Brookhaven National Laboratory

Statement of Work

for

Utility Master Plan - 2026

Facilities and Operations Directorate

Energy & Utilities Division

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ABSTRACT

Brookhaven National Laboratory (BNL) is seeking to retain an engineering firm to prepare a **15-year** Utility Master Plan (UMP) for the Laboratory that establishes clear objectives, performance goals, and an actionable investment roadmap for meeting the Laboratory's current and future utility infrastructure needs. These goals must address reliability, resiliency, and redundancy needs. The engineering firm shall first conduct a comprehensive survey of the current and near future power, thermal, potable water, wastewater treatment, and utility requirements for the Laboratory. The UMP shall evaluate the capacity, condition, and performance of the current utility infrastructure relative to projected demand and growth, and identify deficiencies, gaps, constraints, and vulnerabilities that could impact reliability, resilience, or regulatory compliance. The UMP shall develop a prioritized strategic plan for the Laboratory to satisfy forecasted utility infrastructure requirements of key on-site energy distribution and transmission systems. In addition, the UMP shall identify interim measures necessary to maintain the reliability and operability of existing utility infrastructure during the planning and execution of long-term improvements.

The engineering firm is to investigate the following utilities for the UMP:

- Steam generating facilities
- Steam distribution and condensate return infrastructure
- Chilled water generating and distribution infrastructure
- Potable water pumping, treatment and distribution infrastructure
- Sanitary wastewater collection, pumping, treatment, and disposal infrastructure
- Electrical transmission and distribution infrastructure
- Site monitoring and data acquisition infrastructure

The UMP is being developed for BNL's Facilities and Operations (F&O) Directorate, which includes multiple stakeholder organizations with vested interests in the outcome of this effort. Key stakeholders include the Modernization Project Office (MPO), the Campus Development Office, Site Planning and Infrastructure, and the Energy and Utilities (EU) Division.

MPO is responsible for the engineering, design, cost estimating, and project management of conventional construction projects, including those that interface with or extend into BNL's utility infrastructure systems. MPO may be an organization executing specific projects identified by the UMP on behalf of EU.

The Campus Development Office ensures that the Lab's real property assets are upgraded as required to maintain the current and future programmatic and scientific needs. These offices have teams working to obtain various types of Department of Energy (DOE) funding to execute projects identified as part of the UMP final deliverable.

The Energy and Utilities (EU) Division is responsible for the operations, maintenance, emergency response, and all aspects involved in the continuity of operations of the major utilities servicing the broader BNL Campus. Such utilities include medium-voltage transmission infrastructure, steam generation and distribution infrastructure, chilled water production and distribution infrastructure, potable water production and distribution infrastructure, and wastewater treatment infrastructure. In addition, the EU Division is responsible for all energy purchases including electric, gas, and bulk fuels. While other stakeholders may have their role, the primary customer of the UMP team will be EU Division.

Throughout the effort to prepare the UMP, the engineering firm is expected to work collaboratively with personnel from the Laboratory's EU Division who are responsible for operating and maintaining all utilities onsite. The firm is expected to meet regularly onsite with personnel from the EU Division, and other stakeholders as necessary such as scientific staff and large user facility owners as requested/required.

The engineering firm is to complete the UMP within one year from the date of authorization, providing interim draft UMP reports for review and comment. The final UMP is to consist of a written summary report, with electronic files of the referenced material, and a PowerPoint presentation for the Laboratory's management discussing the findings and recommendations.

Table of Contents

1. Utility Master Plan (UMP)

1.1 Introduction to Brookhaven National Laboratory

Brookhaven National Laboratory (BNL) is one of 17 national laboratories, and of the 17, one of ten directly overseen by the Department of Energy's (DOE) Office of Science. BNL is managed by Brookhaven Science Associates (BSA), a consortium formed by Stony Brook University and Batelle Memorial Institute. BNL's purpose is best expressed in its' Mission Statement:

> *"We advance fundamental research in nuclear and particle physics to gain a deeper understanding of matter, energy, space, and time; apply photon science and nanomaterials research to energy challenges of critical importance to the nation; and perform cross-disciplinary research for computation, sustainable energy, national security, and Earth's ecosystems."*

BNL was established by the Atomic Energy Commission (AEC) in 1947 on the former site of Camp Upton, a U.S. Army Base used in World War I and II. Originally established to conduct nuclear research, several early nuclear reactors were built onsite including the High Flux Beam Reactor (HFBR), the Brookhaven Graphite Research Reactor (BGRR) and the Medical Research Reactor. In time, the research emphasis moved from reactor research to nuclear particle research through the construction of several particle accelerators including the Linear Accelerator (LINAC), Alternating Gradient Synchrotron (AGS), and Relativistic Heavy Ion Collider (RHIC). The AEC also was incorporated into the Department of Energy, reflecting the broader nature of fundamental research. Over the years, the research conducted by scientists at BNL has resulted in the award of seven Noble Prize awards, along with numerous other honors.

Today, the tradition of research continues at BNL through the construction in recent years of the National Synchrotron Light Source II (NSLS-II), the Center for Functional Nanomaterials (CFN), and the Interdisciplinary Science Building (ISB). Currently in planning and design is the Electron Ion Collider (EIC), a particle accelerator to be built within the existing RHIC magnet ring, as recently the RHIC mission has ended.

The research at BNL is conducted on a 5,265-acre campus staffed by approximately 3,000 scientists, engineers, technicians, administrators, and support personnel housed in hundreds of buildings onsite. The utility infrastructure supporting the research at BNL is extensive and includes a Central Steam Facility (CSF) producing steam for distribution through an extensive underground piping network to the buildings onsite; a Central Chilled Water Facility (CCWF) producing chilled water for distribution also through an extensive underground piping network; a potable water system consisting of wells, treatment facilities (WTP), elevated storage tanks, and underground distribution piping; wastewater and stormwater collection piping, Wastewater Treatment Facility (WWTF), and various effluent piping; electric transmission and distribution network, substations, switchgear, and distribution cabling; plus a sitewide building management control communication system and other communication networks.

1.2 Definitions

For purposes of this document, the following terms shall have the meanings indicated below. Proposers may supplement these definitions within their technical approach where appropriate; however, these definitions shall govern the intent of the UMP.

- Brookhaven Science Associates (BSA): A partnership between the Research Foundation for the State University of New York on behalf of Stony Brook University, and Batelle.
- Critical Infrastructure: Utility infrastructure, systems, or components whose failure would significantly impair campus operations, life safety, research activities, data operations, or other mission-critical functions.
- Deferred Maintenance: Maintenance, repair, replacement or renewal activities that have been postponed beyond the recommended service interval or useful life of the asset, resulting in increased risk of failure, reduced reliability, diminished performance, or higher future capital cost.
- Energy & Utilities (EU): The Division at BNL is responsible for operating and maintaining all utility systems in a safe and efficient manner. This includes electric transmission and distribution, natural gas distribution, steam generation and distribution, chilled water generation and distribution, compressed air, potable water supply and distribution, fire alarm detection systems, and wastewater collection and treatment.
- Interim Project: Limited-duration measures necessary to maintain reliability and support near-term growth during the transition to long-term system solutions.
- Long-Term: A planning horizon generally extending beyond fifteen (15) years, encompassing strategic infrastructure investments, campus growth considerations, lifecycle replacement planning, resiliency improvements, and major utility system transformations.
- Master Plan: The comprehensive strategic planning document developed under this UMP that evaluates existing campus utility infrastructure conditions, forecasts future demand, identifies deficiencies and opportunities, prioritizes capital improvements, and establishes phased implementation strategies to support BNL's operational, financial, resiliency, and growth objectives.
- Modernization Project Office (MPO): The department at BNL responsible for engineering, design, cost estimating, scheduling, and project controls on conventional construction projects undertaken by the Laboratory, including the selection of Architectural/Engineering firms, contractors and others engaged for these projects.
- Redundancy / Redundant Systems: The provision of additional or alternate utility infrastructure, equipment, pathways, or operational capability intended to maintain continuity of service in the event of equipment failure, maintenance outage, utility interruption, or other abnormal operating conditions.
- Reliability: The ability of a utility system or infrastructure asset to consistently perform its intended function under normal operating conditions over time with minimal unplanned outages, interruptions, failures, or service degradation.
- Resiliency: The ability of campus utility infrastructure and associated operations to anticipate, withstand, adapt to, respond to, and recover from disruptive events or changing conditions while maintaining critical functions. Resiliency considerations may include severe weather events, flooding, utility outages, cyber incidents, equipment failures, climate change impacts, fuel supply disruptions, operational emergencies, and other natural or man-made hazards.

