend outage.

Thoughtful design of construction phasing was incorporated in the documents to minimize down time for these critical laboratory facilities and to provide safe routing for student pedestrians.

» **COMPLETION DATE**

2021

» **COST**

$9.1 Million

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

David Hammock
919.515.2030
david_hammock@ncsu.edu

THERMAL UTILITIES TO PARTNERS II & TOXICOLOGY

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

Cost: $9.1 Million

The goal for this project was to connect Partners II and Toxicology buildings to the central utility plant (CUP). Underground utilities including chilled water (CHS+CHR) and steam (HPS,PC+HPC) were extended from the Central Utility Plant to the buildings. Additionally, building mechanical rooms were converted from stand-alone generating facilities to utility receiving buildings.

RMF provided 1,600 trench-feet of underground thermal distribution design for steam using a pre-engineered, Class A, piping system and a fully restrained mechanical join ductile-iron pipe for chilled water. The design also included Structural and Mechanical design for six new steam vaults; building mechanical room design for steam PRV stations, hot water heat exchangers, hot and chilled water pumps; suite of flow and energy monitoring systems for new building connections; and design phasing drawings, notes and specifications to maintain building services during the utility transitions.

Two critical research facilities on centennial campus with aged, inefficient and unreliable cooling and heating generation systems were connected to a modern, reliable and efficient energy plant. The central plant boasts chilled water thermal storage along with combined heat and power.

» **COMPLETION DATE**

2018

» **COST**

$2.25 Million

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

Robert Still
919.328.6776
bastill@ecuvm.cis.ecu.edu

REPLACE CHILLED WATER & HVAC - MCGENNIS, MESSICK & SPEIGHT BUILDINGS

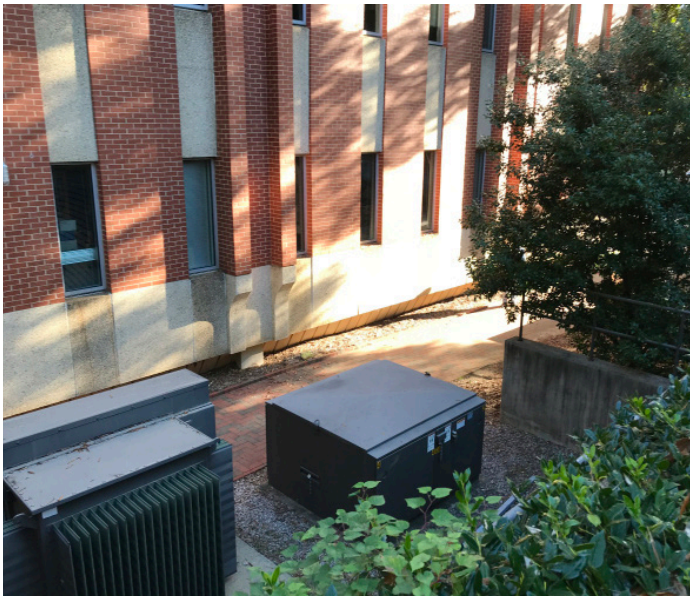
EAST CAROLINA UNIVERSITY | GREENVILLE, NC

This project's goal was to connect three buildings: Messick, McGinnis and Speight to the central campus chilled water loop and repair two AHU's in Messick.

RMF's scope of work included underground chilled water distribution and short segments of underground steam and storm water. Mechanical room modifications to Speight and Messick enabled service from the central plant along with energy monitoring. Two air-handling units in Messick were also be repaired. In addition, several three-way control valves were replaced with 2-way control valves where appropriate for delta T improvements. This project also included the replacement of steam supply to Speight Building as well as medium voltage electrical work. The area where these utilities were constructed was very congested with various underground utilities.

A key feature of the project was use of directionally drilled chilled water piping which minimized campus disruption during construction.

4.2 - Past Performance



» **COMPLETION DATE**

2025 (Est.)

» **COST**

$45 Million

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

Damian Lallathin
919.513.0373
damian_lallathin@ncsu.edu

MEDIUM VOLTAGE POWER DISTRIBUTION GRID MODERNIZATION

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

The vision for this project is to design and construct a modern self-healing 15kV power distribution system, to serve North Carolina State University's main campus for the next 40 years, in fidelity with the electrical distribution master plan, using robust processes to ensure human safety and system quality with minimized campus impact.

This project will provide design and construction administration services to support a $40+M 15kV electrical distribution system upgrade for main (Central and North) campus. The project includes five miles of duct bank trenching, 57 new switches, 111 building transformer tie-ins, and 11 building replacement transformers The design will be delivered in multiple packages, five of which have independent CA processes (Bid, Submittal Review, Close-out, Record Documents).

The project is critical and complex. Delivering power to campus reliably during construction and long term is crucial for both normal function of campus and sensitive campus research programs. Routing duct bank through the high-density areas the campus will require intricate attention to detail during design. Building transitions from old to new circuits and switches during construction will require a significant investment in analysis and logistical planning. Additionally, implementation of a campus wide, automated, self-healing SCADA system of this size will require specialized technical support over a long-term duration.

» **COMPLETION DATE**

2021

» **COST**

$5.3 Million

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

Damian Lallathin
919.513.0373
damian_lallathin@ncsu.edu

CENTENNIAL CAMPUS CHILLED WATER THERMAL ENERGY STORAGE TANK

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

North Carolina State University's (NCSU) Centennial Campus is growing with new buildings such as Plant Sciences and EB Oval and with loop additions including the College of Textiles and Monteith Research Center. This project design expanded central chilled water plant capacity with the addition of a stratified chilled water thermal energy storage tank (TES).

During advanced planning stages, options and comparative analysis were developed for each element of the design. The tank was sited to minimize grading and structural retaining walls while remaining accessible and relatively obscure from primary campus views. A deep foundation system consisting of H-piles to bedrock was selected to minimize settlement. Tank aspect ratio was selected to ensure that top of water elevation was at the tallest point on campus yet align well with the top elevation of the adjacent chiller plant. During this stage of design, RMF provided a detailed comparison of steel vs. concrete tank construction with consideration for cost, construction, operations and maintenance.

A 3.5M gallon welded steel tank was selected based on first cost, site construction restraints and bidder competition. The tank stores 25,000 ton-hrs of cooling at 12F temperature differential. From a hydraulic perspective, the tank replaces the current plant primary to secondary bridge / de-coupler. If the primary loop generates more flow than the secondary is consuming, the excess flow will charge the tank.

If the secondary loop is consuming more than the primary is generating then the tank will discharge. Maximum design charge and discharge rate is 12,000 GPM or 6,000 tons at 12 degree temperature differential.

The TES is controlled via a Honeywell HC900 Hybrid PLC system that operates on an Iconics graphics and SCADA package. **An energy model was developed to optimize TES charge and discharge cycles for standard large general service and large general service time-of-use rate structures. Graphical dashboards, key performance indicators and automatic controls sequencing was then developed based on the energy model output.** In addition, RMF also provided sequencing and integration of a nearby steam turbine generator (STG).

4.2 - Past Performance

» COMPLETION DATE

2018

» COST

$4.6 Million

» SERVICES PROVIDED

Mechanical
Electrical
Civil
Structural

» REFERENCE

Mike Draughn
336.782.0071
draughmd@wfu.edu

NORTH CHILLER PLANT TRANSFORMATION

WAKE FOREST UNIVERSITY | WINSTON-SALEM, NC

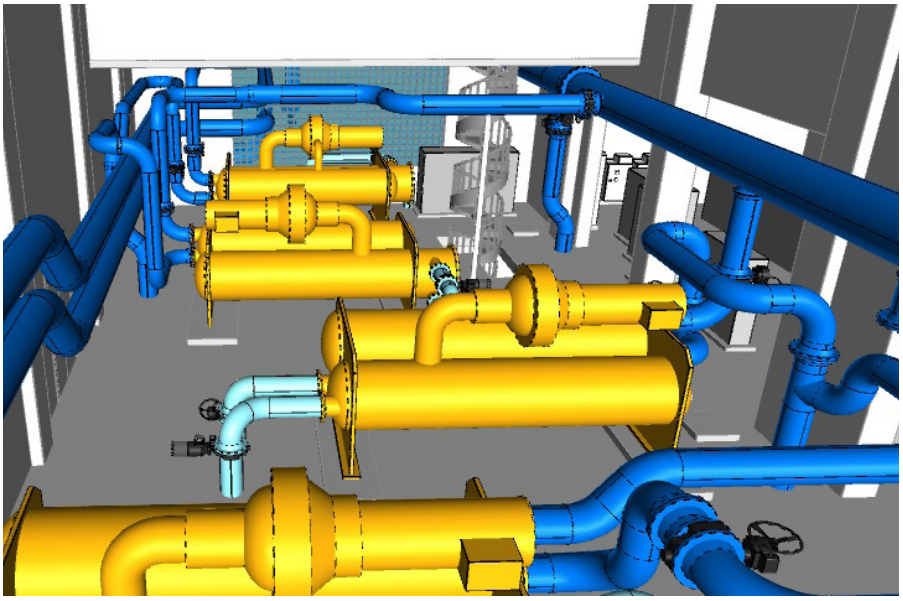
Cost: $4.6 Million

The North Chiller Plant provides chilled water for comfort and process to residential, classroom and laboratory facilities on campus at Wake Forest University. RMF provided planning, design and construction administration services to modernize and transform the aging north chiller plant into a state-of-the-art facility. The project included the replacement of the existing chillers, towers, piping, pumps and electrical system. Utilizing only the existing building shell and medium voltage power supply, 2,400 tons of chilled water generation was added to a facility designed for only 1,200 tons of cooling.

