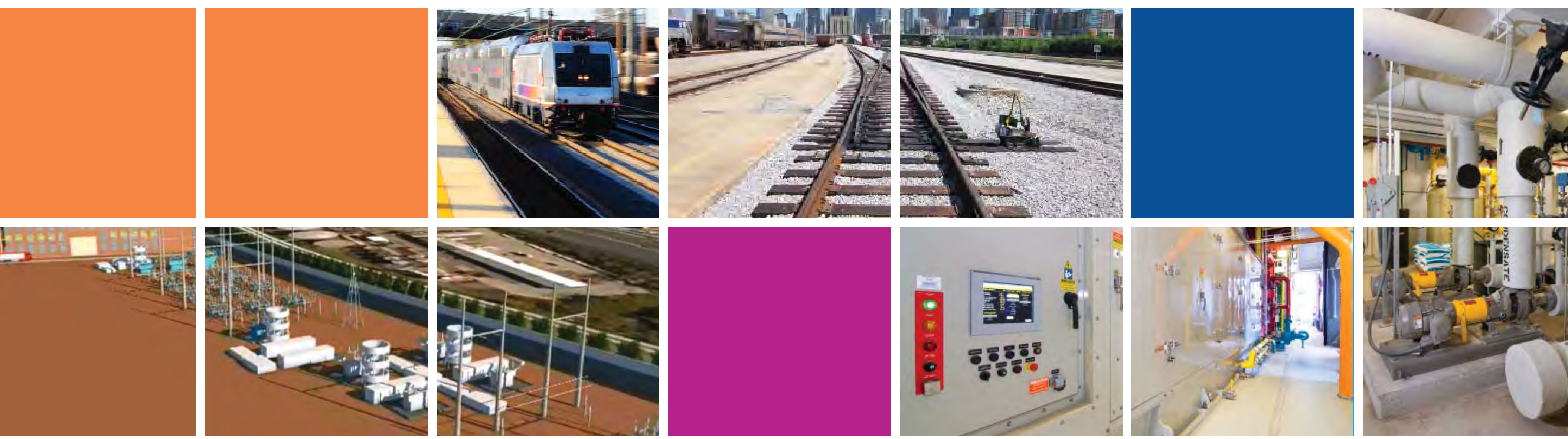
Technical Proposal for Design, Engineering,
Construction Assistance and Other Technical Services for the

NJ TRANSITGRID Project

RFP No. 15-031 | August 25, 2015



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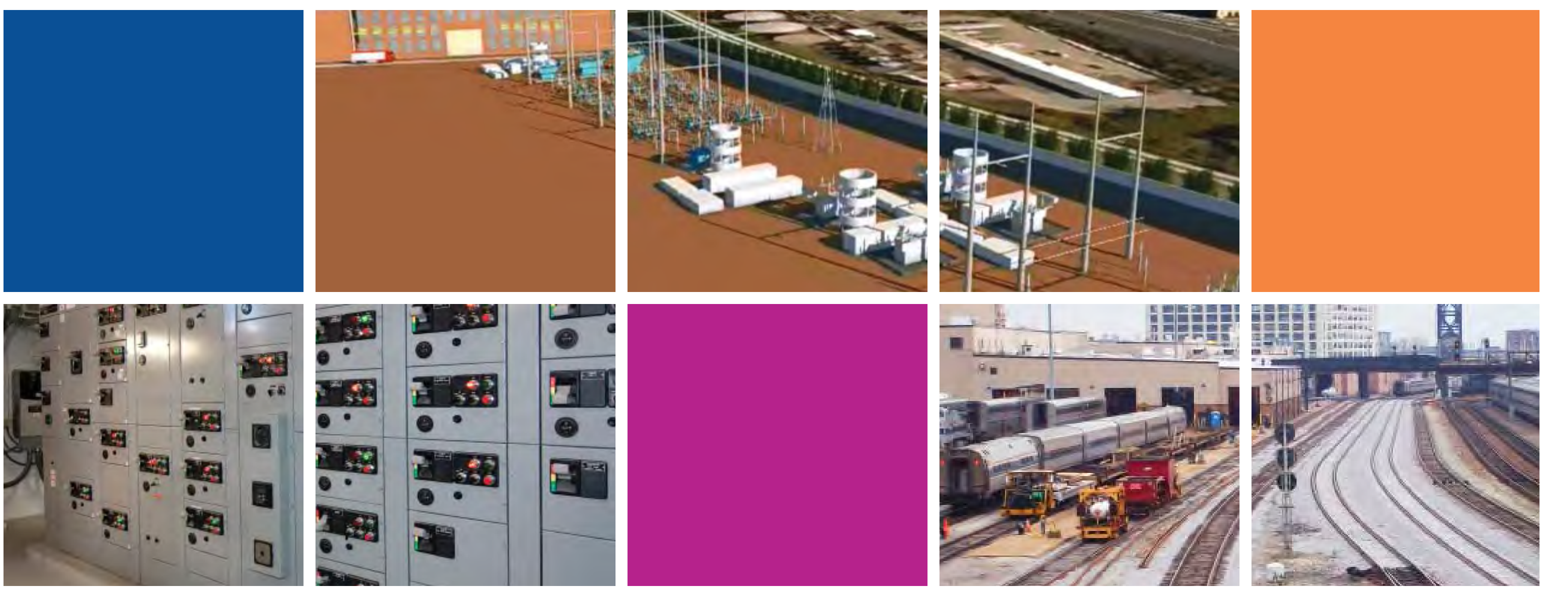