- Useful Life: The estimated operational lifespan during which an asset or system is expected to perform its intended function in a reliable and economically maintainable manner under normal operating conditions.

1.3 Utility Master Plan Objectives and Goals

A significant portion of the core BNL utility infrastructure is decades old, with some components and systems antiquated, worn, or long beyond their useful life. While capital improvements and upgrades are regularly performed, many parts of the existing utility infrastructure were not designed for the level of resiliency that is currently demanded by the scientific community. In addition, there are constantly new utility demands of the new research facilities. Cost, capacity, and reliability must all be considered. BNL is seeking to retain an experienced multi-functional engineering firm to undertake a site-wide Master Utility Plan to analyze the current utility infrastructure, understand the requirements for projected growth and long-term goals, and identify infrastructure improvements and projects necessary for BNL to continue its mission into the future.

The engineering firm executing the UMP shall perform a comprehensive evaluation and analysis of the utility systems at BNL to develop a thorough understanding of the existing infrastructure. This effort shall include assessment of asset conditions, service capabilities, distribution networks, and the ability of the systems to reliably support current and future operational demands.

As part of the evaluation and analysis phase, the UMP project team shall, at a minimum, perform the following activities:

- Conduct interviews with supervisors, operators, and craft personnel for each utility system to capture operational knowledge and field conditions.
- Conduct interviews with Energy and Utilities (EU) engineering staff and management to understand system performance, challenges, and priorities.
- Engage with the Campus Development Office to gain insight into anticipated future utility demands and campus growth.
- Coordinate with Modernization Project Office (MPO) teams involved in utility-related projects to understand lessons learned, as well as planned and ongoing work, to avoid conflicts and duplication of effort.
- Consult with the EU cartographer to better understand both above- and below-grade infrastructure, mapping accuracy, and system complexity.
- Review available operations and maintenance (O&M) manuals, as-built drawings, and maintenance records for critical utility assets.
- Perform site walkthroughs and visual inspections of all major utility plants.
- Perform representative field walkthroughs of distribution systems for each utility to assess condition, complexity, and accessibility. These shall include locations where utilities enter and exit facilities, above-grade installations, and accessible/exposed below-grade infrastructure.
- Review additional supporting documentation, including inspection reports, non-destructive testing records, photographs, prior studies, and feasibility reports, as made available by UMP stakeholders.

The activities listed above represent the minimum requirements necessary to establish a baseline understanding of the current condition of campus utilities, the lifecycle status of critical infrastructure, anticipated campus growth, and the level of effort required to modernize and maintain these systems. This list is not intended to be exhaustive. The project team shall apply their experience and professional judgment to identify and perform any additional tasks required to develop a complete and accurate assessment and evaluation of system needs.

The goal of the UMP is to establish a long-term, integrated vision for the BNL utility system. This roadmap is not simply a list of viable projects, but a coordinated master plan that defines how the Laboratory will transition from its current utility infrastructure to a system capable of reliably and securely supporting projected future institutional requirements within the 15-year plan.

The UMP will identify and evaluate viable projects while placing them within a broader strategic framework that considers system-wide needs, project interdependencies, and logical sequencing. The plan will focus on infrastructure upgrades, system reinforcements, and operational improvements that enhance capacity, reliability and resilience, ensuring continuity of mission-critical operations under a range of operating conditions and growth.

Individual and interdependent projects shall be described in terms of their scope, system performance impacts, and contributions to energy generation, transmission, and distribution capacity, along with preliminary considerations such as equipment sizing and planning-level costs. Supporting materials, including flow diagrams and conceptual drawings, will be provided as appropriate to illustrate how these elements work together within the overall system.

The intent of the UMP is to provide a coherent and forward-looking framework that guides decision-making and investment, ensuring that the Laboratory can continue to fulfill its mission without interruption into the future.

The utility and infrastructure systems to be studied shall include:

- Steam generating and distribution infrastructure, including:
    - Major Oil Storage Facility (MOSF)
    - Central Steam Facility (CSF)
    - Natural gas supply and infrastructure
    - Control systems, communication systems, and balance of plant equipment
    - Entire underground steam supply and condensate return piping systems including the above ground condensate pumps outside of the central steam facility
    - Steam system pressure-reducing valve (PRV) stations within the buildings being served
    - Condensate return pump package within the individual buildings
    - All systems, piping, components, and plant equipment within the Central Steam Facility
    - Emergency generator, fuel storage tank, and transfer switch

- Central chilled water generating and distribution infrastructure, including:
    - Central Chilled Water Facility (CCWF)
    - Satellite Chilled Water Facility (SCWF) at the Chemistry Building (B555)
    - Thermal Energy Storage Tank (TES)
    - Chemical treatment facilities (condenser water and central chilled water loop)
    - Control systems and network communication systems
    - Compressed air supply systems, piping, and distribution

- Chilled water distribution boundary to the chilled water supply and return valve
    - Feasibility of adding a second thermal energy storage tank
    - Addition of a back-up diesel generator to provide backup power, in whole or part

- Potable water pumping and distribution infrastructure, including:
    - Supply wells including all ancillary equipment and systems
    - Water Treatment Facility (WTF)
    - Elevated potable water storage tanks
    - Potable water piping distribution network (including hydrants, valves, piping, fire protection, and backflow prevention devices)
    - Control systems and network communication systems
    - The potable water system boundary to the service entrance of the buildings or the outlet of the building backflow prevention device
    - Suffolk County Water Authority (SCWA) emergency water service

- Wastewater treatment infrastructure, including:
    - Wastewater Treatment Facility (WWTF)
    - Sanitary collection system (including piping, lift stations, metering, etc.)
    - Control Systems
    - Treatment facilities
    - The boundary of the wastewater collection starts at the facility lift stations, or clean-outs and extends to the sewage treatment plant
    - Approach and impact to the WWTF to handle additional blow-down from E-IC cooling towers

- Electric transmission and distribution infrastructure, including:
    - 69kV OH Transmission systems
    - 69kV/13.8kV site substations, and 13.8kV or 2.4kV, to 480V, or 208V unit substations
    - Existing electric distribution manholes and duct banks
    - Sitewide electrical medium voltage distribution conductor networks at 13.8kV; 2.4 kV; underground and overhead.
    - Existing 69kV Automatic Throw Over (ATO) system
    - Relaying fault protection systems
    - Service entrance equipment to the first point of “attachment”
    - Proposed 69kV PSEG transmission system upgrades and integration with existing feeders
    - Future power requirements onsite, including, but not limited to the power requirements for new planned buildings and research facilities such as the EIC Electron Ion Collider (EIC).
    - Identification of system vulnerabilities of the current distribution system and recommend measures to alleviate such vulnerabilities (i.e. 69kV wooden pole infrastructure with double circuits)

    - Analysis of the excessive use of radial feeders and the ability to perform switching for redundant supply
    - Feasibility of installing automatic switching capability
    - Feasibility of installing a power management system

- Miscellaneous sitewide integrated systems, including:
    - Individual utility plant Supervisory Control and Data Acquisition Systems (SCADA)
    - Continued integration of utility systems into a central SCADA system
    - Natural gas supply, distribution, and opportunities for expansion
    - Software systems to enable safety, efficiency and accuracy, i.e. ArcGIS, hydraulic modeling, etc.

The analysis of each utility system shall consider the state of existing equipment, the condition of the equipment within its life cycle, and the ability of the existing infrastructure to reliably meet projected Laboratory growth through into the future. The analysis shall evaluate system reliability and resilience and identify improvements necessary to support future operational requirements.

In addition, specific attention shall be given to utility system safety and worker safety. The Engineer shall report any imminent hazards in any of the utility structures, systems and components (SSC) that they identify through their assessments and recommend mitigation strategies. The engineer shall also identify any Environmental, Safety, & Health (ES&H) improvements or benefits associated with new technologies and new safety systems focused on reducing or removing worker hazards and risks, i.e. exposure to water hammer, heat exposure, shock hazard, arc flash, presence of asbestos on utility systems, etc.