Meticulous attention to equipment selection, layout, accessibility and modeling enabled the new plant to have even better reliability, efficiency and service access than the original design. All plant systems were modeled in AutoDesk Revit MEP. Virtual tours of the plant were made at critical points during the design process. Two 1,200 ton variable speed drive chillers were pre-purchased based on a life-cycle energy model. The model's hours and operating conditions were custom developed based on 12 months of metering and controls data points. Additionally, long lead electrical transformers and switchboards were also pre-purchased to facilitate an accelerated design and construction window.

The variable primary plant features drives on each chiller, pump and tower fan along with chiller plant optimization by Optimum Energy. Additional plant features include chilled water air-dirt separation along with a high-efficiency condenser water filtration system.

Civil and structural design upsized the chiller water distribution mains, expanded the cooling tower yard and provided tower access platforms. Additionally, a screen wall was added to shield views of the new cooling towers from a nearby business school.



» **COMPLETION DATE**

2018

» **COST**

$3.6 Million

» **SERVICES PROVIDED**

Mechanical
Electrical
Civil
Structural

» **REFERENCE**

Greg Spiro
470.351.9867
greg.spiro@facilities.
gatech.edu

HOLLAND PLANT CHILLED WATER SYSTEM MODERNIZATION AND EXPANSION

GEORGIA INSTITUTE OF TECHNOLOGY | ATLANTA, GA

The Holland Plant introduced chilled water production in 1970 and has been incrementally expanded since that time to support the campus' growth. There are several projects planned on campus that would exceed the existing chilled water capacity of the Holland plant. This project enabled the campus to reliably serve the chilled water needs of the campus as well as provided the cooling tower capacity required for the future replacement of its existing 8,000 ton cooling tower.

For this project, RMF provided the design for an additional 2,000 tons of chilled water in place of a 1,060 ton unit and a 2,000 ton cooling tower along with associated support infrastructure. This enabled the Holland Plant to reach its full potential. Critical success factors for the project included successful coordination with ongoing project such as RMF's JCI GESPC project and detailed modeling of complex piping / equipment layout in the Holland Plant.

4.2 - Past Performance

DISTRICT ENERGY PLANT 2 - EXPANSION PHASE 1

UNIVERSITY OF GEORGIA | ATHENS, GA

» COMPLETION DATE

2016

» COST

$4.8 Million

» SERVICES PROVIDED

Mechanical
Electrical
Civil
Structural
Architectural
Energy

» REFERENCE

Eric Sherman, PE
706.542.7485
ericis@uga.edu

This project was the first step of a phased plan to expand the production capacity of the south campus chilled water system by 6,000 tons. The additional chilled water generation equipment was installed in a new building adjacent to the existing District Energy Plant #2 (DEP-2) located at the intersection of East Campus Road and Cedar Street. DEP-2 was being expanded to handle the new building loads added to the south campus loop, particularly the addition of the science learning center. Over time, the plant will also absorb capacity void associated with retirement of aging decentralized building chillers.

The first phase included the civil, structural and architectural infrastructure for the first 3,000 tons of cooling. All infrastructure systems have been setup for simple and thoughtful expansion with no shut-down requirements moving forward. The mechanical portion of the first phase of the DEP-2 expansion included a 1,000 Ton variable speed electric water-cooled centrifugal chiller. Chiller selection and selection parameters including condenser water flow rates, variable speed drives, etc. were economically evaluated using a net present value life-cycle methodology. Associated cooling tower, pumps, piping and controls have been carefully design for ease of service. The chilled water system was configured using a variable primary hydraulic arrangement. A variety of water filtration systems were evaluated during the design process which led to implementation of a SpiroTherm air-dirt separator on the chilled water system along with an Arkal disc type condenser water filtration system. Electrical service for the first phase of the DEP-2 expansion will come from the existing 12.47kV medium voltage (MV) campus loop feed. Options were developed to allow duel ended electrical services including back-up transformer and switchgear capabilities.

RMF adapted templates to utilize Revit MEP 3D modeling software for chiller plant design. The team regularly provided virtual, animated, 3D tours to UGA during the design process for best review of layout, fit and function.

In addition to providing full design services, RMF's deliverables included full cost estimating and back-up calculations for each submission phase. RMF coordinated with a construction manager during the process and provided support for bidding and construction administration involvement which included bi-weekly site visits.

CURRENT HIGHER-EDUCATION CLIENTS IN NORTH CAROLINA

- **UNC Greensboro**
- UNC Charlotte
- UNC - Chapel Hill
- Appalachian State University
- North Carolina State University
- North Carolina A&T State University
- Winston-Salem State University
- Western Carolina University
- East Carolina University

4.3 - Current Workload & State Projects Awarded

RMF's North Carolina staff provides an ideal level of coverage in all necessary engineering disciplines and depth in each discipline to accurately maintain production commitments and contract schedules. RMF strives to maintain a workload that is balanced for the current staff levels, and vice versa. We do not take on more work than we can perform well. The personnel proposed for this project have worked together on numerous similar projects, and are fully aware of how to plan their work and budget their time accordingly to be efficient and timely. Our current workload is such that RMF could begin work on the project immediately.

Over the last 23 years, RMF has worked on more than 400 contracts for the State of North Carolina, totaling over $2 billion in design and construction. Our team is very familiar with the processes and requirements of UNC Greensboro and the NC Office of State Construction.

4.4 - Proposed Design Approach

Project Management
Subsequent award, the North Carolina Infrastructure team will develop a project execution plan. The management plan will include detailed scope for each discipline, a design and construction schedule and a preliminary construction cost estimate. Our project management approach is to provide early action, responsive communication and a collaborative mindset.

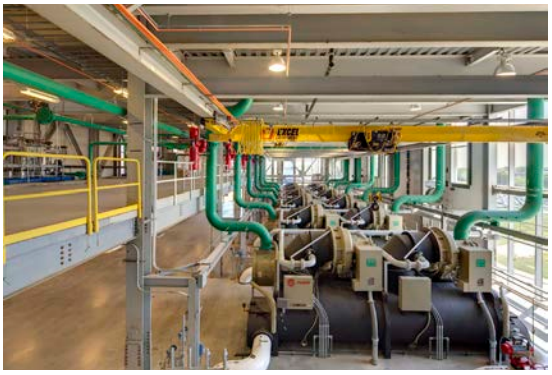
Planning Options
In keeping with our collaborative approach, RMF will develop distribution routing options and include clear illustrations, construction cost and other comparative advantages and disadvantages such as traffic, parking and student impacts for presentation to UNCG. In a parallel effort the mechanical team will evaluate and perform field work and develop a concept plan and location for chilled water connections for each building to be added to the central loop. Additionally, loads analysis and energy modeling will be performed for the plant chiller replacement. Hydraulic modeling and chilled water pipe sizing will be confirmed.

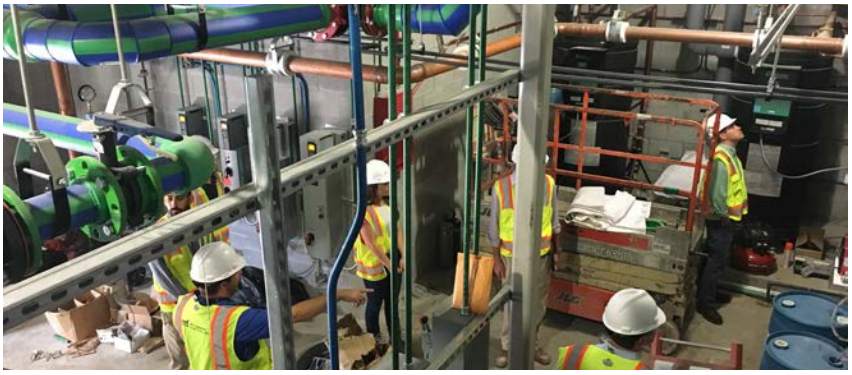
Distribution Design
Upon completion of a grade B site survey, our team of civil engineers will perform in-field verification of existing site utilities to ensure accuracy. Chilled water valve or manhole locations and building entry points will then be meticulously selected for optimal location. Engineers will utilize PipeFlo for hydraulic modeling along with AutoCAD Civil 3D and Revit MEP for our tightly coordinated design documentation. Detailed documentation will emphasize project phasing, outage restrictions, traffic control and parking control in coordination with UNCG's project management team and building liaisons.

Buildings Connection Design
Significant efforts will be made to ensure building performance post central system connection exceeds current levels. The team will develop a solid understanding of how the building currently operates, inclusive of deficiencies and with consideration for future planned modifications. Design engineering components include intensive field work, laser scanning, cooling loads and hydraulics analysis. When our team leaves this room it will be more organized and spacious than ever before.

Construction Administration
Our design team transforms into the construction team with the same personalities onsite. This avoids any loss of project history. The proposed team is highly experienced and are regularly in the Greensboro area. During similar past projects on campus the construction administration team have been onsite several times per week to provide responsive and timely engineering support.







4.5 - Recent Experience with Project Costs and Schedules

RMF has been very successful in completing projects within the budgetary constraints and design time allocations. Continuous in-house cost estimating is performed to insure the project, at completion, is within the construction cost budget. RMF has a close connection to construction activities and construction costs and has a proven track record of cost control. RMF performs a significant amount of work in a design-build capacity with mechanical contracting firms and is in-tune with actual material and labor costs.

Schedules are maintained by establishing a realistic time schedule with the client, weekly meetings between the design team members to review the schedule and reporting to the client the anticipated obstacles in maintaining the schedule. Our approach to project schedule control is a MS Project schedule used as the primary tool for indicating the sequence of events and allowable time periods for completing specific project phases and elements. The time requirements for the survey, data gathering, analysis, working sessions and conceptual design are tracked. At the beginning of a project, the schedule is reviewed with all engineering disciplines and discussed in depth with the client to ensure that everyone has a clear idea of what progress must be made by key milestones. The schedule is reviewed weekly at the in-house coordination meetings and monthly with the client. The frequent reviews ensure that no members of the design team will lose focus of the scheduled commitments.