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NJ TRANSIT Corp.
Procurement Department
One Penn Plaza East, 6th Floor
Newark, NJ 07105-2246
Attn: Thomas J. Fusco

RE: Technical Proposal for NJ TRANSIT RFP NO. 15-031 - Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project

Dear Mr. Fusco:

You need and deserve a strong partner to help you get the NJ TRANSITGrid project across the finish line on budget and on schedule. Jacobs has assembled a team with the microgrid technical expertise, in-depth understanding of railroad engineering and operations, and the regulatory know how to deliver your first-of-its-kind railroad microgrid – on budget and on schedule. We have dedicated our most knowledgeable resources to this project, have the proven experience and expertise to manage risk, have a strong understanding of your objectives based on our prior work with Sandia, so you can be confident that we will meet the challenge. ***Our Team is fully charged, and ready to go.***

The Jacobs NJ TRANSITGrid Team:
- Jacobs Engineering Group Inc.
- Burns Engineering, Inc.
- Levitan & Associates, Inc.
- LTK Engineering Services
- InfraMap Corp.
- exida Consulting, LLC

DBE Subconsultants:
- GTS Consultants, Inc.
- Jersey Boring & Drilling Co., Inc.
- LKG-CMC, Inc.
- Matrix New World Engineering, Inc.
- Richard Grubb & Associates, Inc.
- SJH Engineering, PC
- Sowinski Sullivan Architects, PC
- Sullivan Cove Consultants, LLC

We Understand the Goals and Objectives of this Request for Proposal (RFP)
We are prepared to meet your goal of developing a microgrid system capable of providing reliable power to support critical transit infrastructure by:
- ✓ Executing the project consistent with Federal Transit Administration (FTA) grant requirements and providing programmatic submittals and reports in conformance with your Superstorm Sandy Recovery and Resilience Program.
- ✓ Assessing technology options and assisting you in selecting the technology providing the highest level of reliability, potential for expandability, and affordability.
- ✓ Right-sizing the power plant based on complete and accurate power load analysis studies.
- ✓ Navigating the regulatory process to avoid time consuming and costly regulatory delays, and fast tracking the regulatory requirements.
- ✓ Developing the design for the NJ TRANSITGrid to support the NJ TRANSIT/BEM Team in preparing an Environmental Impact Statement (EIS), meeting permitting requirements, and preparing a 20% design package to be included in the RFP for the final design, construction, and potential operation of the NJ TRANSITGrid.
- ✓ Supporting you after contract award through construction support services and other technical assistance as required, including stakeholder communications and third party coordination.

Areas of Concern
Based on a full understanding of the project goals and objectives, the regulatory process, and our assessment of risk, we have identified areas where due diligence, smart thinking, and consensus building can achieve risk avoidance or risk mitigation to minimize areas of concern. We have studied the areas of concern, and believe they are all manageable. We believe the three areas requiring the most comprehensive risk mitigation strategies relate to early equipment procurement, the regulatory process, and constructability. ***A more detailed discussion on risk avoidance and mitigation can be found in the Introduction -Section 1 and under Task 7 Risk Management in the Work Plan -Section 5.***