1.4 Specific Requirements to be Identified for Each Utility

The UMP shall provide the following information for each utility system:

- Description of the Current Infrastructure

- A comprehensive assessment of the existing infrastructure, including, but not limited to:
    - Age, remaining useful life, and identification of assets already operating beyond their beyond useful life expectancy
    - Installed capacity, peak output, and overall system redundancy and resiliency
    - Ability to support long-term mission requirements and projected future requirements and demands
    - Geographic location of assets across the BNL site and their suitability for long-term service
    - Conformance to applicable codes, standards, safety requirements, and regulations
    - Environmental, safety, and health considerations

- Projects to Achieve Long-Term Sustained Distribution and Transmission Reliability
    - A gap analysis relative to current and anticipated future requirements
    - Identification of capital projects required to provide robust, maintainable, and resilient utility systems

    - Projects shall be focused on eliminating single points of failure, improving redundancy, modernizing aging infrastructure, and adding on-site generation
    - Systems shall be evaluated and designed to support future load growth, evolving mission needs
    - Recommended solutions shall support a reliability expectancy extending 15-years for each utility system
- Interim and Transitional Projects[1] (limited-duration measures necessary to maintain reliability and support near-term growth during the transition to long-term system solutions)
    - Identification of limited-duration or bridging projects required to maintain reliability during system transitions or to accommodate near-term growth
    - Interim projects shall:
        - Be clearly identified as transitional in nature
        - Avoid precluding or constraining long-term system solutions
        - Minimize possibility of obsolescence
    - Recommendation shall identify:
        - Capital requirements
        - Temporary expansion of service capabilities, if required
- Prioritization of requirements:
    - All recommendations shall be organized by system and prioritized within each system
    - Prioritization shall be supported by documented data and risk analysis
    - All recommendations shall be assigned:
        - A priority with the specific utility
        - A priority across all utility categories
    - Viable alternatives to the recommendations shall be identified and evaluated

- Cost estimates (for both long term and interim transitional projects)
    - Cost estimates for proposed projects or repairs shall be based on current estimating data (R.S. Means, DOE G 413.3-21A Cost Estimating Guide, etc.), actual vendor or contractor quotations, current BNL, or consultant experience
    - BNL will provide guidance on mark-ups and overheads to be applied

1.5 UMP Format

The UMP shall be prepared as a strategic planning document that supports informed decision-making, utility-related capital planning, and implementation sequencing across the Laboratory. The report shall be concise, well-organized, and suitable for executive review, technical planning, and future project development.

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[1] *Note: Interim and transitional projects are largely intended only to support continuity during the transition to long-term infrastructure solutions. Development of these projects is secondary to, and shall not detract from, the UMP's primary objective of establishing sustained, long-term utility system reliability.*

The UMP report shall include, at a minimum:

1. Executive Summary
2. Purpose, planning horizon, assumptions, and methodology
3. Summary of existing utility systems and baseline conditions
4. Projected future campus and utility demand assumptions
5. Utility-specific analyses and findings
6. Gap, risk, and vulnerability summary
7. Alternatives and recommended long-term strategies
8. Interim or transitional measures
9. Prioritized and phased implementation roadmap
10. Planning-level cost summary
11. Cross-utility prioritization matrix
12. Key decisions, risks, and follow-on actions for BNL

Supporting diagrams, one-lines, conceptual system figures, and summary tables shall be provided where useful to communicate system relationships, project dependencies, and implementation sequencing.

1.6 Deliverables

The Engineer's investigative team shall spend time onsite to meet with BNL personnel, inspect the individual utility infrastructure systems and facilities, and present preliminary findings and recommendations to BNL Energy and Utility Division (EU) staff. An initial onsite kickoff meeting with EU staff shall be conducted at the start of the project, followed by recurring monthly progress meetings with EU to present findings, analyses, and recommendations throughout the course of the UMP effort. Monthly progress meetings shall be conducted onsite at least bi-monthly, with alternate monthly meetings by ZOOM or Microsoft Teams.

At four (4) months, the engineer shall issue a report and presentation presenting the results of the Engineer's investigative findings of the utility infrastructure including:

- Executive summary of what has been learned:
  - major system risks
  - emerging cross-utility issues
  - key capacity or resilience concerns
  - major uncertainties still being resolved
- Baseline assessment by utility
  - existing system description at a high level
  - major asset age/condition findings
  - known operational constraints
  - apparent single points of failure
  - obvious safety / ES&H / maintainability concerns
  - early view of whether current infrastructure can support projected needs
- Planning assumptions and future demand basis
  - planning horizon
  - campus growth assumptions

  - major known future projects
  - utility load projection methodology
  - assumptions still needing confirmation from BNL
- Gap and risk register
  - deficiencies
  - vulnerabilities
  - bottlenecks
  - reliability/resilience risks
  - consequence of inaction
- Issues requiring BNL direction, a brief section identifying the following:
  - unresolved questions
  - planning assumptions BNL must confirm
  - scope clarifications
  - data gap
  - strategic choices that affect the final UMP
- Updated work plan for the remainder of the project

BNL shall have up to three (3) weeks to review and resolve any questions that could not be resolved at the presentation. One (1) week after transmittal a comment reconciliation meeting shall be scheduled. The Engineer shall provide meeting minutes for the reconciliation meeting within two (2) business days, and address and incorporate all comments into the next submission.

At eight (8) months. The Engineer shall submit a 90% Draft UMP Report that includes all findings, projects, prioritizations, and roadmaps. All findings, analyses, recommendations, cost estimates, and proposed schedule for implementation shall be included. BNL shall have four (4) weeks to review the draft UMP report and provide a consolidated list of comments back to the Engineer. One (1) week after transmittal a comment reconciliation meeting shall be scheduled. The Engineer shall provide meeting minutes for the reconciliation meeting within two (2) business days, and address and incorporate all comments into the next submission.

At 11 months, the Engineer shall submit a 100% draft report of the UMP for BNL EU review. BNL shall have two (2) weeks to review the 100% report and provide a consolidated list of comments back to the Engineer. One (1) week after transmittal a comment reconciliation meeting shall be scheduled. The Engineer shall provide meeting minutes for the reconciliation meeting within two (2) business days.

The Engineer shall incorporate all final comments into the Final UMP Report, to be submitted at twelve (12) months.

Each interim submission shall be made with four printed copies, and one electronic shared word version (hosted on OneDrive or SharePoint) copy allowing distribution and review by EU staff members.

The final UMP report shall be accompanied by an in-person PowerPoint presentation, having an executive summary of findings, recommendations, cost estimates, schedule and plan for implementation.

1.7 BNL Supplied Material

BNL will supply the Engineer with the following material:

- Existing historian data, trends, and metrics as requested and available
- Access to BNL utility maps
- Access and escort to utility facilities
- Knowledgeable contacts for each of the utilities
- Project liaison
- Access to BNL Standards Based Management System (SBMS) for BNL Policies and Procedures
- Access to BNL documents (e.g. Annual Laboratory Plan, Site Energy and Water Plan, Site Environmental Report, completed feasibility studies, etc.)
- Access to Site Electrical One Line Diagrams
- A list of already identified interim or proposed projects
- Utility outage data
- Utility building facility condition assessment data
- Annual purchased utility data (electric, natural gas, fuel oil)

1.8 BNL Required Training

Prior to performing work onsite, all Contractor personnel shall complete and maintain the following:

- BNL Registration and Badging
- BNL Contractor/Vendor Orientation (CVO)
- Ladder Safety Training: Contractors must provide confirmation that their staff have been trained in the safe use of ladders meeting OSHA 29CFR1926.1060(a). As part of the escorted entry, known issues for fixed ladders will be briefed by BNL staff to the contractor and mitigation measures will be agreed to.
- Confined Space Entry Training: Contractors must provide their written confined space entry program (including training and qualification records) meeting OSHA 29 CFR 1910.146 for BSA review. If the contractor cannot provide a written program and supporting training/qualification documentation, contractor personnel shall perform work under BNL's confined space program while escorted and directed by qualified BNL staff and complete BNL's site-specific confined space training prior to entry.
- Fall Protection Training and applicable Job Performance Measure (JPM)
- Contractor employees will be required to provide and don a safety harness before entering any steam, chilled water, or electrical manhole
- Vendor shall take all BNL training unless they have current applicable safety programs in place, to be submitted to BNL for prior approval. BNL training is site-specific and does not serve as documentation of qualification for confined space, ladder, or fall protection
- Contractor personnel shall attend a daily pre-task briefing conducted by the BNL staff as required, including the signing of a work package. The briefing shall include review of applicable procedures and permits and Identification of hazards and special precautions. Vendor shall provide EU with at least 3-5 days advanced notice of the intent to visit a utility or meet with department staff.