RMF can develop total project cost models for renovations and new construction related to the project design options. The modeling can involve a combination of unitary costs (cost per net square foot, linear foot, unit module, or functional unit) and vendor quotes for large equipment (transformers, switchgear, medium-voltage cable, etc.).

Previous examples of meeting project budgets include:

UNC Greensboro Human Health Performance Chiller Plant
RMF Estimate: $900,000
Winning Bid: $811,000

North Carolina State University Centennial Campus Infrastructure Medium Voltage Electrical Distribution
RMF Estimate: $1,255,002
Winning Bid: $1,338,332

Wake Forest University North Campus Chiller Plant
RMF Cost Estimate: $4,600,000
Winning Bid: $4,400,000

Wake Forest University North Campus Chiller Plant

4.6 - Construction Administration Capabilities

RMF offers construction administration primarily on a weekly basis, but can also accommodate daily or less frequent needs as required by the client. The firm maintains in-house engineers for civil, structural, mechanical, and electrical services, as well as architectural support. The comprehensive team ensures that construction correspondence is logged and processed in a timely fashion.

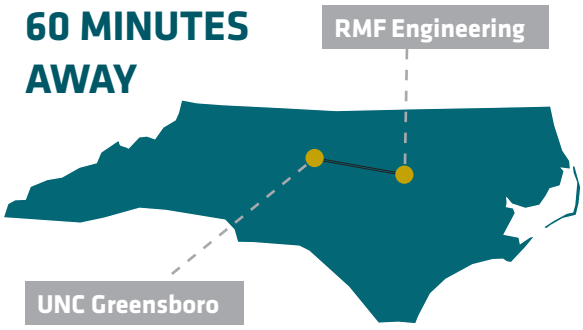
A key area of RMF's qualify control during construction consists of frequent and timely site observations. Projects often call for numerous site visits throughout the construction sequence until final acceptance. Construction issues are continuously identified to minimize significant punch-list items at the project's closeout.

Construction phase services typically include:

- Review of Shop Drawings
- Review of Submittal Materials Installed
- Request for Information Processing
- Conduct / Attend Progress Meetings
- Maintain Minutes of Progress Meetings
- Review Applications for Payment
- Conduct Site Inspections / Periodic Site Visits
- Submit Punch List
- System Commissioning and Testing
- Safety Inspections

4.7 - Proximity to and Familiarity with the Area Where Project is Located

RMF's project team is located in Raleigh, North Carolina which is approximately a **60 minute** drive to UNC Greensboro. RMF previously completed the design and multi-phased replacement of deteriorating steam distribution systems in the heart of UNC Greensboro's campus and the chiller replacement at the Human Health Performance facility. Both of these projects highlight our understanding of campus guidelines, location and requirements for familiar campus systems.



4.8 - Record of Successfully Completed Projects without Major Legal or Technical Problems

For the past 20 years, no judgments have been made against RMF Engineering. RMF believes in a partnership with our clients. We take great strides to ensure that mistakes do not happen; they are limited through processes such as Quality Control and Design Assurance. We can guarantee that we will be responsive to your requests and we will make certain that a concern is handled to your satisfaction.

4.9 - Energy Conservation / LEED Experience

RMF has extensive experience in energy auditing and identifying methods for reduction in annual utility operating costs. The significance of the mechanical and electrical systems warrants consideration of energy efficient design. RMF takes every opportunity to incorporate energy efficient technology and sustainable design in utility systems. RMF has experience in reducing energy consumption with innovative technologies such as solar and geothermal energy, heat recovery and daylighting, as well as green roofs and rainwater collection.

RMF has designed over 75 LEED certified projects. Recent and relevant projects include:

- **East Campus Steam Plant**
  Duke University
- **West Campus Chilled Water**
  Duke University
- **Yarbrough Chilled Water Plant**
  North Carolina State University
- **District Energy Facility Hot Water to East Drive**
  Harvard University
- **North Chiller Plant**
  University of Massachusetts Amherst
- **South Campus Chiller Plant**
  Ohio State University
- **Chilled Water Plant No. 3**
  Ohio State University
- **East Campus Chiller Plant**
  Ohio State University
- **West Plant**
  College of William & Mary
- **Chilled Water Plant**
  Yale University Science Park

05
MINORITY BUSINESS PARTICIPATION PLAN

QC Review

RMF's Day With An Engineer

2018 ACE Mentor Banquet

CSI Women Trailblazers Panel

DIVERSITY, EQUITY AND INCLUSION

The Management of RMF Engineering is firmly committed to complying with and meeting the intent of minority participation. Management is dedicated to the policy that HUB's, MBE's, SB's, SBD's and WOSB's shall be provided opportunities to participate as subcontractors for any contract where subcontracting of work is required by the basic contract and the application of these laws and regulations is specified, or where there is otherwise an opportunity for taking advantage of such services.

RMF has a strong affirmative action policy and recruits, hires, trains and promotes persons in all job titles without regard to race, color, religion, age, sex, disability, national origin, veteran status, or any characteristic protected by applicable law. We recruit from historically black colleges and universities.

RMF is especially excited by the advances by women and minority employees that have resulted in leadership and ownership positions in the firm.

RMF's 280 employees represent the greatest asset to the company, and each is hired and provided mentorship with the goal of achieving the highest possible career growth. Employee development and education has been the largest single focus at RMF for the last decade. A customized Project Management Program and 2-year Leadership Development Program have been very successful in training the younger professional staff.

Tuition reimbursement has benefited dozens of full-time employees for securing their first and second degrees. Everyone is encouraged at multiple levels to seek their full potential and be the best in their field. It is quite common for members of the RMF team to reach 25, 30, and 35 years of service levels, a testament to the care of employees and their loyalty.

The inclusion and empowerment of all people is recognized and incorporated throughout RMF's core values and business practices. RMF promotes and sustains an environment of belonging, respect, and beliefs of our employees. We combine our individual talents, skills, and experiences to enhance the lives of our employees and surrounding communities.

COMMUNITY ENGAGEMENT

Many of our staff are active participants in organizations that seek to promote diversity in the AEC professions. A number of these students have continued mentorship with RMF as engineering co-op students. Many have become full time employees.

Several of RMF's employees have taken active roles in industry organizations to promote the professional development of woman/minorities in the engineering field. A long-time favorite has been the Children's Home, where RMF has been its largest sponsor. RMF's Raleigh office is a top tier sponsor for the Triangle Chapter of the American Heart Association.

The Association's goal is to educate communities in NC on living a healthy heart lifestyle, focusing on minorities, where the need is greatest.

06
SF 330

ARCHITECT - ENGINEER QUALIFICATIONS

PART I - CONTRACT-SPECIFIC QUALIFICATIONS

A. CONTRACT INFORMATION

1. TITLE AND LOCATION (*City and State*)

Campus Chilled Water Infrastructure and Equipment Improvements (Greensboro, NC)

2. PUBLIC NOTICE DATE	3. SOLICITATION OR PROJECT NUMBER
January 4, 2022	

B. ARCHITECT-ENGINEER POINT OF CONTACT

4. NAME AND TITLE

Greg Carnathan, PE, CEM, LEED AP - Principal in Charge / Director

5. NAME OF FIRM

RMF Engineering, Inc.

6. TELEPHONE NUMBER	7. FAX NUMBER	8. E-MAIL ADDRESS
919.941.9876	919.941.9957	greg.carnathan@rmf.com

C. PROPOSED TEAM

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

	(Check) PRIME	(Check) J-V PARTNER	(Check) SUBCON-TRACTOR	9. FIRM NAME	10. ADDRESS	11. ROLE IN THIS CONTRACT
a.	[X]	[ ]	[ ]	RMF Engineering Reliability. Efficiency. Integrity. [X] CHECK IF BRANCH OFFICE	8081 Arco Corporate Drive Suite 300 Raleigh, NC 27617	Mechanical, Electrical, Civil and Structural Engineering
b.	[ ]	[ ]	[X]	CLH DESIGN [ ] CHECK IF BRANCH OFFICE	400 Regency Forest Drive Suite 120 Cary, NC 27518	Landscape Design
c.	[ ]	[ ]	[ ]	[ ] CHECK IF BRANCH OFFICE		
d.	[ ]	[ ]	[ ]	[ ] CHECK IF BRANCH OFFICE		
e.	[ ]	[ ]	[ ]	[ ] CHECK IF BRANCH OFFICE		
f.	[ ]	[ ]	[ ]	[ ] CHECK IF BRANCH OFFICE		

D. ORGANIZATIONAL CHART OF PROPOSED TEAM

[X] (Attached)

INSERT ORGANIZATIONAL CHART BELOW OR ATTACH.

ORGANIZATIONAL CHART

Resumes provided are for our Key Personnel only. Additional support staff resumes can by provided upon request. RMF's full time staff is composed of over 70 licensed professional engineers and more than 125 engineering college graduates.