Project Management Leadership
We have developed a management team that consists of experts in power, railroad engineering, regulations, and microgrid construction. Our Project Manager, **Roger Copeland, PE**, has been involved in at least 10 microgrid projects and has managed 6 of them from planning to construction. Our Deputy Project Manager, **Diaa Elmaddah, PE,** is a seasoned railroad engineering professional with extensive experience delivering projects on active commuter rail lines. Roger will be your single point of contact for the project and focus on driving the overall project performance and the power engineering tasks. Diaa will manage

the day-to-day requirements of the project and work closely with Rail Engineering, Project Controls, and Quality Task Leaders to assure ongoing performance and project execution. ***For more details on our Team's structure refer to Team Organization & Resource Allocation – Section 6.***

Technical Execution
The technical execution of the work is led by our highly qualified professionals aligned to meet the challenges of this project. Our Team of professionals provides:

- Strong microgrid and rail expertise and leadership.
- Prior NJ TRANSIT project experience.
- Prior experience with NJ TRANSIT and Sandia on the Alternatives Analysis.
- Extensive PJM, NERC, and FERC expertise.
- Prior experience with PJM's Reliability Pricing Model Capacity Valuation Mechanism, which will provide you with the economic and financial information required to understand the financial aspects of selling power, and operating and maintaining a microgrid system.
- Former NJ TRANSIT personnel to support development of innovative financial structures to maximize profit without impacting the core goal of the project.
- Thorough, proven, and effective Project Controls.

Additional information is provided on our Team in Qualifications of the Individuals – Section 3 and our actual execution of the project can be found in the Work Plan - Section 5.

Quality
Jacobs lives by the mantra "we own quality", meaning we take responsibility for our actions and work and expect the same of our subconsultants. Our Quality Manager, Russell Ferretti, PE, CMQ/OE, CQA, will make sure the Team adheres to the quality control procedures, while our Quality Control Task Leader, Bruno Fiorentino of Burns, will control the quality of the job. ***You can find a more detailed write-up on Quality in the Quality Assurance Plan – Section 7 and our Work Plan – Section 5 Task 1.3 Quality Control.***

Total Commitment
The Jacobs Team is fully committed to this project. The Senior Management of each of the firms have committed to Jacobs the key staff identified on our organization chart ***contained in Team Organization / Resource Allocation – Section 6***. The Project Executive for Jacobs, Stanley Rosenblum, has the authority to make decisions on behalf of Jacobs, and our Project Manager, Roger Copeland, is fully empowered to make decisions related to this project. Stan will meet with Roger at least monthly to review the project and provide Roger the full support he needs to drive success.

We Will Deliver
We believe our Team can make a difference in delivering this project for you based on:

- ✓ Our work on the Sandia Report;
- ✓ Our expertise in managing risk related to equipment, regulation, and construction; and
- ✓ Our strong, proven, and ongoing relationships, both with NJ TRANSIT and third party stakeholders including Amtrak, local communities, FTA, PSE&G, regulators, and other interested parties.

Our commitment to you is to:

- ♦ Dedicate our staff to this project;
- ♦ Provide you the best advice possible from our experts;
- ♦ Manage the identified risk; and
- ♦ Make certain the path we take is constructable and delivers for you a microgrid project that is known as the type of projects all electrified railroads want to replicate.

Sincerely,

JACOBS ENGINEERING GROUP INC.

Stanley Rosenblum, Vice President / Project Executive

Roger Copeland, PE, Project Manager

Icons Used in Our Proposal

Team

Constructability

Quality

Power

Section 1

Section 1 | Introduction

The decision to design and advance the NJ TRANSITGrid is an innovative, first of its kind major undertaking. You need and deserve a partner that has the management experience, engineering expertise, and regulatory know-how to drive the schedule and budget and complete the project successfully. You also require a strong partner that knows both rail electric traction and microgrid power systems. Jacobs has assembled a best in class team of leaders in the rail and the power marketplace to meet your goals and deliver this important NJ TRANSITGrid project. We recognize the challenges, understand the risks, and will work with you to allow you to move forward with confidence. Together, we can develop and advance a project that will make a tremendous difference in the lives of your customers during periods of major power disruptions, and demonstrates to your stakeholders and peers that NJ TRANSIT is a leader in resiliency and recovery.

We Understand Your Challenges

Peak Performance – The #1 goal of the project is to provide a safety net power system to the commercial power grid in the event of a major power failure. It has to work – and work right. It is critical that the system effectively and efficiently manage the unique variable power demands of an electrified railroad that can operate either in islanded mode or as part of a commercial power grid. You need a partner who has the knowledge to design a system that performs to your demands.