2. Firm Qualifications

2.1 Submission Format

The engineering firm seeking to provide the Utility Master Plan (UMP) shall submit to BNL in their response to the project RFQ the following information:

Tab 1 Cover Letter

- The name, title, address, telephone number, and e-mail address of the individual within your firm who will be the Project Executive for the project and BNL's primary contact concerning the RFP.
- The names and job titles of the primary staff proposed to provide services for the UMP, BSA will have first right of refusal for proposed team. Similarly, any new members added later will require review and approval.
- A statement attesting that the firm will perform all services identified in the RFQ as required by UMP.
- Your firm's main office address, and addresses for any branch offices expected to be involved with the UMP.

Tab 2 General Firm Information

- Proper name of the firm
- History of the firm, including, nature of their business through the years, and identification of current managing personnel
- Number of registered professional engineers working for the firm
- Total technical staff
- Whether any sub-consultants will be retained to work on the project, names and qualifications
- Address and office phone number of either the main office or the branch office where the key personnel who will administer the project are located
- Name and contact information (address, office phone number and cell phone number) of the individual who will serve as the Project Executive. This individual shall be a professional engineer registered in New York State
- Organization chart for all key personnel indicating the name of the Project Executive, and the professional engineers who will be responsible for the analysis of each utility infrastructure
- The Project Executive and each professional engineer shall have thorough knowledge in their areas of expertise.

Tab 3 Prior Firm Experience Completing Campus UMPs and/or Campus Utility Upgrades

The project team, including subconsultants, shall have demonstrated experience and a track record completing UMPs and design for campus utility infrastructure upgrades on comparable in size for Brookhaven National Laboratory. This experience shall be demonstrated by describing their experience on at least three (3) similar projects as the BNL UMP, especially prior UMPs or utility projects completed for other national laboratories, scientific research facilities, college campuses, industrial complexes, or military bases within the past seven (7) years. The comparable projects submitted shall demonstrate the firms' experience with the identification of campus utility infrastructure upgrades such as site wide infrastructure resiliency and redundancy projects; underground central piping distribution for thermal energy, potable water, wastewater, and storm water; central heating/refrigeration plants; and on-site generation/substation, and power transmission/distribution. The experience shall be expressed in project profiles of each of two to three pages in length detailing:

- Name of project
- Proposed team members' role on project
- Client for whom the project was completed
- Contact information for client individuals overseeing the UMP, design or implementation project (i.e. name, title, address, phone number)
- Utilities analyzed or upgraded
- Key findings and recommendations of the UMP/lessons learn from construction
- Description of utility infrastructure upgrade, and total project budget
- Key firm personnel who worked on the project with roles and responsibilities
- Status of supporting project, and date completed
- The Contractor must have successfully completed, in the capacity of a prime contractor, at least two (2) construction projects of similar locations in size and complexity to facilities like BNL within the past five (5) years. At least one (1) of these projects must have been performed at a federal or New York State site.
- BSA will use the Subcontractor Past Performance Questionnaire (AMS-Form-008) to verify the offeror's past performance based on the references provided.
- The Contractor must also demonstrate experience complying with both federal and New York State requirements within the past five (5) years.

Tab 4 Project Executive

The firm shall submit the qualifications of their Project Executive in a resume demonstrating:

- The individual shall be a professional engineer registered in New York State with at least 15 years of professional experience in the analysis and design of utility infrastructure systems supporting multi-building campus environments.
- Managerial experience directing engineering teams in the performance of utility analyses and design upgrades
- Specific projects that the Project Executive has managed
- Educational background

The Project Executive shall remain on the project throughout the duration of the project. Should for any reason the individual not complete the project, the firm shall submit replacement candidates with the required experience for consideration by BNL.

Tab 5 Proposed Project Team with Resumes

The key personnel anticipated to work on the UMP shall be identified and a resume provided indicating their experience.

The engineering team proposed to work on each utility infrastructure shall be identified with an organization chart and resumes for the investigators for each utility. The team shall include team members with experience in utility master planning, engineering, and operating the specific utility being studied.

Tab 6 Proposed Work Plan

The engineering firm shall submit to BNL in response to the RFQ their proposed Work Plan to complete the UMP. The Work Plan shall include, but not be limited to:

- Project team with organization charts
- Means and methods for survey, analysis, conditional assessment of primary equipment, and any recommended specialized testing of the existing current utility infrastructures
- Statement that recent electrical and fuel consumption, and energy usage data for the Laboratory will be obtained, analyzed, and tabulated
- How the basis for future growth projections for each utility load will be determined
- Means and methods to be used to identify projects that enhance energy availability, transmission, and distribution, system redundancy, resiliency, and system lifecycle
- The basis for prioritization of recommended projects within a utility and across all utilities
- Methods and techniques used for cost estimating
- Format to be provided for the UMP
- Plan for scheduling the progress of the UMP in accordance with the UMP milestone schedule
- The Quality Assurance/Quality Control (QA/QC) program to be adhered to during the performance of the UMP

Tab 7 File Formats

Microsoft Office Suite software shall be utilized for material prepared for the UMP including shared WORD for all text; shared EXCEL for tables, spreadsheets, cost estimates, and graphs; and PowerPoint for all presentations. The final UMP Report shall be submitted in Adobe .pdf format, with the original material in Microsoft Word electronically transmitted for backup and possible future BNL use.

All drawings for the project shall be prepared in Autodesk AutoCAD software in either MEP or Revit. All drawings shall be converted into Adobe .pdf format for inclusion in the UMP report. The original AutoCAD files shall be electronically transmitted to BNL for backup and possible future BNL use.

Any utility drawing or mapping shall be prepared in GIS to accomplish integration within the BNL master utility maps.

3. Summary of Site/Utility Data

- 318 Buildings
- 3,000 employees
- Primary Electric: 69kV / 180 MVA
- Peak electrical demand: 59.4 MW (prior to decommissioning the Relativistic Heavy Ion Collider; RHIC)
- Underground Primary: 64.9 miles
- Overhead Primary 6.2 miles
- Potable Water Storage: 1.5M gallons
- Potable Water Piping: 35.2 miles
- Sanitary Collection Piping: 24.1 miles
- Central Chiller Plant: 10,800 tons
- Chilled Water and Compressed Air Piping: 10 miles
- Central Steam Boilers: 475,000 lbs./hr. 125 psi steam
- Steam/Condensate Piping: 9.6 / 10 miles
- Major Fuel Oil Storage: 2.3M gallons
- Underground Natural Gas Piping: 6 miles
- Underground Telecom Cables: 35 miles
- Process Control Wiring: 11.4 miles
- Non-Potable Water Piping: 14.8 miles
- Storm System Piping: 25.9 miles
- Parking Spaces: 5,132
- Total Paved Area: 547,338 sq. yards
- Paved Roads: 28.9 miles
- Sidewalks: 12 miles

Note: historical utility data such as fuel usage, thermal generation, and electrical usage, etc. to be provided by BNL after contract award

4. Exploration of On-Site Energy Production

A goal of the BNL UMP is to focus on efforts that will aid BNL in meeting future energy requirements and improving site resiliency. The selected engineering firm shall investigate specific energy projects that BNL can implement to meet its future energy needs.

Projects to be identified may include, but are not limited to:

1. Onsite Energy Generation
   - Co-generation
   - Gas turbines
   - Fuel cells
   - Other means of producing energy
   - Alternative fuel analysis for steam generation
2. Campus Energy Systems Optimization
   - Decentralized Energy Solutions: Transitioning from centralized heating to distributed energy systems that minimize losses from underground distribution.
   - Energy Storage: Installation of battery systems to store surplus energy and provide backup power during peak demand. Storage of excess thermal energy to re-use during peak operations.
   - Integrated Energy Management: Utilizing advanced control algorithms and software to balance energy supply and demand dynamically, enhancing resilience and efficiency.