RMF Engineering

PRINCIPAL IN CHARGE
GREG CARNATHAN, PE, CEM, LEED AP

MEP PROJECT MANAGER / LEAD MECHANICAL ENGINEER
JONATHAN EVELETH, PE, CEM, LEED AP

LEAD CIVIL ENGINEER
MATTHEW BOATWRIGHT, PE

LEAD ELECTRICAL ENGINEER
MARK DEMANA, PE

STRUCTURAL ENGINEER
JIM RICHES, PE

CLH DESIGN

LANDSCAPE DESIGN
HEATHER RHYMES

ADDITIONAL NORTH CAROLINA SUPPORT STAFF

MIKE MCCLENATHAN, PE
CHRIS SKILLESTAD, PE
CHASE DAVIS, PE, CEM
GREGORY RILEY, PE
MARK BERTAGNA, PE
MIKE WILKINS, PE
KIRSTIE NUGENT, PE
DANIEL MCKNIGHT
ELIJAH LOWDER
DANIEL CRAIG
TANNER COMPTON
VITALIS OKAFOR
LUKE MCCARN
ROBERT CURRY
THOMAS GOREVESKI
FRANKIE THOMPSON
GABRIELLE TOPALIN
GREGORY JOHNSON

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM
GREG CARNATHAN, PE, LEED AP, CEM	**PRINCIPAL IN CHARGE**	23	21

15. FIRM NAME AND LOCATION (City and State)

RMF Engineering, Inc. (Raleigh, NC)

16. EDUCATION (DEGREE AND SPECIALIZATION)	17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
MESSIAH COLLEGE BS, Mechanical Engineering / 1998	Professional Engineer, NC # 028322; LEED Accredited Professional; Certified Energy Manager

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

Mr. Carnathan is a mechanical engineer with extensive experience planning, analyzing and designing thermal infrastructure systems. Specific knowledge areas include steam, hot water and chilled water systems in direct buried, trenched or tunnel installations. His responsibilities regularly include quality control, project management, strategic planning, energy modeling, economic analysis, multi-discipline coordination, pipe and material system selection, stress and deflection analysis, condensate management, operational safety,

19. RELEVANT PROJECTS

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Steam Distribution System Replacement UNC Greensboro | Greensboro, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2020

RMF to provide design services to replace approximately 600 LF of 8" HPS and 4" PC. Various distribution methodologies were investigated and presented to UNCG during early design planning (direct buried, shallow trench and walkable tunnel). UNCG and RMF worked together to implement the most cost effective temporary solution that still met minimum demand requirements by investigating each building's seasonal usage during the estimated construction window.

Check if project performed with current firm	Size: N/A	Cost: $1.5 Million	Role: Principal in Charge
X			

b.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Health and Human Performance Facility Chiller Replacement UNC Greensboro | Greensboro, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2017

RMF performed field work to develop an AutoDesk Revit MEP as-built model of the existing chilled water mechanical room and cooling tower areas. Next, load calculations, and energy models were developed based on current and planned building space programming requirements. Two new chillers were selected along with a new cooling tower, pumps, and modern plant control system.

Check if project performed with current firm	Size: N/A	Cost: $820,000	Role: Principal in Charge
X			

c.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Centennial Campus Thermal Utilities Infrastructure North Carolina State University | Raleigh, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2015	2018

RMF designed thermal utility connections for the College of Textiles Lab, Monteith Research Center, Constructed Facilities Lab and for completion of the main distribution loop. RMF met with NCSU and building occupants to understand their requirements for a power outage and a custom phasing plan was developed to minimize down time for these critical laboratory facilities.

Check if project performed with current firm	Size: N/A	Cost: $11 Million	Role: Principal in Charge
X			

d.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Thermal Utilities to Partners II and Toxicology North Carolina State University | Raleigh, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2020	2021

RMF provided 1,600 trench-feet of underground thermal distribution design for steam using a pre-engineered, Class A, piping system and a fully restrained mechanical join ductile-iron pipe for chilled water. The design also included Structural and Mechanical design for six new steam vaults.

Check if project performed with current firm	Size: N/A	Cost: $9.1 Million	Role: Principal in Charge
X			

e.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings East Carolina University | Greenville, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2018

This project's goal was to connect three buildings: Messick, McGinnis and Speight to the central campus chilled water loop and repair two AHU's in Messick. RMF's scope of work included underground chilled water distribution and short segments of underground steam and storm water. Mechanical room modifications to Speight and Messick enabled service from the central plant along with energy monitoring.

Check if project performed with current firm	Size: N/A	Cost: $2.25 Million	Role: Principal in Charge
X			

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

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM
JONATHAN EVELETH, PE, CEM, LEED AP	**MEP PROJECT MANAGER / LEAD MECHANICAL ENGINEER**	14	7

15. FIRM NAME AND LOCATION (City and State)

RMF Engineering, Inc. (Raleigh, NC)

16. EDUCATION (DEGREE AND SPECIALIZATION)	17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
GEORGIA INSTITUTE OF TECHNOLOGY BS, Mechanical Engineering / 2007	Professional Engineer, NC # 041582; Certified Energy Manager; LEED Accredited Professional

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

Mr. Eveleth is a mechanical engineer who specializes in the analysis, design, and construction of building and infrastructure systems serving educational, industrial, healthcare, and commercial facilities. He is most knowledgeable in the areas of campus utilities (steam, chilled water). His background as a design-build contractor gives him a unique perspective on the need for high quality documents with a focus on constructability.

19. RELEVANT PROJECTS

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Health and Human Performance Facility Chiller Replacement UNC Greensboro | Greensboro, NC	2017	2017
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

RMF performed field work to develop an AutoDesk Revit MEP as-built model of the existing chilled water mechanical room and cooling tower areas. Next, load calculations, and energy models were developed based on current and planned building space programming requirements. Two new chillers were selected along with a new cooling tower, pumps, and modern plant control system.

☒ Check if project performed with current firm	Size: N/A	Cost: $820,000	Role: Lead Mechanical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Centennial Campus Thermal Utilities Infrastructure North Carolina State University | Raleigh, NC	2015	2018
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

RMF designed thermal utility connections for the College of Textiles Lab, Monteith Research Center, Constructed Facilities Lab and for completion of the main distribution loop. RMF met with NCSU and building occupants to understand their requirements for a power outage and a custom phasing plan was developed to minimize down time for these critical laboratory facilities.

☒ Check if project performed with current firm	Size: N/A	Cost: $11 Million	Role: Lead Mechanical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Thermal Utilities to Partners II and Toxicology North Carolina State University | Raleigh, NC	2020	2021
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

RMF provided 1,600 trench-feet of underground thermal distribution design for steam using a pre-engineered, Class A, piping system and a fully restrained mechanical join ductile-iron pipe for chilled water. The design also included Structural and Mechanical design for six new steam vaults.

☒ Check if project performed with current firm	Size: N/A	Cost: $9.1 Million	Role: Lead Mechanical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings East Carolina University | Greenville, NC	2017	2018
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

This project's goal was to connect three buildings: Messick, McGinnis and Speight to the central campus chilled water loop and repair two AHU's in Messick. RMF's scope of work included underground chilled water distribution and short segments of underground steam and storm water. Mechanical room modifications to Speight and Messick enabled service from the central plant along with energy monitoring.

☒ Check if project performed with current firm	Size: N/A	Cost: $2.25 Million	Role: Lead Mechanical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Centennial Campus Chilled Water Thermal Energy Storage Tank North Carolina State University | Raleigh, NC	2018	2020
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

North Carolina State University's (NCSU) Centennial Campus is growing with new buildings such as Plant Sciences and EB Oval and with loop additions including the College of Textiles and Monteith Research Center. This project design expanded central chilled water plant capacity with the addition of a stratified chilled water thermal energy storage tank (TES).

☒ Check if project performed with current firm	Size: N/A	Cost: $5.3 Million	Role: MEP PM / Lead Mechanical Engineer

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

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM
MATT BOATWRIGHT, PE	**LEAD CIVIL ENGINEER**	11	10

15. FIRM NAME AND LOCATION (City and State)

RMF Engineering, Inc. (Raleigh, NC)

16. EDUCATION (DEGREE AND SPECIALIZATION)	17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
NORTH CAROLINE STATE UNIVERSITY BS, Civil Engineering / 2011	Professional Engineer, NC # 041981

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

Mr. Boatwright is a civil engineer with experience in the design of civil utilities and solid knowledge of steam and chilled water distribution systems. His design experience is focused primarily on complex utility installations in congested sites. He also has experience with general site planning, design and permitting involving storm drainage analysis, stream buffer intrusions, site grading and hardscape restorations.

19. RELEVANT PROJECTS

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Steam Distribution System Replacement UNC Greensboro | Greensboro, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2020

RMF to provide design services to replace approximately 600 LF of 8" HPS and 4" PC. Various distribution methodologies were investigated and presented to UNCG during early design planning (direct buried, shallow trench and walkable tunnel). UNCG and RMF worked together to implement the most cost effective temporary solution that still met minimum demand requirements by investigating each building's seasonal usage during the estimated construction window.

☒ Check if project performed with current firm	Size: N/A	Cost: $1.5 Million	Role: Project Manager

c.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Centennial Campus Thermal Utilities Infrastructure North Carolina State University | Raleigh, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2015	2018

RMF designed thermal utility connections for the College of Textiles Lab, Monteith Research Center, Constructed Facilities Lab and for completion of the main distribution loop. RMF met with NCSU and building occupants to understand their requirements for a power outage and a custom phasing plan was developed to minimize down time for these critical laboratory facilities.

☒ Check if project performed with current firm	Size: N/A	Cost: $11 Million	Role: Project Manager

d.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Thermal Utilities to Partners II and Toxicology North Carolina State University | Raleigh, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2020	2021

RMF provided 1,600 trench-feet of underground thermal distribution design for steam using a pre-engineered, Class A, piping system and a fully restrained mechanical join ductile-iron pipe for chilled water. The design also included Structural and Mechanical design for six new steam vaults.

☒ Check if project performed with current firm	Size: N/A	Cost: $9.1 Million	Role: Project Manager

e.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings East Carolina University | Greenville, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2018

This project's goal was to connect three buildings: Messick, McGinnis and Speight to the central campus chilled water loop and repair two AHU's in Messick. RMF's scope of work included underground chilled water distribution and short segments of underground steam and storm water. Mechanical room modifications to Speight and Messick enabled service from the central plant along with energy monitoring.

☒ Check if project performed with current firm	Size: N/A	Cost: $2.25 Million	Role: Project Manager

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
North Chiller Plant Transformation Wake Forest University | Winston-Salem, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2018

The North Chiller Plant provides chilled water for comfort and process to residential, classroom and laboratory facilities on campus at Wake Forest University. RMF provided planning, design and construction administration services to modernize and transform the aging north chiller plant into a state-of-the-art facility. The project includes replacement of the existing chillers, towers, piping, pumps and electrical system.