Regulatory/Interconnection – There are significant requirements for regulatory and interconnection approvals, as well as the potential for improvements to the local transmission grid. Of particular concern is the PJM approval process, which is long and can affect the cost of the project. You need a proven partner to help you navigate the approval process.

Schedule – The PJM interconnection process requires early procurement of generation equipment. Risk minimization through properly structured contracts is a necessity for successful early procurement. In addition, FTA funding includes a Buy American requirement, which can present challenges for equipment selection. We also recognize the challenge of reaching consensus with third parties such as Amtrak. You need a partner who understands your procurement requirements and risk tolerance, and can help you work within your constraints to drive the process and meet the schedule.

Constructability – There are significant construction challenges associated with completing the work required within the existing rail right-of-way. You need a partner with extensive transmission line experience in congested environments combined with the experience working inside your railroads, who understands how to avoid and mitigate pinch points and operating conflicts.

- *We will meet the challenges. We are fully charged and ready to go.*

Section 1

- *Our knowledge of the power demands and our technical expertise deliver peak performance.*

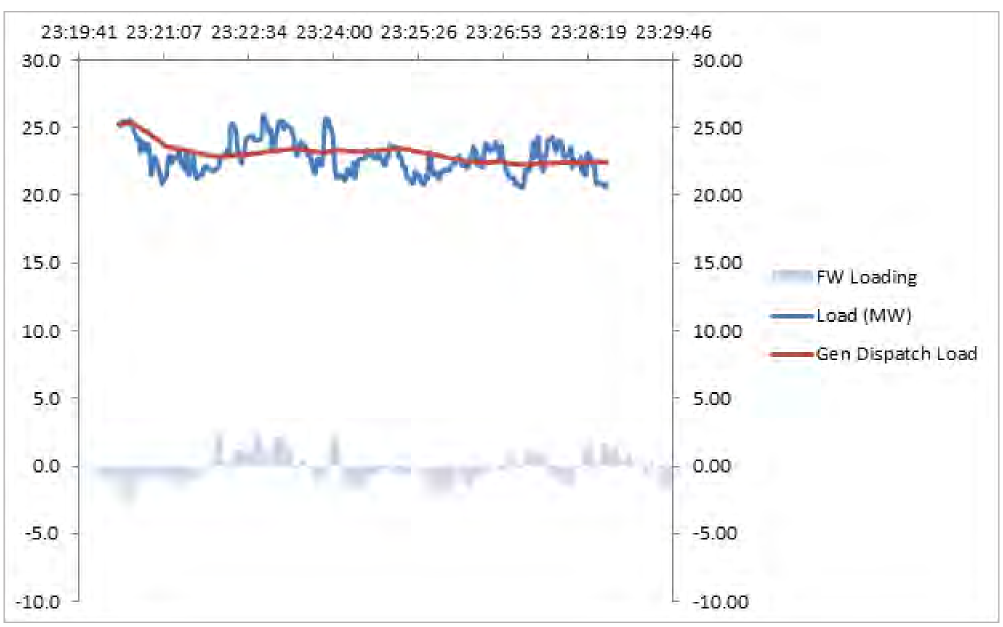
Peak Performance

We understand and have modeled the power needs of the Northeast Corridor and NJ TRANSIT. Jacobs' and Burns' work on the Sandia Microgrid Alternatives Analysis Study means we understand the work that has already been done.

LTK recently conducted the power load analysis for Amtrak on the NEC, so we have a unique understanding of Amtrak power demands, which is a large component of the composite load profile. We have a unique understanding of the economic, technical, and operational aspects of the project, so we are ready to start work immediately.

We have the expertise and the experience needed to develop strong technical solutions. Our Project Manager, **Roger Copeland,** is an expert in microgrid systems. Roger brings a distinctive set of management and technical skills, since he has been responsible for all stages of development for energy projects, including the conceptualization, planning, design, procurement, construction, testing, and commissioning. He has the ability to communicate complex technical issues, so you fully understand the options under consideration.