The projects identified above are representative samples of the types of projects the Laboratory wishes to evaluate for inclusion in the BNL UMP.

5 Steam Generating and Distribution Infrastructure Evaluation

5.1 Description of Existing Infrastructure

The BNL campus is heavily dependent upon steam from the Central Steam Facility (CSF-Building 610) for building heating, and for critical humidification/dehumidification in numerous research facilities such as NSLS-II, the Center for Functional Nanomaterials (CFN), Computational Science, the Collider Accelerator Department (future Electron-Ion Collider), and the Interdisciplinary Science Building (ISB). High pressure steam at 125 psig is produced in four (4) boilers at the CSF and then distributed through miles of underground piping to numerous buildings onsite, with condensate being returned in condensate piping that generally parallels the steam mains.

The CSF houses four (4) high pressure steam water tube boilers. The four boilers are Boiler B-1A rated at 45,000 PPH, B-5 rated for 180,000 PPH, and Boilers B-6 and B-7 each rated for 125,000 PPH. Total steam generating capacity is 45,000 PPH. Boiler B-1A is the oldest boiler with approximately 63 years of service, with Boiler B-6 being the newest now with 33-years of service. The three larger boilers each have a feedwater economizer, with B-1A lacking an economizer. The economizer on Boiler B-6 is in process of being replaced. Each boiler has an individual combustion fan that is powered via a variable frequency drive. Each boiler is a water tube boiler fired on fuel oil and/or natural gas. Two deaerators provide feedwater to the four boilers. The primary condensate tank which receives return water from the underground piping system is located just outside the CSF in a double-walled underground tank. Vertical turbine pumps located above the tank transfer the return condensate to the deaerators, with feedwater pumps transferring de-aerated water to the economizers and then to the boilers for B-5,- 6 and -7, and directly to B-1A. A water softening system, and chemical feed system adjusting pH and adding sodium sulfite is located by Boiler B-1A.


View of Central Steam Facility (CSF)

Table 5.1 - Central Steam Facility Equipment List

Tag	Capacity (PPH)	Manufacturer	Type	Fuel	Year Installed
B-1A	45,000	Combustion Engineering	D	#2/#4 Oil	1963
B-5	180,000	Babcock & Wilcox	FE	Gas/#2/#4 Oil	1965
B-6	125,000	Babcock & Wilcox	A	Gas/#2/#4 Oil	1986
B-7	125,000	Combustion Engineering	D	Gas/#2/#4 Oil	1994

The Combustion Control Systems (CCS), motor control center controlling pumps, combustion fans, and auxiliary equipment is obsolete. A supervisory control and data acquisition system (SCADA) controls the operation of the four boilers providing combustion control, drum level, furnace pressure, and draft control. The SCADA system will be powered by Allen-Bradley Rockwell Automation Control-Logix PLCs, and individual Allen-Bradley Control-Logix PLCs provide burner management control (current control is AB PLC 5). The SCADA system also monitors and controls other balance of plant (BOP) functions such as the deaerators and feedwater pumps. The CCS and burner management systems are currently in process of being replaced. Emissions monitoring and control is provided by a separate continuous emission monitoring system on oilers #6 and #7.

The CSF's 75-year-old building is a 3-story structure, steel framed with masonry walls and flat roof. The building was expanded in stages with newer sections having insulated panel walls. The masonry walls have structural cracks at various locations. Windows, exterior doors, and ventilation louvers are all deteriorated from the decades of service. The floor drainage system is also blocked, possibly from collapsed below slab piping.

Boiler 1A

Onsite storage for fuel oil for the boilers consists of six (6) cylindrical, horizontal, aboveground storage tanks totaling 2,345,000-gallons. The tanks are contained within an earthen diked enclosure with earthen berm providing secondary containment.

Natural gas for the boilers is provided by a dedicated high pressure, underground, National Grid gas main that enters the site and terminates in a fenced, combination meter/pressure reducing station located just outside the CSF. A low-pressure gas main is piped underground from the reducing station to the CSF where gas is distributed to the four boilers.

The underground steam piping and condensate distribution system is nearly 10 miles long, with certain areas looped, providing redundant flow paths. Much of the distribution system is over 65 years old, and frequent steam and condensate leaks are apparent. The CSF requires significant makeup water to offset the losses in the piping system which then results in high expense for chemical treatment of the makeup water, and accelerated deterioration of the boiler tubes. Many sections of the distribution system still have active lines that were manufactured by Ric-Wil, consisting of steel piping, encased with asbestos or mineral wool insulation housed in a corrugated steel conduit.

These Ric-Wil sections require replacement due to their deteriorated condition and presence of asbestos insulation. Certain piping sections have been replaced with pre-engineered, pre-insulated piping systems.

Boiler B-6

Approximately 92 manholes exist in the distribution system with the manhole structures varying in condition, with some subject to interior steam leaks that have damaged their concrete structures. The manholes contain isolation valves. Most manholes contain steam traps that require replacement and have flash steam heat rejection coils that plague the manholes with steam leaks. Several manholes also contain expansion joints which require replacement due to age and condition. A key Manhole MH-1 located just outside the CSF, was recently reconstructed.

Portions of the electrical distribution system in the CSF date from the original building structure, with branch circuits run to power the boiler combustion air fans and control panels. These components date from when the boilers were installed, with associated motor control centers long past their useful life. The CSF is fed from the adjacent B603 Substation. Combustion fans are powered at 460-Volts. Just east of the building, a 1-MW, Cummins, standby emergency generator exists to power the CSF in the event of failure of normal power. The generator has exceeded its expected life expectancy and requires replacement, along with its' associated automatic transfer switch located in the B603 Substation. A 4,000-gallon, double wall, aboveground fuel oil storage tank is located next to the generator.

Boiler B-5

6. Central Chilled Water Infrastructure Evaluation

6.1 Description of Existing Infrastructure

The BNL campus utilizes chilled water produced in the Central Chilled Water Facility (CCWF) and the satellite chilled water facility (Building 555) for environmental cooling of multiple buildings and for process (i.e. magnets, cryogenic systems, power supply, etc.) cooling of several research facilities. Connected buildings and facilities include the NSLS-II, the Center for Functional Nanomaterials (CFN), Computational Science, and the Interdisciplinary Science Building (ISB). Chilled water from the CCWF is distributed to the connected facilities through an underground piping network of cement-lined ductile iron (CLDI) 4” – 30” in diameter. Certain buildings onsite such as B488-Berkner Hall have their own chillers or utilize packaged DX refrigerant cooling systems. Chilled water is typically distributed at 42-degrees supply and with 52-degrees return water.

The CCWF contains nine (9) single-speed, water-cooled, 4160-Volt, electric-centrifugal Trane chillers, each nominally rated at 1,250 tons. The metal building housing the CCWF is divided into north and south wings, with the north wing being the original building constructed about 1990, with the south wing having been constructed in 2011. Three of the four chillers in the north wing were recently replaced. These new machines utilize R-514A refrigerant with the remaining chillers utilizing R-123 refrigerant, except for CH-3 utilizing R-11. The single speed chillers provide redundancy to the plant, and chillers are cycled on and off based upon plant loading. The table below indicates chiller capacities, manufacturer, refrigerant, and year of installation.

Table 6.1 - CCWF Equipment List - Chillers

Tag	Capacity (Tons)	Manufacturer	Type	Refrigerant	Year Installed	Comp. Overhaul
CH-1	1250	Trane	Electric Centrifugal	R-514A	2026	
CH-2	1250	Trane	Electric Centrifugal	R-514A	2026	
CH-3	1250	Trane	Electric Centrifugal	R-11	1990	
CH-4	1250	Trane	Electric Centrifugal	R-514A	2026	
CH-5	1250	Trane	Electric Centrifugal	R-123	2010	2024
CH-6	1250	Trane	Electric Centrifugal	R-123	2010	2025
CH-7	1250	Trane	Electric Centrifugal	R-123	2013	2013
CH-8	1250	Trane	Electric Centrifugal	R-123	2014	2024
CH-9	1250	Trane	Electric Centrifugal	R-123	2015	

Providing condenser water for the chillers, two cooling towers each service a different side of the plant. The north cooling tower consists of four cells, cells 1 through 4, while the south tower consists of five cells, cells 5 through 9. Each cell is nominally rated 1,250 tons. Water from the north tower cells gravity drain to the CCWF where three condenser water pumps in the lower-level pump into a 42-inch distribution header that feeds the north chiller units. Water from the south tower cells gravity drain into a below grade pool, after which five condenser water pumps in the lower-level pump into a 42-inch distribution header that feeds the south chiller units. The distribution header runs through the plant however both sides are isolated from each other via a manual valve. The towers cannot operate with the valve open as the head from the north tower will result in the pool of the south tower overflowing under the current configuration. Return water from the chillers flows into a return header that is piped underground back to the tower cells.