☒ Check if project performed with current firm	Size: N/A	Cost: $4.6 Million	Role: Lead Civil Engineer

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

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM
MARK DEMANA, PE	**LEAD ELECTRICAL ENGINEER**	36	11

15. FIRM NAME AND LOCATION (City and State)

RMF Engineering, Inc. (Raleigh, NC)

16. EDUCATION (DEGREE AND SPECIALIZATION)	17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
OHIO UNIVERSITY BS, Mechanical Engineering / 2002	Professional Engineer: Georgia (PE030272)

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

Mr. Demana is an electrical engineer with over 36 years of experience in electrical design and project management. Coming from a diverse background, Mr. Demana spent the first 15 years of his career as a plant manager for large companies such as General Electric and Gould, Inc. He has experience in the service, installation and operation of power distribution and transmission equipment. He has extensive experience in the design of power generation, distribution, utility infrastructure, lighting, controls, energy plants, voice/data systems and security systems.

19. RELEVANT PROJECTS

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Steam Distribution System Replacement UNC Greensboro | Greensboro, NC	2017	2020
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

RMF to provide design services to replace approximately 600 LF of 8" HPS and 4" PC. Various distribution methodologies were investigated and presented to UNCG during early design planning (direct buried, shallow trench and walkable tunnel). UNCG and RMF worked together to implement the most cost effective temporary solution that still met minimum demand requirements by investigating each building's seasonal usage during the estimated construction window.

Check if project performed with current firm	Size: N/A	Cost: $1.5 Million	Role: Lead Electrical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Health and Human Performance Facility Chiller Replacement UNC Greensboro | Greensboro, NC	2017	2017
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

RMF performed field work to develop an AutoDesk Revit MEP as-built model of the existing chilled water mechanical room and cooling tower areas. Next, load calculations, and energy models were developed based on current and planned building space programming requirements. Two new chillers were selected along with a new cooling tower, pumps, and modern plant control system.

Check if project performed with current firm	Size: N/A	Cost: $820,000	Role: Lead Electrical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Medium Voltage Power Distribution Grid Modernization North Carolina State University | Raleigh, NC	2020	2025 (Est.)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

This project will install a new underground 15kV medium voltage distribution system. Six new feeder loops, twelve circuits, will replace the existing electrical distribution system serving main campus in its entirety. New construction will include metal clad switchgear feeder breaker up fit, distribution feeder ductbank and manhole, cable, pad mounted switchgear and SCADA control scope. The project is currently in the advanced planning stage.

Check if project performed with current firm	Size: N/A	Cost: $45 Million	Role: Lead Electrical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Centennial Campus Chilled Water Thermal Energy Storage Tank North Carolina State University | Raleigh, NC	2018	2020
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

North Carolina State University's (NCSU) Centennial Campus is growing with new buildings such as Plant Sciences and EB Oval and with loop additions including the College of Textiles and Monteith Research Center. This project design expanded central chilled water plant capacity with the addition of a stratified chilled water thermal energy storage tank (TES).

Check if project performed with current firm	Size: N/A	Cost: $5.3 Million	Role: Lead Electrical Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
North Chiller Plant Transformation Wake Forest University | Winston-Salem, NC	2017	2018
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		

The North Chiller Plant provides chilled water for comfort and process to residential, classroom and laboratory facilities on campus at Wake Forest University. RMF provided planning, design and construction administration services to modernize and transform the aging north chiller plant into a state-of-the-art facility. The project includes replacement of the existing chillers, towers, piping, pumps and electrical system.

Check if project performed with current firm	Size: N/A	Cost: $4.6 Million	Role: Lead Electrical Engineer

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

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM
JIM RICHES, PE	**LEAD STRUCTURAL ENGINEER**	27	27

15. FIRM NAME AND LOCATION (City and State)

RMF Engineering, Inc. (Raleigh, NC)

16. EDUCATION (DEGREE AND SPECIALIZATION)	17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
DREXEL UNIVERSITY BS, Civil and Architectural Engineering / 1993	Professional Engineer, NC # 039436

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

Mr. Riches has extensive experience in performing structural and civil engineering for large infrastructure projects and buildings. He has designed steel framed buildings and reinforced concrete structures. These include utility tunnels, underground vaults and chiller and boiler plants with stacks, cranes, and hoists. Multi-discipline coordination is an essential aspect in all of his projects. Structural anchoring and support of various mechanical piping systems and equipment is a common detail in his designs. He has also performed site planning and utility design for underground piping systems and electrical ductbanks and vaults.

19. RELEVANT PROJECTS

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Steam Distribution System Replacement UNC Greensboro | Greensboro, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2020

RMF to provide design services to replace approximately 600 LF of 8" HPS and 4" PC. Various distribution methodologies were investigated and presented to UNCG during early design planning (direct buried, shallow trench and walkable tunnel). UNCG and RMF worked together to implement the most cost effective temporary solution that still met minimum demand requirements by investigating each building's seasonal usage during the estimated construction window.

☒ Check if project performed with current firm	Size: N/A	Cost: $1.5 Million	Role: Lead Structural Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Centennial Campus Thermal Utilities Infrastructure North Carolina State University | Raleigh, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2015	2018

RMF designed thermal utility connections for the College of Textiles Lab, Monteith Research Center, Constructed Facilities Lab and for completion of the main distribution loop. RMF met with NCSU and building occupants to understand their requirements for a power outage and a custom phasing plan was developed to minimize down time for these critical laboratory facilities.

☒ Check if project performed with current firm	Size: N/A	Cost: $11 Million	Role: Lead Structural Engineer

a.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Centennial Campus Chilled Water Thermal Energy Storage Tank North Carolina State University | Raleigh, NC	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2018	2020

North Carolina State University's (NCSU) Centennial Campus is growing with new buildings such as Plant Sciences and EB Oval and with loop additions including the College of Textiles and Monteith Research Center. This project design expanded central chilled water plant capacity with the addition of a stratified chilled water thermal energy storage tank (TES).

☒ Check if project performed with current firm	Size: N/A	Cost: $5.3 Million	Role: Lead Structural Engineer

d.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
Holland Plant Chilled Water System Expansion Georgia Institute of Technology | Atlanta, GA	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2017	2017

This project enabled the campus to reliably serve the chilled water needs of the campus as well as provided the cooling tower capacity required for the future replacement of its existing 8,000 ton cooling tower. RMF provided the design for an additional 2,000 tons of chilled water in place of a 1,060 ton unit and a 2,000 ton cooling tower along with associated support infrastructure.

☒ Check if project performed with current firm	Size: N/A	Cost: $3.6 Million	Role: Lead Structural Engineer

e.

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
District Energy Plant 2 - Expansion Phase 1 University of Georgia | Athens, GA	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	2016	2016

This project was the first step of a phased plan to expand the production capacity of the south campus chilled water system by 6,000 tons. The additional chilled water generation equipment was installed in a new building adjacent to the existing District Energy Plant #2 (DEP-2). DEP-2 was being expanded to handle the new building loads added to the south campus loop, particularly the addition of the science learning center.

☒ Check if project performed with current firm	Size: 6,000 Tons	Cost: $4.8 Million	Role: Lead Structural Engineer

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Heather Rhymes	Landscape Designer	a. TOTAL **8**	b. WITH CURRENT FIRM **7**

15. FIRM NAME AND LOCATION *(City and State)*

CLH design, p.a. - Cary, NC

16. EDUCATION *(DEGREE AND SPECIALIZATION)*	17. CURRENT PROFESSIONAL REGISTRATION *(STATE AND DISCIPLINE)*
Master of Landscape Architecture, NC State University, 2013 Bachelor of Arts, Furman University, 2009	Recently passed all sections of the LARE. Waiting on license paperwork.

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

19. RELEVANT PROJECTS

a.

(1) TITLE AND LOCATION *(City and State)*: **UNC Greensboro Foust Building Facility/Site Conditions Assessment Greensboro, NC**

(2) YEAR COMPLETED — PROFESSIONAL SERVICES: 2022 — CONSTRUCTION *(If applicable)*: TBD

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

CLH is providing an assessment of the site conditions for the Foust Building, the only surviving 19th century building on the UNC Greensboro campus. Role: Landscape Designer. Costs: TBD.

b.

(1) TITLE AND LOCATION *(City and State)*: **North Carolina State University Memorial Belltower Restoration Raleigh, NC**

(2) YEAR COMPLETED — PROFESSIONAL SERVICES: 2018 - 2019 — CONSTRUCTION *(If applicable)*: 2019 - 2021

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

CLH provided landscape architecture and civil engineering services associated with the proposed renovation to the existing Memorial Belltower at NC State University. The scope of work includes the restoration of site paving and other site elements that will be disturbed by the renovation/restoration of the belltower structure. The renovated site includes modifications to improve the universal accessibility of the site and the tower structure, address drainage/moisture issues, replacement of the existing cobblestone paving and restoration/enhancement of the site landscaping. Role: Landscape Designer. Costs: $4.1 million

c.

(1) TITLE AND LOCATION *(City and State)*: **North Carolina State University Howling Cow Creamery and Education Center Raleigh, NC**

(2) YEAR COMPLETED — PROFESSIONAL SERVICES: 2018 — CONSTRUCTION *(If applicable)*: 2019

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

CLH provided site/civil/landscape architectural design and construction phase services associated with the proposed 2,400 SF creamery building at NC State's Lake Wheeler Road facility. Role: Landscape Designer. Costs: $900,000.

d.

(1) TITLE AND LOCATION *(City and State)*: **North Carolina State University Plant Sciences Building Raleigh, NC**

(2) YEAR COMPLETED — PROFESSIONAL SERVICES: 2016 - 2018 — CONSTRUCTION *(If applicable)*: 2019 - 2022

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

CLH has been providing landscape architecture services for this project as part of the Flad Architects design team. Our role has included the development of multiple schematic designs for a covered "porch" which provides space for casual conversation and reflection as well as overflow space from the interior hearth, allowing functions to flow from inside to outside. Role: Landscape Designer. Costs: $116 million.

e.