Our process for selecting the right technology mix for this application is based on sound science. We will develop detailed real-time load projections, and then determine which technology options are capable of meeting the rate of change of load for long-term operation in island configuration. The options will be further expanded with the consideration of energy storage, such as flywheels and large-scale pumped battery storage. This allows for smooth load transitions and a predictable load profile. By load shaping the curve to reduce the noise, other generation options may become viable for consideration, such as simple cycle combustion turbine or a combined cycle machine with provision for waste heat recovery. This concept of load shaping is shown in the graphic below and discussed in great detail in **Task 2 of Section 5 – Work Plan.**



Section 1

Getting the right load curve and finding the most effective and efficient technology mix to supply this load profile is the real key to project success. Our experience in this market and with utility scale frequency regulation informs our thinking and will lead to the optimized solution.

We have broad-based design, construction, and operating experience with different microgrid plant technologies.

As an industry leader in utility scale microgrid applications, we have broad experience in various technology solutions. We understand the practical limitations of performance, where they fit in the marketplace, and how to determine the optimal mix for a given application. We have unmatched experience in utility scale frequency regulation design, which will prove vital in finding a technology mix that can meet the challenging load profile, while not becoming a maintenance problem. We also understand what equipment is manufactured in the US and abroad and can develop a logical approach to Buy America where possible.

We have a thorough understanding of design, construction, and operation and maintenance (O&M). We will leverage this knowledge to develop the logical and lowest risk project packages for each component and system. We have a detailed discussion on the **contract packaging sections (Tasks 13 and 14) in Section 5 – Work Plan** that focuses on the design through construction. We also have full service operations and maintenance staff that currently run many of the largest federal facility and capital programs in the country, such as the NASA program. We are prepared to leverage this knowledge for NJ TRANSITGrid by informing you of what is reasonable in the marketplace, allowing for optimized O&M contract packaging.

We understand microgrid commissioning.

New microgrid / power generation projects require a thoughtful commissioning process to control the risks during start-up. Each system must be individually and thoroughly checked out to verify that each and every component is installed, calibrated, tested, and operating correctly. Failure to do so can result in system inoperability, reliability issues, equipment damage, and potential impact to human life. We take this task very seriously. Our Team will work with you, the installation contractors, and equipment suppliers to make sure that a valid and comprehensive testing and start-up procedure is developed well in advance of system readiness. Our experience and the hands-on approach of our key engineers during start-up and commissioning will guide the process to success. More details on this topic are discussed in Phase 2, Task 6, and Task 9 of Section 5 – Work Plan.

- *Our experience designing two frequency regulation plants in the PJM market gives us unsurpassed working knowledge of both the market and one of the premier suppliers of technology in this market. We designed a 20MW facility in Stephentown, New York, and one in Hazle Township, both that dispatch into the PJM market for ancillary services. These technologies are ideally suited for application such as NJ TRANSITGrid that require rapid response and integrate a noising profile over time.*

- *Our experience and relationships with the regulatory community deliver interconnection approvals on schedule.*

Regulatory / Interconnection

We have managed the PJM process successfully.

The PJM application process is regimented and requires NJ TRANSIT to provide highly technical engineering data to successfully complete the interconnection review process within the time contemplated. The application process timeframe can be reduced by aligning the submission with the PJM schedule driving the review period. Missing a deadline to PJM, submitting incomplete or inaccurate data, or failing to submit the required legal paperwork and fees will result in a loss of your place in the queue, dramatically affecting the project schedule. PJM operates on a six-month schedule, so the schedule impact would be significant. We have successfully navigated the interconnection and regulatory process for PJM as well as other regional transmission entities. As your consultant, we will fully brief NJ TRANSIT on the PJM process and review the requirements, processes, and risks associated with the PJM application. We will develop different approaches to the application process highlighting impacts on schedule, budget, and the risk associated with the various options. Our experience means we have the ability to gain early feedback from PJM reviewers and we understand the concerns of PSE&G. You can be confident that we will minimize the review time, manage the risk, and provide a high-level of certainty on the expected outcome of the process in meeting the anticipated schedule, and reducing the risks of having a complete facility without the ability to sell into the PJM marketplace.

We have deep relationships with PSE&G and other utilities that will have impacts on the regulatory reviews.

One of the levels of uncertainty we will manage is the PJM specified level of investment to the commercial grid that NJ TRANSIT may be required to make to connect the microgrid to the commercial grid. Understanding the potential upgrades PJM and PSE&G may require, and knowing how to successfully work with them to minimize this additional investment is a critical component of project success. Although we believe the improvements to the PJM commercial grid will be minimal because of the size of the plant and the east-to-west flow of the power, we will set up discussions and reviews with PSEG staff and regulator reviewers to understand, as best as possible, their potential requirements. Minimizing unexpected upgrades will be vital to controlling costs. Our relationships at multiple levels with these third parties will allow you to properly plan for risk and exposure.