Existing Cooling Towers at CCWF

The table below indicates cell capacity, manufacturer, and year of installation.

Table 6.2 - CCWF Equipment List - Cooling Towers				
Tower	Capacity (Nom. Cooling Tower Tons)[1]	Manufacturer	Year Installed	Notes
600-1	1360	Baltimore Air Coil	2017	
600-2	1360	Baltimore Air Coil	2017	
600-3	1360	Baltimore Air Coil	2017	
600-4	1360	Baltimore Air Coil	2017	
600-5	1250	Baltimore Air Coil	2013	2024 Fill Repl./Rehab
600-6	1250	Baltimore Air Coil	2013	2025 Fill Repl./Rehab
600-7	1250	Baltimore Air Coil	2014	2025 Fill Repl./Rehab
600-8	1250	Baltimore Air Coil	2014	2026 Fill Repl./Rehab
600-9	1250	Baltimore Air Coil	2015	2026 Fill Repl./Rehab

1. Cooling tower tonnage assumes 15,000 BTU/ton to account for the standard 12,000 BTU/ton plus additional 3,000 BTU waste heat.

The chilled water produced in the CCWF is pumped through an underground distribution piping network to over 20-buidings onsite. The distribution network is approximately 10-miles in length, consisting of cement-lined ductile iron piping varying in size from 36-inch to 24-inch. The chilled water piping system in the CCWF is configured in a primary-secondary pumping network with each chiller having a dedicated, constant-speed, chilled water pump pumping return water through the machine. The chilled water supply from each chiller is manifolded together and piped to Building 659, the pump house, where nine secondary pumps pump the water into the distribution network. The secondary pumps are each on a variable frequency drive, allowing for variable flow operation to match pressure requirements in the distribution system. Portions of the piping system are 35-years or older.

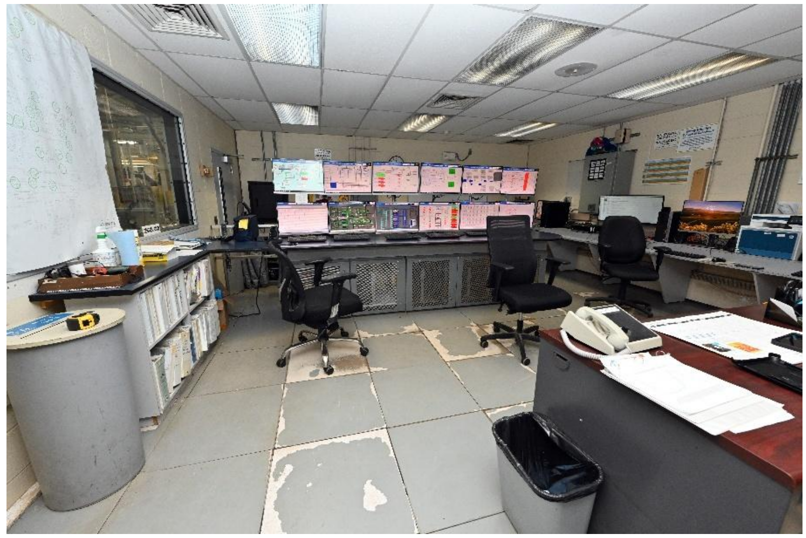
Chilled Water Storage Tank

A 3,200,000-gallon vertical aboveground thermal energy storage tank provides storage capacity for the chilled water piping system. The storage tank enables the CCWF to produce chilled water overnight during low electric billing periods, allowing injection of the stored water into the system during peak daytime periods to reduce the electric costs from the CCWF.

Closeup of Tower Cell Air Intake Louvers

Chemical treatment for the condenser water system, consists of carrion inhibitors, an oxidizing biocide, and a non-oxidizing biocide. A new chemical treatment system for the chilled water distribution system was recently constructed in Building B659 that injects caustic, silica, and azole into the closed loop system.

Operational control of the CCWF is through an Aveva Wonderware human machine interface (HMI) for an Allen-Bradley ControlLogix PLC system communication over ControlNet and Ethernet. Supervisory points and alarms are also pulled through a gateway to communicate with the Automated Logic Control (ALC) building management system for monitoring and alarm notification functions.



CCWF Control Room

The chillers are fed at 4,160 Volts from the Substation at Building 600. Switchgear SWGR-600-1 feeds the motor starters for four chillers and SWGR-600-2 feeds the motor starters for five chillers. The bus in each switchgear is rated at 1200 Amps 4160-Volts. Each branch circuit in the two switchgears has a fused switch. Each switchgear is dual fed from switches at the Substation. The primary chilled water pumps, and the condenser water pumps are fed at 480-Volts from motor control centers. The secondary chilled water pumps in Building 659 are controlled via 480-Volt variable frequency drives. Cooling tower fans are fed 480-Volt power from motor control centers. The condition of the entire electrical distribution system in the CCWF needs to be verified by the UMP Engineer.

The buildings connected to the central chilled water distribution system include those indicated in the table below. The system operates as a supply header system with take offs into buildings and returns back to a central return header. It is not a loop configuration, allowing the supply header to have a second source of chilled water from the satellite chilled water facility which can supply any facility in the network.

Table 6.3 - CCWF Distribution - Building Connected Loads

Building	Building Name	Approximate Load (Tons)
400	Research Support Building	120
463	Biology Building	240
480	Condensed Matter Physics & Materials Science	110
490	NASA/Economic Development & Technology Transfer	650
510	Physics	600
515	Information Technology	700
535	Instrumentation Division	210
555	Chemistry Building	850
701/703	Reactor Building/NSLS II Research Lab	250

725	Computational Science Initiative (CSI)	450
734	Interdisciplinary Science Building (ISB) I	470
735	Center for Functional Nanomaterials (CFN)	600
741	NSLS II LOB 1	410
742	NSLS II LOB 2	360
743	NSLS II LOB 3	260
744	NSLS II LOB 4	210
745	NSLS II LOB 5	360
747	NSLS II Cooling Tower	410
801	Isotope Research Facility	220
815	Environmental Sciences Division (ESD)	260
911	Collider Accelerator Department	90

The satellite chilled water facility (SCFW) is located in B555. This facility generally supports the operation of the central chilled water facility during high load periods, providing redundancy by producing chilled water and pumping it directly into the site's supply header.

The SCWF contains two (2) variable-speed, water-cooled, 460-Volt, electric-centrifugal Carrier chillers, each nominally rated at 650-tons. Both chillers were overhauled in 2025 as part of an energy savings reinvestment project. These machines utilize R-134A refrigerant with the. The chillers are cycled on and off based upon plant loading. The table below indicates chiller capacities, manufacturer, refrigerant, and year of installation.

Table 6.4 - SCWF Equipment List - Chillers

Tag	Capacity (Tons)	Manufacturer	Type	Refrigerant	Year Installed	Comp. Overhaul
CH-5	650	Carrier	Variable Speed Electric Centrifugal	R-134A	2005	February 2025
CH-6	650	Carrier	Variable Speed Electric Centrifugal	R-134A	2005	February 2025

Providing condenser water for the chillers are two single face cooling towers located on the roof of B555, each tower containing two individual cells. Each tower is nominally rated 650-tons. Water from the tower cells gravity drain to the SCWF where condenser water pumps in the lower-level pump into two 10-inch distribution headers with a cross connection with a manual valve that allows either pump to feed either chiller, but causes a flow balance restriction when open with both pumps on; and thus must be closed to operate two chillers. Condenser water piping in this facility is compromised and should be evaluated at part of the UMP. The table below indicates cell capacity, manufacturer, and year of installation.