(1) TITLE AND LOCATION *(City and State)*: **East Carolina University Life Sciences and Biotechnology Building Greenville, NC**

(2) YEAR COMPLETED — PROFESSIONAL SERVICES: 2016 - 2018 — CONSTRUCTION *(If applicable)*: 2019 - 2021

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

CLH provided civil engineering and landscape architecture services for the Life Sciences and Biotechnology Building project. This project included construction of a new five-story building and surface parking lot to be located on two Greenville city blocks. The design approach consisted of placing the building in the west and northwest portion of the site to create a "gateway" to the ECU campus from Cotanche and Tenth Streets. Role: Landscape Designer. Costs: $90 million.

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	1

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Steam Distribution System Replacement Greensboro, NC	2017	2020

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
UNC Greensboro	Bill Chatfiled	336.334.5269

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

STEAM DISTRIBUTION SYSTEM REPLACEMENT

UNC GREENSBORO | GREENSBORO, NC

Cost: $1.5 Million

As part of a multi-phased replacement of deteriorating steam distribution in the heart of their campus, UNC Greensboro contracted RMF to provide design services to replace approximately 600 LF of eight-inch HPS and four-inch PC. Various distribution methodologies were investigated and presented to UNCG during early design planning (direct buried, shallow trench and walkable tunnel). Approximate budgets, schedules and long term comparisons were provided for each methodology, allowing UNCG and RMF to select the system best suited for the project.

In order to accommodate the University's desired system of shallow trench distribution, RMF developed a phased approach that would provide the necessary flexibility to accommodate the available budget and construction schedule. The two phase approach was coordinated with traffic and pedestrian control requirements, bus routes and available laydown space; working to split the project due to budget and schedule restrictions at an area that would also help minimize impact to campus operations. Pedestrian phasing and traffic control was of high importance as the alignment was located directly adjacent the Elliot University Center, under a busy walkway just south of the Kaplan Commons courtyard. The utility alignment was also laid out to utilize z-bends and loops to avoid utility conflicts and sensitive areas. These features allowed the team to avoid the use of mechanical expansion joints and associated ongoing maintenance.

Multiple temporary service options were investigated and provided for consideration, including temporary electrical hot water heaters, temporary above ground stream distribution, and temporary FO Boilers. UNCG and RMF worked together to implement the most cost effective temporary solution that still met minimum demand requirements by investigating each building's seasonal usage during the estimated construction window.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Mechanical, Electrical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	2

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Health and Human Performance Facility Chiller Replacement Greensboro, NC	2017	2017

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
UNC Greensboro	Johnny Waterson	336.334.5269

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

HEALTH AND HUMAN PERFORMANCE FACILITY CHILLER REPLACEMENT

UNC GREENSBORO | GREENSBORO, NC

Cost: $820,000

The Health and Human Performance facility, constructed in 1989, is the largest building on campus of UNC Greensboro. It contains classroom buildings along with two substantial gymnasiums. As the buildings stand-alone chiller plant reached the end of its reliable useful life, RMF was selected to engineer a new cooling solution to improve reliability, and efficiency for the facility.

RMF performed field work to develop an AutoDesk Revit MEP as-built model of the existing chilled water mechanical room and cooling tower areas. Next, load calculations, and energy models were developed based on current and planned building space programming requirements. Equipment selection followed based on life-cycle cost analysis.

Two new chillers were selected along with a new cooling tower, pumps, and modern plant control system. Variable speed centrifugal chillers were installed in 200-ton and 400-ton increments for ideal operation during a wide range of cooling loads. A new refrigerant monitoring system was also installed. Control sequences were modernized to take advantage of cold condenser water relief and new pump variable speed drives.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT			
	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Mechanical, Electrical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	3

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Centennial Campus Thermal Utilities Infrastructure Raleigh, NC	2015	2018

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
North Carolina State University	Jake Terrell	919.513.7874

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

CENTENNIAL CAMPUS THERMAL UTILITIES INFRASTRUCTURE

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

Cost: $11 Million

With great reliability and efficiency benefits, the central campus chilled water and steam systems are growing rapidly on NCSU's Centennial Campus. RMF designed thermal utility connections for the College of Textiles Lab, Monteith Research Center, Constructed Facilities Lab and for completion of the main distribution loop.

The AutoDesk Civil 3D design includes more than 3,000 trench feet each of large bore high pressure steam, pumped condensate, high pressure condensate return and chilled water piping in direct-buried cut and cover trench. High pressure steam piping utilizes a class A system with aerogel insulation while chilled water is a fully restrained ductile-iron design. Additionally, mechanical rooms at each building connection are being re-configured using AutoDesk Revit 3D to improve access for maintenance and to allow reception of central utilities and metering.

Installation of the new thermal utility piping required the existing College of Textiles building transformer to be relocated. RMF met with NCSU and building occupants to understand their requirements for a power outage and a custom phasing plan was developed to minimize down time for these critical laboratory facilities. A combination of new ductbank and connecting into existing ductbank allowed for the transformer swap over to occur over a weekend outage.

Thoughtful design of construction phasing was incorporated in the documents to minimize down time for these critical laboratory facilities and to provide safe routing for student pedestrians.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Electrical, Mechanical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	4

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Thermal Utilities to Partners II and Toxicology Raleigh, NC	2020	2021

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
North Carolina State University	David Hammock	919.515.2030

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

THERMAL UTILITIES TO PARTNERS II & TOXICOLOGY

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

Cost: $9.1 Million

The goal for this project was to connect Partners II and Toxicology buildings to the central utility plant (CUP). Underground utilities including chilled water (CHS+CHR) and steam (HPS,PC+HPC) were extended from the Central Utility Plant to the buildings. Additionally, building mechanical rooms were converted from stand-alone generating facilities to utility receiving buildings.

RMF provided 1,600 trench-feet of underground thermal distribution design for steam using a pre-engineered, Class A, piping system and a fully restrained mechanical join ductile-iron pipe for chilled water. The design also included Structural and Mechanical design for six new steam vaults; building mechanical room design for steam PRV stations, hot water heat exchangers, hot and chilled water pumps; suite of flow and energy monitoring systems for new building connections; and design phasing drawings, notes and specifications to maintain building services during the utility transitions.

Two critical research facilities on centennial campus with aged, inefficient and unreliable cooling and heating generation systems were connected to a modern, reliable and efficient energy plant. The central plant boasts chilled water thermal storage along with combined heat and power.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT			
	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Mechanical, Electrical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	5

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings Greenville, NC	2017	2018

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
East Carolina University	Robert Still	919.328.6776

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

REPLACE CHILLED WATER & HVAC - MCGENNIS, MESSICK & SPEIGHT BUILDINGS

EAST CAROLINA UNIVERSITY | GREENVILLE, NC

Cost: $2.25 Million

This project's goal was to connect three buildings: Messick, McGinnis and Speight to the central campus chilled water loop and repair two AHU's in Messick.

RMF's scope of work included underground chilled water distribution and short segments of underground steam and storm water. Mechanical room modifications to Speight and Messick enabled service from the central plant along with energy monitoring. Two air-handling units in Messick were also be repaired. In addition, several three-way control valves were replaced with 2-way control valves where appropriate for delta T improvements. This project also included the replacement of steam supply to Speight Building as well as medium voltage electrical work. The area where these utilities were constructed was very congested with various underground utilities.

A key feature of the project was use of directionally drilled chilled water piping which minimized campus disruption during construction.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Mechanical, Electrical, Civil, Structural

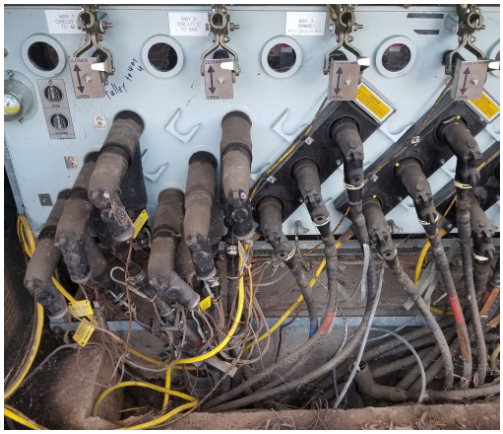
F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	6

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Medium Voltage Power Distribution Grid Modernization Raleigh, NC	2020	2025 (Est.)

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
North Carolina State University	Damian Lallathin	919.513.0373

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



MEDIUM VOLTAGE POWER DISTRIBUTION GRID MODERNIZATION

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

Cost: $45 Million

The vision for this project is to design and construct a modern self-healing 15kV power distribution system, to serve North Carolina State University's main campus for the next 40 years, in fidelity with the electrical distribution master plan, using robust processes to ensure human safety and system quality with minimized campus impact.

This project will provide design and construction administration services to support a $40+M 15kV electrical distribution system upgrade for main (Central and North) campus. The project includes five miles of duct bank trenching, 57 new switches, 111 building transformer tie-ins, and 11 building replacement transformers The design will be delivered in multiple packages, five of which have independent CA processes (Bid, Submittal Review, Close-out, Record Documents).

The project is critical and complex. Delivering power to campus reliably during construction and long term is crucial for both normal function of campus and sensitive campus research programs. Routing duct bank through the high-density areas the campus will require intricate attention to detail during design. Building transitions from old to new circuits and switches during construction will require a significant investment in analysis and logistical planning. Additionally, implementation of a campus wide, automated, self-healing SCADA system of this size will require specialized technical support over a long-term duration.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Mechanical, Electrical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	7

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Centennial Campus Chilled Water Thermal Energy Storage Tank Raleigh, NC	2018	2021

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
North Carolina State University	Damian Lallathin	919.513.0373

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

CENTENNIAL CAMPUS CHILLED WATER THERMAL ENERGY STORAGE TANK

NORTH CAROLINA STATE UNIVERSITY | RALEIGH, NC

Cost: $5.3 Million

North Carolina State University's (NCSU) Centennial Campus is growing with new buildings such as Plant Sciences and EB Oval and with loop additions including the College of Textiles and Monteith Research Center. This project design expanded central chilled water plant capacity with the addition of a stratified chilled water thermal energy storage tank (TES).