We have experts on NERC and FERC and fully understand the requirements of these agencies.

As a generator owner connected to the bulk electrical system, you will fall under the purview of Federal regulations regarding Critical Infrastructure Protection for this project. Our experience and expertise in the requirements of NERC CIP 5.0 regarding cybersecurity, along with appropriate storm and other event hardening requirements, will assure full compliance with the established standards. We will use our expertise and experience to make this project as impenetrable as possible and provide you with the confidence that the microgrid will operate as intended during major disruptions to the commercial grid.

Section 1

We have relationships with the NJBPU and understand state-level utility regulations. Existing New Jersey utility regulations allow on-site generation to serve facilities that are located on property contiguous to where the generating facility is located. If the properties are not geographically located next to each other, but are separated by an easement, public thoroughfare transportation or utility owned right-of-way, then an exemption would have to be obtained from the NJBPU. If the NJ TRANSIT and Amtrak properties are deemed not contiguous under existing state utility regulations, NJ TRANSIT would have to become a utility in order to serve the Amtrak load.

We understand New Jersey utility regulations and our relationships with both the NJBPU and PSE&G allow us to work with the Commission's staff for an exemption to this regulation based on strong public interest associated with the project.

We can leverage our experience with Amtrak to fashion a fast-track review process. Developing an integrated review and approval process with Amtrak is critical to maintaining the schedule. Members of our Team work daily with Amtrak, and we have the relationships to help bring them into the project in a collaborative fashion.

Schedule

We can streamline project mobilization based on previous work.

Through our work on the Sandia Microgrid Alternatives Analysis Study, County Yard, Portal Bridge, and extensive involvement in the Superstorm Sandy Recovery and Resiliency Program, we already know your systems and the project background. This will allow for seamlessly moving into the next steps of the project reporting requirements and interface without wasting valuable time.

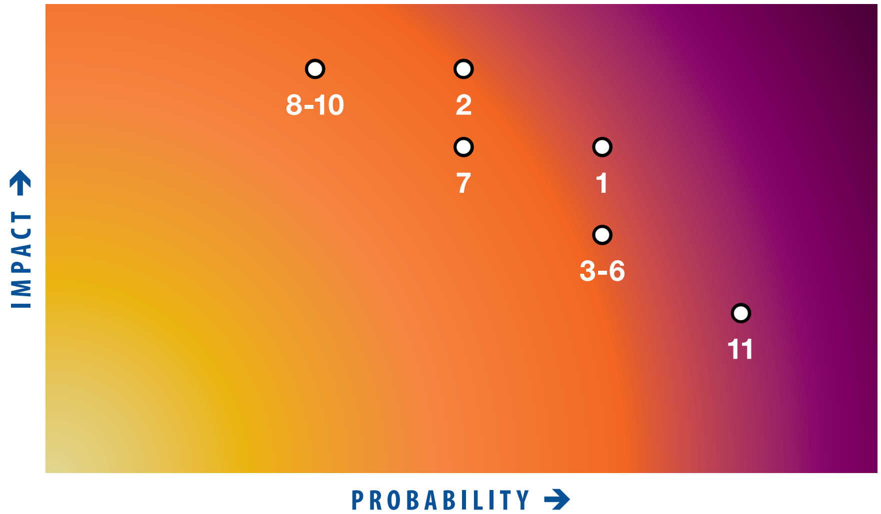
We will keep the project on schedule through Active Risk Management.

We have conducted a preliminary risk review session on this opportunity and have identified some of the key risks to the project and operational success. These risks are based on our Team's perspective. One of the first things we would do is to collaborate with you to identify risks based on further knowledge and understanding of the project. We can view preliminary risks on a heat map, shown below, which drives attention to those items that are most likely to cause the largest problems. Our first pass risk review for this project identified the following key risks that warrant immediate attention. **In Task 7 of Section 5 – Work Plan,** we discuss these risks in detail.

- *Our streamlined approach delivers NJ TRANSITGrid on time.*

TOP RISKS

1. Long equipment lead times
2. Inadequate load data
3. Discord on basis of design
4. Distribution along Right-of-Way
5. Funding
6. BPU regulations for Amtrak
7. Inadequate construction QA
8. Stakeholders withdraw support
9. Environmental permitting
10. BPU prohibits T&D along NJ TRANSIT ROW
11. Inadequate basis for O&M future



One of the key risk components is long equipment lead times and equipment selection. Equipment varies drastically not only in performance but in physical arrangements and design criteria between vendors and technology. The PJM interconnection process, the air permit, and the basis of design development for the 10% and 20% submittals are dependent on selection of the equipment. We have identified this step as crucial in the overall project implementation, and advocate risk mitigations measures to deal with this issue.