Table 6.5 - SCWF Equipment List - Cooling Towers				
Tower	Capacity (Nom. Cooling Tower Tons)[1]	Manufacturer	Year Installed	Notes
555-TW1C1	650	Baltimore Air Coil	2005	2025 Fill Replacement
555-TW1C2	650	Baltimore Air Coil	2005	2025 Fill Replacement
555-TW2C1	650	Baltimore Air Coil	2005	2025 Fill Replacement
555-TW2C2	650	Baltimore Air Coil	2005	2025 Fill Replacement

1. Cooling tower tonnage assumes 15,000 BTU/ton to account for the standard 12,000 BTU/ton plus additional 3,000 BTU waste heat.

Finally, SCWF is equipped with a 585-ton “free-cooling” heat exchanger utilizing condenser water, with operating conditions as outlined in the table below.

Table 6.6 - SCWF Equipment List - Heat Exchanger						
Tag	Model	Cooling Capacity (Ton)	Chilled Water EWT/LWT	Chilled Water Flow (GPM)	Condenser Water EWT/LWT	Condenser Water Flow (GPM)
HX-FC	Tranter GXD-100-L-5-HP-221	585	56F / 47F	1,560	45F / 52F	1,950

The 3,200,000-gallon storage tank enables the CCWF to generate and store surplus chilled water overnight in the tank and then release the surplus during peak summertime periods. This process allows fewer chillers to be online during the peak daytime periods, allowing a reduction in the electric demand of the plant on the power supply grid. Free cooling utilizing the heat exchanger can be achieved during winter conditions generally when the outside air temperature is below 40-degrees F.

7. Potable Water Pumping, Treatment and Distribution Infrastructure Evaluation

7.1 Description of Existing Infrastructure

BNL owns and operates its own EPA certified (5111891) Community Water System, consisting of supply wells, a water treatment plant (WTP), two (2) elevated storage tanks, and approximately 35-miles of distribution piping. The supply system provides potable water to the campus buildings for drinking and toilet facilities, fire protection, and process applications. The wells extract ground water from an unconfined upper glacial sand and gravel aquifer at drilled depths of approximately 150 feet. All wells have electrically driven turbine deep well pumps with shafts that go down approximately 50-feet from the surface. Well 7 supplies water to the WTP, while Wells 10, 11 and 12 discharge directly into the network piping distribution system. The outputs from Wells 10, 11 and 12 are pumped through carbon filters to remove low-level PFAS. Two air stripping towers of 11,250 scfm, while are no longer needed to remove volatile organic compounds, cannot be bypassed. The table below lists the existing wells with their location, year installed, permitted withdrawal capacity, actual capacity, and services status.

Table 7.1 - Existing Potable Water Supply Wells					
Well No.	Location	Year	Permitted Capacity (GPM)	Actual Capacity (GPM)	Service Status
4	West of Upton Road (Bldg. 614)	1960	1,200	0	Off-line
6	West of Upton Road (Bldg. 618)	1964	1,200	0	Off-Line
7	West of Upton Road	1964	1,200	820	Active
10	Along Fifth Avenue (Bldg. 634)	1980	1,200	1,000	Active
11	Along Fifth Avenue (Bldg. 635)	1981	1,200	1,000	Active
12	Along Fifth Avenue (Bldg. 637)	1983	1,200	1000	Active

Wells 4 and 6 have been removed from service. The output from Well 7 has declined due to age. This well has been reconditioned several times over the last 15 years.

Under a separate project a Suffolk County Water Authority (SCWA) water supply main has been constructed to provide emergency backup to the BNL supply wells. An interconnection supply building is currently under construction that can provide up to 3,500 gpm.

The WTP is located on the east side of Upton Road near the intersection of Cornell Avenue. The WTP has a capacity of 6,000,000 gallons/day (6MGD). Water from Well 7 is directed to the WTP due to high concentrations of manganese and iron. The WTP consists of the following treatment units:

- Aeration tank
- Rapid mix tank
- Sodium hypochlorite injection system
- Flocculation process
- Lime feed system

- Retention tank
- Slow mix tank
- Rapid sand filter
- Wet well with lift pumps, packed aeration tower
- Clear well
- High service pumps

The WTP primarily treats high concentrations of iron and manganese, reducing these to drinking water level standards.

Existing Elevated Storage Tank

Potable water is pumped to two elevated storage tanks onsite. A new hydrospheroid tank which has a capacity of 500,000 gallons and has recently been placed in service. The older tank located at the east end of Cornell Avenue is 75.5 feet in diameter with a storage capacity of 1,000,000 gallons. The tank has a torus bowl tank with spherical roof. The tank was constructed by Chicago Bridge & Iron Works in 1985. The pressure in the distribution system is maintained at from 55 to 70-psig.

The potable water distribution piping network, approximately 35-miles in total length, consists of underground piping, fittings, and appurtenances of various ages. The older sections date from World War II with miles of asbestos-cement pipe (transite) with some cast iron mains, and some galvanized building service piping sections. Newer sections dating from the 1990's are of cement-lined ductile iron piping or PVC. The transite, cast iron and galvanized pipes along with many isolation valves and hydrants should all be evaluated as parts of this UMP

8. Wastewater Collection, Treatment and Disposal Infrastructure Evaluation

8.1 Description of Existing Infrastructure

The wastewater generated onsite, including that from the toilet rooms, laboratory sinks, laboratory process cooling water, boiler blowdown at the CSF, etc., is typically gravity drained or pumped from basements of individual buildings into the site sanitary sewerage piping collection system. The sewerage collection piping system is an approximate 25-mile-long network composed mostly of reinforced concrete pipe (RCP) and vitrified clay pipe (VCP) and some PVC , with some sections dating back to the original Army base used in World War I and II. Much of the pipe in the collection system has deteriorated from breakage and tree root intrusion and now requires replacement.

The collection system utilizes approximately 60 lift pump stations in combination with force mains and gravity to cause the wastewater to flow to the Wastewater Treatment Plant (WWTP). The lift stations typically consist of either steel or reinforced concrete wet wells with duplex lift pumps. Pump motor starters are contained in aboveground control panels. In the wet wells, tear-drop level switches typically initiate pump operation based on wet well level.

The WWTP was originally constructed by the Army during World War I and reconstructed in 1940. It has received several upgrades since, including the construction of a Filter Building with two (2) disc filters and four groundwater recharge basins in 2013. The Plant has a permitted capacity of 2,300,000 gallons per day (2.3 MGD), with daily average about 0.2 MGD, resulting from summertime influent flow averaging 0.3 MGD, and wintertime averaging 0.2 MGD. The heightened summertime flow results from the higher onsite summer population of visiting scientists and students, and increased process cooling.

Treatment processes at the WWTP include:

- Comminution/screening
- Flow metering
- Radioactive/pH/Conductivity monitoring
- Primary settling tanks
- Countercurrent aeration tanks with final clarifiers
- Dual sludge aerobic digesters
- Silt traps
- Filter Building with two (2) disc filters
- Parshall flume and sampling manhole
- Two (2) holding basins
- Four (4) recharge basins
- Pump station to return disc filter backwash water for treatment

The sludge and scum collected from settling tanks and aeration tanks is processed in the two aerobic digesters. After processing, the treated sludge is transferred to a vacuum truck for offsite disposal at the scavenger tank at the Southwest Suffolk County Sewer Districts' Bergen Point WWTP in Babylon, NY.

Treated effluent from the final clarifiers flows to the Filter Building where two (2) disc filters remove particulate material from the treatment plant effluent. Backwash water from the disc filters is pumped to the head of the plant for treatment. The treated effluent then flows by gravity through a Parshall flow measuring flume with sampling manhole and then is distributed into four (4) groundwater recharge basins where it is polished and returned to groundwater. Prior to discharge, the effluent is sampled and monitored at the sampling manhole in accordance with the Plant's NY State Pollution Discharge Elimination System (SPDES) permit requirements.

Should effluent not be suitable for discharge, the Plant effluent can be diverted to two (2) holding ponds, each with a plastic reinforced bottom liner. One pond, constructed in 1978 has a storage capacity of 2,800,000 gallons, with the second pond, constructed in 1989, having a capacity of 4,000,000 gallons. Total storage capacity is 6,800,000 gallons. From the holding ponds, the effluent can be returned to the plant for treatment or directed to the recharge basins after sampling verifies satisfactory discharge characteristics.