During advanced planning stages, options and comparative analysis were developed for each element of the design. The tank was sited to minimize grading and structural retaining walls while remaining accessible and relatively obscure from primary campus views. A deep foundation system consisting of H-piles to bedrock was selected to minimize settlement. Tank aspect ratio was selected to ensure that top of water elevation was at the tallest point on campus yet align well with the top elevation of the adjacent chiller plant. During this stage of design, RMF provided a detailed comparison of steel vs. concrete tank construction with consideration for cost, construction, operations and maintenance.

A 3.5M gallon welded steel tank was selected based on first cost, site construction restraints and bidder competition. The tank stores 25,000 ton-hrs of cooling at 12F temperature differential. From a hydraulic perspective, the tank replaces the current plant primary to secondary bridge / de-coupler. If the primary loop generates more flow than the secondary is consuming, the excess flow will charge the tank.

If the secondary loop is consuming more than the primary is generating then the tank will discharge. Maximum design charge and discharge rate is 12,000 GPM or 6,000 tons at 12 degree temperature differential.

The TES is controlled via a Honeywell HC900 Hybrid PLC system that operates on an Iconics graphics and SCADA package. **An energy model was developed to optimize TES charge and discharge cycles for standard large general service and large general service time-of-use rate structures. Graphical dashboards, key performance indicators and automatic controls sequencing was then developed based on the energy model output.** In addition, RMF also provided sequencing and integration of a nearby steam turbine generator (STG).

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	RMF Engineering, Inc.	Raleigh, NC	Mechanical, Electrical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	8

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
North Chiller Plant Transformation Winston-Salem, NC	2017	2018

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
Wake Forest University	Mr. Mike Draughn	336.782.0071

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

NORTH CHILLER PLANT TRANSFORMATION

WAKE FOREST UNIVERSITY | WINSTON-SALEM, NC

Cost: $4.6 Million

The North Chiller Plant provides chilled water for comfort and process to residential, classroom and laboratory facilities on campus at Wake Forest University. RMF provided planning, design and construction administration services to modernize and transform the aging north chiller plant into a state-of-the-art facility. The project included the replacement of the existing chillers, towers, piping, pumps and electrical system. Utilizing only the existing building shell and medium voltage power supply, 2,400 tons of chilled water generation was added to a facility designed for only 1,200 tons of cooling.

Meticulous attention to equipment selection, layout, accessibility and modeling enabled the new plant to have even better reliability, efficiency and service access than the original design. All plant systems were modeled in AutoDesk Revit MEP. Virtual tours of the plant were made at critical points during the design process. Two 1,200 ton variable speed drive chillers were pre-purchased based on a life-cycle energy model. The model's hours and operating conditions were custom developed based on 12 months of metering and controls data points. Additionally, long lead electrical transformers and switchboards were also pre-purchased to facilitate an accelerated design and construction window.

The variable primary plant features drives on each chiller, pump and tower fan along with chiller plant optimization by Optimum Energy. Additional plant features include chilled water air-dirt separation along with a high-efficiency condenser water filtration system.

Civil and structural design upsized the chiller water distribution mains, expanded the cooling tower yard and provided tower access platforms. Additionally, a screen wall was added to shield views of the new cooling towers from a nearby business school.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT			
	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Raleigh, NC	Mechanical, Electrical, Civil, Structural

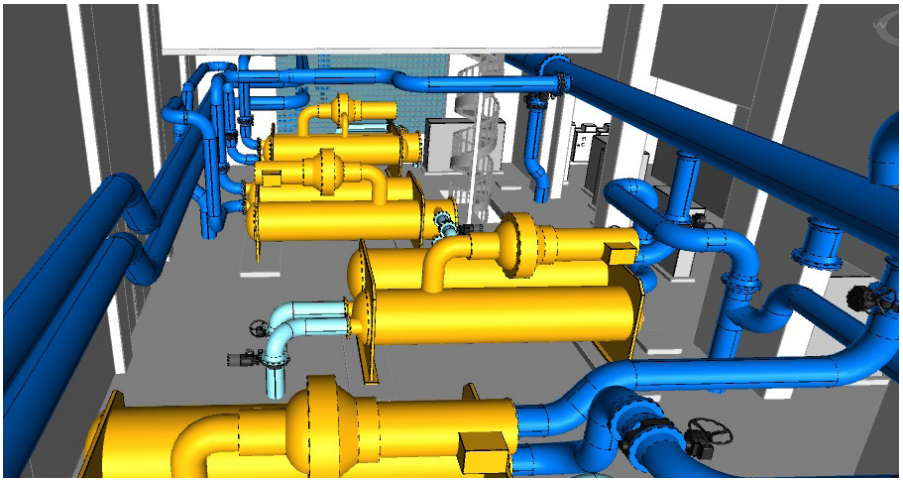
F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	9

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
Holland Plant Chilled Water System Modernization and Expansion Atlanta, Georgia	2017	2018

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
Georgia Institute of Technology	Greg Spiro, PE	404.894.3623

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



HOLLAND PLANT CHILLED WATER SYSTEM MODERNIZATION AND EXPANSION

GEORGIA INSTITUTE OF TECHNOLOGY | ATLANTA, GA

Cost: $3.6 Million

The Holland Plant introduced chilled water production in 1970 and has been incrementally expanded since that time to support the campus' growth. There are several projects planned on campus that would exceed the existing chilled water capacity of the Holland plant. This project enabled the campus to reliably serve the chilled water needs of the campus as well as provided the cooling tower capacity required for the future replacement of its existing 8,000 ton cooling tower.

For this project, RMF provided the design for an additional 2,000 tons of chilled water in place of a 1,060 ton unit and a 2,000 ton cooling tower along with associated support infrastructure. This enabled the Holland Plant to reach its full potential. Critical success factors for the project included successful coordination with ongoing project such as RMF's JCI GESPC project and detailed modeling of complex piping / equipment layout in the Holland Plant.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	RMF Engineering, Inc.	Atlanta, Georgia	Mechanical, Electrical, Civil, Structural

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)	20. EXAMPLE PROJECT KEY #
	10

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
District Energy Plant 2 - Expansion Phase 1 Athens, Georgia	2016	2016

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
University of Georgia	Eric Sherman, PE	706.542.7485

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

DISTRICT ENERGY PLANT 2 - EXPANSION PHASE 1

UNIVERSITY OF GEORGIA | ATHENS, GA

Cost: $4.8 Million

This project was the first step of a phased plan to expand the production capacity of the south campus chilled water system by 6,000 tons. The additional chilled water generation equipment was installed in a new building adjacent to the existing District Energy Plant #2 (DEP-2) located at the intersection of East Campus Road and Cedar Street. DEP-2 was being expanded to handle the new building loads added to the south campus loop, particularly the addition of the science learning center. Over time, the plant will also absorb capacity void associated with retirement of aging decentralized building chillers.

The first phase included the civil, structural and architectural infrastructure for the first 3,000 tons of cooling. All infrastructure systems have been setup for simple and thoughtful expansion with no shut-down requirements moving forward. The mechanical portion of the first phase of the DEP-2 expansion included a 1,000 Ton variable speed electric water-cooled centrifugal chiller. Chiller selection and selection parameters including condenser water flow rates, variable speed drives, etc. were economically evaluated using a net present value life-cycle methodology. Associated cooling tower, pumps, piping and controls have been carefully design for ease of service. The chilled water system was configured using a variable primary hydraulic arrangement. A variety of water filtration systems were evaluated during the design process which led to implementation of a SpiroTherm air-dirt separator on the chilled water system along with an Arkal disc type condenser water filtration system. Electrical service for the first phase of the DEP-2 expansion will come from the existing 12.47kV medium voltage (MV) campus loop feed. Options were developed to allow duel ended electrical services including back-up transformer and switchgear capabilities.

RMF adapted templates to utilize Revit MEP 3D modeling software for chiller plant design. The team regularly provided virtual, animated, 3D tours to UGA during the design process for best review of layout, fit and function.