We believe the most effective and practical way to manage the risk is to right-size the equipment, **as discussed in Task 2 of our Work Plan,** and then procure the equipment prior to design completion. We understand that you typically would not take this path from a procurement philosophy, but our experience can help mitigate the risks of this approach, and we trust we can develop a path to success. We are prepared to discuss the risks of this approach, share numerous success stories of risk avoidance and cost assurance, and recognize the advantages with FTA funding timing, Buy America provisions, design and cost certainty, and schedule compliance.

We understand the FTA regulations regarding equipment sourcing and Buy America provisions. Our Team routinely selects and purchases major equipment and understands the limitations and challenges that Buy America presents. We have the background and understanding of the various generation technologies and where they are sourced. We can help you meet the Buy America provisions, where possible, and provide the required waiver documentation for items, such as the static frequency converters, that cannot be sourced from American suppliers.

Section 1

Constructability

We are already familiar with the work proposed on the transmission lines in the right-of-way.

Through Burns' experience with the Sandia Microgrid Alternatives Analysis Study, we already understand what needs to be done in the right-of-way and where the pinch points are. We also know from prior project experience, the local community groups will be vocal over any modifications to their views or elimination of trees. We know how to work with communities to build consensus and reduce opposition to transit investments.

As a single team with a extensive experience working on the NJ TRANSIT Rail, Amtrak, and HBLRT systems, we have complete understanding NJ TRANSIT's and Amtrak's design requirements, operating philosophy, safety culture, and tolerance level to customer and community concerns. We know the physical characteristics of the railroad rights-of-way this project will impact, and recognize the design and layout of the transmission and distribution lines will have to address conflicts, clearance, and capacity constraints. Our intimate understanding guides our project scheduling, construction plans, and community engagement to make sure that the proposed solutions can be implemented on time, with minimal impacts and community outcry. We will work with appropriate NJ TRANSIT staff on the railroad, engineering department, and community outreach to assess potential areas of risk, and implement time tested mitigation strategies to manage the outcome and avoid potential delays caused by field conditions, rail operations concerns, or stakeholder opposition. Our Team has done this with projects such as the Montclair Connection, the Bergen Line Second Tracking, and the Meadowlands project.

- *Our understanding of your system and the work proposed delivers implementation with minimal impacts*

Summary

We understand the pressure and expectations placed on you to "get this project right". You need a trusted partner to work through the issues, provide the best advice, and manage the project schedule. You need a partner to help you drive success. **We are that partner.** Our unparalleled knowledge of the preliminary work, ability to apply critical thinking, unique experience in the areas of microgrid, energy storage solutions, our regulatory understanding and relationships, and our track record of delivering complicated projects in and around operational railways makes the Jacobs Team the right choice to help you achieve project success.

Our Project Management Team of Roger Copeland and Diaa Elmaddah provides strong leadership on both sides of this important equation: rail and power. They have the key background and understanding to lead this complex technical team of professions to deliver project success for the NJ TRANSITGrid.

We are fully charged and ready to go.

Section 1

The Jacobs' Team Difference

The Jacobs Team is uniquely positioned to support your project objectives. Our exceptional set of qualifications, people, and experiences will provide you with the resources and expertise to deliver the NJ TRANSITGrid on budget, on schedule, and fully operational.

- We start fully engaged because of Jacobs and Burns involvement in the Sandia Report. We are in the best position to support NJ TRANSIT in selecting the right technology by virtue of our understanding of your expectations, and our knowledge of technology choices.
- We understand the power demands of NJ TRANSIT and Amtrak. LTK's prior studies will allow us to fast-track the analysis and provide certainty to our study. Locking down the power needs drives the entire schedule; and getting the power load right is critical to right-sizing the power plant.
- As EPCm microgrid experts, Jacobs will be able to guide you through each stage of the project and help mitigate risk along the way. As your partner, we will develop a risk mitigation plan for each stage and make certain NJ TRANSIT has no surprises. With a high-profile project like the NJ TRANSITGrid, it is critical that your stakeholders and decision makers are kept fully informed.
- Our extensive first-hand experiences with regulators and utility stakeholders including NJBPU, NERC, PJM, FERC, and others will provide NJ TRANSIT with a roadmap to gain acceptance and a "crystal ball," so you can better plan for the demands and requirements placed on the project. We can take the unpredictability out of PJM and others.
- Jacobs' microgrid and rail experience enables seamless execution and project delivery. We have worked with all our partners on previous projects and know they share our core values. Our singular vision promotes teamwork and coordination, resulting in great work products and a tremendously open, out-of-the-box thinking environment.