9. Electrical Transmission and Distribution Infrastructure Evaluation

9.1 Description of Existing Infrastructure

Incoming power to BNL is provided by the local utility, the Long Island Power Authority (LIPA), a New York State government entity, responsible for providing electrical power for the residents of Nassau and Suffolk Counties and a portion of the southeastern corner of the Borough of Queens in New York City. LIPA owns the transmission and distribution lines, substations, poles, cables and building services for residential, commercial and industrial customers. LIPA has contracted the maintenance and service of their utility infrastructure to Public Service Electric and Gas-Long Island (PSEG-LI), a subsidiary of New Jersey based Public Service Electric and Gas (PSEG).

The BNL site is powered by two (2) 69 kV overhead transmission lines, Preferred Line to BNL onsite substation 603 (9W Temple Place) and Alternate Line to onsite Substation 631 (8K Fifth Avenue). A 69 kV tie line running between Substations 603 and 631 is used to configure the distribution under specific operating conditions as required.

The major 69 kV equipment in Substation 603 (by the CSF) consists of four (4) gas circuit breakers (GCBs), a number of line and bus disconnect switches and four (4) oil-filled air-cooled transformers stepping the 69 kV power down to 13.8 kV. The transformers are rated at 20/26.7/29.87 MVA.

The major 69 kV equipment in Substation 631/638 consists of one (1) oil circuit breaker (OCB), four (4) gas circuit breakers (GCBs), several line and bus disconnect switches and five (5) oil-filled air-cooled transformers stepping the 69 kV power down to 13.8 kV. The transformers are rated at 20/26.7 MVA.

Substations 603, 631 and 638 have metal enclosed buildings which house the 15 kV switchgear lineups. The bus of the 15 kV switchgears is connected to the secondary taps of the 69 kV to 13.8kV power transformers via cable bus or bus duct. Substation 603 has four (4) 15 kV switchgear lineups, Substation 631 also has four (4) 15 kV lineups, and Substation 638 has one (1) 15 kV switchgear lineup.

The 15 kV switchgear lineups feed power to the 15 kV distribution substations located throughout the BNL site. Feeder circuits are primarily run in underground duct banks, although several feeder circuits are routed overhead on poles.

Twenty-eight (28) 13.8 kV GE Magna Blast breakers in Substation 603 (on Bus 1 and 3) are currently being replaced.

GE Magna Blast Lineup in Substation 631

The site has a limited 2.4 kV distribution system which is fed via four (4) substations with 13.8 kV to 2.4 stepdown transformers. The 2.4 kV distribution system serves areas that primarily date from the old U.S. Army buildings and immediate surrounding areas.

480-Volt unit substations are located at various load centers throughout the BNL site. Typically, the substations are single or double-ended, fed via 15 kV (or 2.4 kV) cabling with 13.8 kV (or 2.4 kV) to 480-Volt oil-filled air-cooled transformers, and associated 480-Volt distribution switchgear and/or switchboards.

In Substation 603, 69 kV Switchgear Line-up-Bus 1 is approximately 70 years old, Bus 3 is 56 years old, and Bus 2 is 36 years old. Bus 0 is 11 years old.

In general, most of the existing electrical distribution systems consist of outdated electrical equipment that is past or nearing its expected service life. Maintenance of the medium voltage (15 kV and 2.4 kV) is difficult due to the unavailability of parts for the aged equipment and costly due to the coordination of required power outages without other paths to feed the power.

The engineering firm preparing the UMP is expected to evaluate and analyze the complete Electrical Transmission and Distribution Utility Infrastructure. The evaluation is to include LIPA services, medium voltage substations, transformers, switchgear, switches, underground distribution duct banks and cabling, distribution substations with transformers and switchboards. The evaluation is to determine defects and problems with the existing components and make recommendations for correction. The evaluation is to include an analysis of the distribution system to identify areas of the site requiring electrical reinforcement with new distribution duct bank, feeders and substations to handle current and projected future loads from new buildings and research facilities.

Significant consideration should be given to the safety of BNL staff operating the switchgear with a goal of all systems operating with a potential arc flash energy level below 8 cal./cm^2.

10. Site Monitoring and Data Acquisition Infrastructure Evaluation

10.1 Description of Existing Infrastructure

Brookhaven National Laboratory currently maintains three (3) campus-wide site monitoring and data acquisition networks, the Automated Logic Control (ALC) building automation systems providing environmental control in most buildings, the Allen-Bradley Rockwell Automation Control-Logix supervisory control and data acquisition (SCADA) systems in the utility plants, and the Keltron fire alarm system that relays critical utility alarms back to the Energy & Utilities (EU) Division. Finally, the site also maintains a chemical treatment system with standalone interfaces for cooling towers, that interfaces back to ALC for centralized monitoring and trending.

The ALC building automation system provides automatic operation of the heating, ventilating and air conditioning (HVAC) systems in nearly all major buildings onsite. BNL's standardization of a single manufacturer's building automation system onsite provides several key advantages, including requiring that the controllers and components of only a single manufacturer need to be stocked for maintenance rather than having to stock the controllers and components of multiple manufacturers. Also, EU engineers and technicians only need to be familiar with the programming of a single manufacturer's controllers rather than requiring knowledge of multiple manufacturers' programming intricacies. The Energy Management team owns, operates, and maintains the ALC system on behalf of the lab, with support from the local authorized manufacturer's representative. The in-house team has engineering design, programming, calibration, and integration capabilities. The total points connected to the ALC building automation systems campus-wide are estimated to be in excess of 10,000. The ALC systems in the individual buildings are networked site-wide via the BNL network and conduit infrastructure allowing Facilities and Operations (F&O) as well as systems users to view the operation in the individual buildings from their offices, as required.

The ALC system is constantly being expanded to integrate various efficiency controls, predictive maintenance algorithms, and to provide visibility and alarm transmission capabilities from the critical utility Allen-Bradley PLC control systems.

The Allen-Bradley Control-Logix SCADA systems monitor and control operations in the Central Steam Facility (CSF), the Central Chilled Water Facility (CCWF), the Water Treatment Plant (WTP), and the Wastewater Treatment Plant (WWTP). The systems utilize Allen-Bradley Rockwell Control-Logix programmable logic controllers (PLCs) for programming with an AVEVA (formerly In-Touch) Wonderware human machine interface (HMI) software for operator interaction. The ALC network communicates selected data to the individual SCADA networks through different protocols including Modbus and Ethernet allowing engineers in the CSF to monitor operation of the environmental systems in critical buildings. The total number of points connected to the SCADA network in the utility plants is estimated to be approximately 2,000.

BNL is seeking to improve and expand the monitoring of key campus operations by connecting additional critical utility systems and equipment to the SCADA systems. A major component of this expansion would be monitoring and possibly controlling the transmission and distribution of electrical power on campus, including monitoring/controlling of key components in all the major substations, such as:

- Power monitoring and switching of the 69 kV circuit breakers
- Monitoring of the 69 kV to 13.8 kV transformers
- Pressure monitoring of the 15kV SF_6 switches
- Power monitoring and switching of the 13.8 kV substation circuit breakers
- Monitoring of the switches and transformers in the distribution substations throughout the BNL campus

12. Regulatory Requirements

All work performed under this Contract shall be executed in full compliance with applicable Department of Energy (DOE) requirements, Federal, State, and Local regulations, and Brookhaven National Laboratory (BNL) policies, procedures, and standards. The Awarded Bidder shall ensure that all personnel, subcontractors, and suppliers are fully aware of, and adhere to, the requirements outlined in this Section.

12.2 Federal, State and Local Regulations

The following Federal, State, and Local laws, regulations, and ordinances, are applicable to the development of the UMP:

- Federal regulations such as OSHA (29 CFR 1910, 29 CFR 1926), NFPA standards, and EPA regulations (40 CFR, 49 CFR).
- New York State Building, Fire, Mechanical, Plumbing, and Energy Codes, as adopted and amended by the State of New York.
- Suffolk County and Town of Brookhaven permitting requirements, zoning ordinances, and environmental regulations.

End of SOW