In addition to providing full design services, RMF's deliverables included full cost estimating and back-up calculations for each submission phase. RMF coordinated with a construction manager during the process and provided support for bidding and construction administration involvement which included bi-weekly site visits.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT			
	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	**RMF Engineering, Inc.**	Atlanta, GA	Mechanical, Electrical, Civil, Structural, Architectural, Energy
b.	**RMF Engineering, Inc.**	Raleigh, NC	

G. KEY PERSONNEL PARTICIPATION IN EXAMPLE PROJECTS

26. NAMES OF KEY PERSONNEL (From Section E, Block 12)	27. ROLE IN THIS CONTRACT (From Section E, Block 13)	28. EXAMPLE PROJECTS LISTED IN SECTION F (Fill in "Example Projects Key" section below before completing table. Place "X" under project key number for participation in same or similar role.)									
		1	2	3	4	5	6	7	8	9	10
Greg Carnathan, PE, CEM, LEED AP	Principal in Charge	X	X	X	X	X	X	X	X	X	X
Johnathan Eveleth, PE, AEE, CEM, LEED AP	MEP Project Manager / Lead Mechanical Engineer		X	X	X	X		X	X	X	X
Matthew Boatwright, PE	Lead Civil Engineer	X		X	X	X	X	X	X	X	
Mark Demana, PE	Lead Electrical Engineer	X	X	X	X	X	X	X	X	X	X
Jim Riches, PE	Structural Engineer	X		X				X		X	X
Heather Rhymes	Landscape Designer										

29. EXAMPLE PROJECTS KEY

NO.	TITLE OF EXAMPLE PROJECT (FROM SECTION F)	NO.	TITLE OF EXAMPLE PROJECT (FROM SECTION F)
1	**Steam Distribution System Replacement** UNC Greensboro	6	**Medium Voltage Power Distribution Grid Modernization** North Carolina State University
2	**Health and Human Performance Facility Chiller Replacement** UNC Greensboro	7	**Centennial Campus Chilled Water Thermal Energy Storage Tank** North Carolina State University
3	**Centennial Campus Thermal Utilities Infrastructure** North Carolina State University	8	**North Chiller Plant Transformation** Wake Forest University
4	**Thermal Utilities to Partners II and Toxicology** North Carolina State University	9	**Holland Plant Chilled Water System Modernization and Expansion** Georgia Institute of Technology
5	**Replace Chilled Water & HVAC - McGennis, Messick & Speight Buildings** East Carolina University	10	**District Energy Plant 2 - Expansion Phase 1** University of Georgia

H. ADDITIONAL INFORMATION

30. PROVIDE ANY ADDITIONAL INFORMATION REQUESTED BY THE AGENCY. ATTACH ADDITIONAL SHEETS AS NEEDED.

NORTH CAROLINA BOARD OF EXAMINERS
FOR ENGINEERS AND SURVEYORS
4601 Six Forks Rd Suite 310
Raleigh, North Carolina 27609

RMF Engineering, Inc, P.C.
5520 Research Park Drive, Ste 300
Baltimore, MD 21228

This is to Certify that:

RMF Engineering, Inc, P.C. is licensed with the North Carolina Board of Examiners for Engineers and Surveyors, and is authorized to practice ***engineering*** under the provisions of Chapter 89C and 55B of the General Statutes of North Carolina.

This authorization must be renewed annually, and **expires on June 30, 2022**

License No. : C-1125

THE NORTH CAROLINA BOARD OF EXAMINERS FOR ENGINEERS AND SURVEYORS

Executive Director

POST IN PLACE OF BUSINESS

Issued 06/15/2021

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Expires: 12/31/2022

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Status: CURRENT
Expires: 12/31/2022

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Status: CURRENT
Expires: 12/31/2022

I. AUTHORIZED REPRESENTATIVE

The foregoing is a statement of facts.

31. SIGNATURE

32. DATE: January, 27, 2022

33. NAME AND TITLE

Greg Carnathan, PE, CEM, LEED AP - Principal in Charge / Director

ARCHITECT-ENGINEER QUALIFICATIONS

1. SOLICITATION NUMBER (If any)

PART II - GENERAL QUALIFICATIONS

(If a firm has branch offices, complete for each specific branch office seeking work. Limit one page per office.)

2a. FIRM (OR BRANCH OFFICE) NAME	3. YEAR ESTABLISHED	4. UNIQUE ENTITY IDENTIFIER
RMF Engineering, Inc.	1983	107668386

2b. STREET	5. OWNERSHIP
8081 Arco Corporate Drive, Suite 300	a. TYPE: Corporation

2c. CITY	2d. STATE	2e. ZIP CODE	b. SMALL BUSINESS STATUS
Raleigh	NC	27617	N/A

6a. POINT OF CONTACT NAME AND TITLE	7. NAME OF FIRM (If block 2a is a branch office)
Greg Carnathan, PE, CEM, LEED AP - Principal in Charge / Director	

6b. TELEPHONE NUMBER	6c. E-MAIL ADDRESS
919.941.9876	greg.carnathan@rmf.com

8a. FORMER FIRM NAME(S) (If any)	8b. YEAR ESTABLISHED	8c. UNIQUE ENTITY IDENTIFIER
Ross Murphy Finkelstein, Inc.	1983	107668386

9. EMPLOYEES BY DISCIPLINE

a. Function Code	b. Discipline	c. No. of Employees (1) FIRM	c. No. of Employees (2) BRANCH
02	Administrative	40	5
06	Architect		
12	Civil Engineers	10	2
21	Electrical Engineers	25	5
42	Mechanical Engineers	55	11
57	Structural Engineers	3	
10	Chemical Engineers		
08	CADD Technicians	25	13
15	Construction Engineers		
12/21/42	Junior Engineers/Designers		
15	Construction Inspector	6	
52	Sanitary Engineer	2	
	Architectural Designer	1	
	Civil Designer	10	3
	Commissioning Agent	15	4
	Electrical Designer	30	7
	Energy Engineer	6	
	Inspector	5	
	Information Technology	5	1
	Plumbing Engineer	5	1
	Mechanical Designer	37	8
	Total	280	60

10. PROFILE OF FIRM'S EXPERIENCE & ANNUAL AVERAGE REVENUE FOR LAST 5 YEARS

a. Profile Code	b. Experience	c. Revenue Index Number (see below)
A06	Airports; Terminals; Hangers; Freight Handling	3
A08	Animal Facilities	5
B01	Barracks; Dormitories	5
E02	Educational Facilities; Classrooms	7
F02	Field Houses; Gymnasiums; Stadiums	5
G01	Garages; Vehicle Maint. Facilities; Parking Decks	1
H04	Heating, Ventilating, Air Conditioning	7
H09	Hospitals & Medical Facilities	7
L01	Laboratories; Medical Research Facilities	7
L06	Lighting (Exterior; Street; Memorials; Athletic Fields)	3
P07	Plumbing & Pipe Design	6
P08	Prisons & Correctional Facilities	3
P12	Power Generation, Transmission, Distribution	6
R05	Refrigeration Plants/Systems	7
R06	Rehabilitation (Buildings; Structures; Facilities)	5
R08	Research Facilities	7
S09	Structural Design; Special Structures	3
S11	Sustainable Design	7
T02	Testing & Inspection Services	2
T06	Tunnels & Subways	6
U03	Utilities (Gas & Steam)	6
V01	Value Analysis; Life-Cycle Costing	1

11. ANNUAL AVERAGE PROFESSIONAL SERVICES REVENUES OF FIRM FOR LAST 3 YEARS

(Insert revenue index number shown at right)

a. Federal Work	8
b. Non-Federal Work	9
c. Total Work	10

PROFESSIONAL SERVICES REVENUE INDEX NUMBER

1. Less than $100,000
2. $100,000 to less than $250,000
3. $250,000 to less than $500,000
4. $500,000 to less than $1 million
5. $1 million to less than $2 million
6. $2 million to less than $5 million
7. $5 million to less than $10 million
8. $10 million to less than $25 million
9. $25 million to less than $50 million
10. $50 million or greater

12. AUTHORIZED REPRESENTATIVE

The foregoing is a statement of facts.

a. SIGNATURE 

b. DATE: January, 27, 2022

c. NAME AND TITLE: Greg Carnathan, PE, CEM, LEED AP - Principal in Charge / Director

ARCHITECT – ENGINEER QUALIFICATIONS

1. SOLICITATION NUMBER *(If any)*

PART II – GENERAL QUALIFICATIONS

(If a firm has branch offices, complete for each specific branch office seeking work.)

2a. FIRM (OR BRANCH OFFICE) NAME **CLH design, p.a.**		3. YEAR ESTABLISHED 1993	4. DUNS NUMBER 968278309
2b. STREET 400 Regency Forest Drive, Suite 120		5. OWNERSHIP a. TYPE S-Corporation	
2c. CITY Cary	2d. STATE NC	2e. ZIP CODE 27518	b. SMALL BUSINESS STATUS 541320 / 54133 / HUB Certified with NC Dept. Of Admin.
6a. POINT OF CONTACT NAME AND TITLE Steven Miller, PE, Vice President			7. NAME OF FIRM *(If block 2a is a branch office)*
6b. TELEPHONE NUMBER 919.319.6716	6c. E-MAIL ADDRESS smiller@clhdesignpa.com		
8a. FORMER FIRM NAME(S) *(If any)*		8b. YR. ESTABLISHED	8c. DUNS NUMBER

9. EMPLOYEES BY DISCIPLINE

a. Function Code	b. Discipline	c. No. of Employees (1) FIRM	c. No. of Employees (2) BRANCH
02	Administrative	2	
12	Civil Engineers	2	
12	Civil Engineer Intern	4	
16	Construction Administration	1	
39	Landscape Architects	7	
39	Landscape Designers	4	
	Other Employees		
	Total	20	

10. PROFILE OF FIRM'S EXPERIENCE AND ANNUAL AVERAGE REVENUE FOR LAST 5 YEARS

a. Profile Code	b. Experience	c. Revenue Index Number *(see below)*
A08	Animal Facilities	2
C06	Churches	1
E02	Educational Facilities	6
G01	Garages/ Parking Decks	1
L04	Libraries	2
P13	Public Safety Facilities	2
R04	Recreation Facilities/ Parks	3
	Roadway	1
	NC Military	1

11. ANNUAL AVERAGE PROFESSIONAL SERVICES REVENUES OF FIRM FOR LAST 3 YEARS
(Insert revenue index number shown at right)

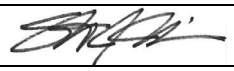
a. Federal Work	0
b. Non-Federal Work	6
c. Total Work	6

PROFESSIONAL SERVICES REVENUE INDEX NUMBER

1. Less than $100,000
2. $100,000 to less than $250,000
3. $250,000 to less than $500,000
4. $500,000 to less than $1 million
5. $1 million to less than $2 million
6. $2 million to less than $5 million
7. $5 million to less than $10 million
8. $10 million to less than $25 million
9. $25 million to less than $50 million
10. $50 million or greater

12. AUTHORIZED REPRESENTATIVE

The foregoing is a statement of facts.

a. SIGNATURE 

b. DATE
January 10, 2022

c. NAME AND TITLE
Steven Miller, PE, Vice President