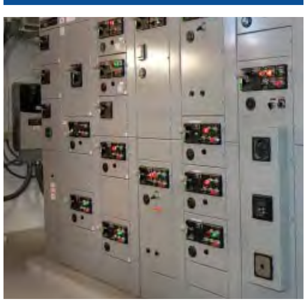
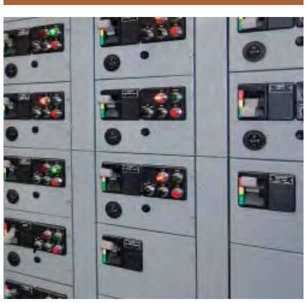
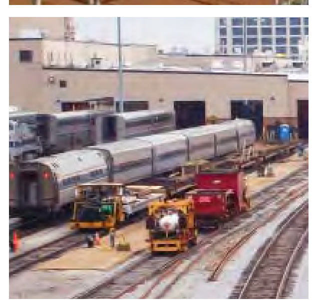
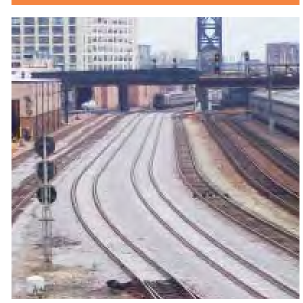
Jacobs' and Burns' extensive rail experience with Amtrak and NJ TRANSIT makes sure the power elements of the project are fully integrated into the rail needs and requirements.

Our balanced expertise makes sure that NJ TRANSIT achieves both their most important objective – a microgrid that is designed for NJ TRANSIT's rail needs, and one that will work and move people in times of crisis and in periods of normality.

Fully charged. Ready to go. Jacobs NJ TRANSITGrid Team

2 Qualifications of Firms



Section 2

Section 2 | Qualifications of Firms

The Jacobs Team is comprised of individuals with the expertise, experience, and relationships to successfully deliver for you the NJ TRANSITGrid Project consistent with your project performance goals, schedule, and budget. Our Team will provide you with the expertise to right-size the project and select the best technology, the experience to advance the project through procurement and construction in Phase 2, and the relationships and knowledge to navigate through the PJM, NERC, FERC, and NPCC process and secure approvals from third parties such as Amtrak.

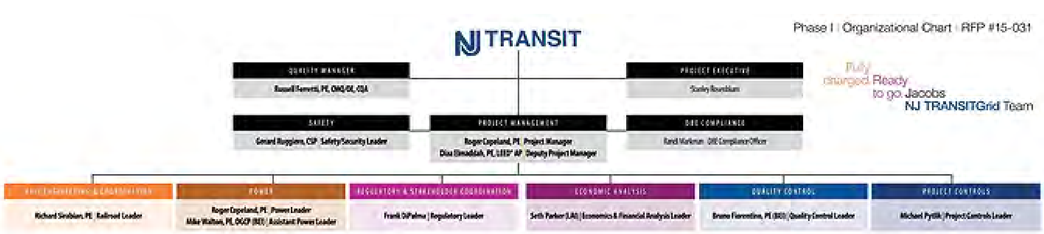
ORGANIZATIONAL STRUCTURE AND PERSONNEL REQUIRED FOR PROJECT:

Our Team is structured to assure:

- Streamlined and well-defined management structure.
- Single point of contact between NJ TRANSIT and our Project Team.
- Empowered task leaders responsible for the execution of the work plan.
- Assigned responsibility for the Integration and coordination of the work performed.
- Defined Task Leader responsible for the engineering elements of microgrid, including the structural foundation for the microgrid.
- Defined Task Leader responsible for the rail, civil, and structural engineering elements.
- Strong Project Controls Leader responsible for analyzing the schedule and budget, overall progress and document control.
- Independent Quality Assurance Manager and Safety Manager.

THE CORE MANAGEMENT TEAM: The Core Management Team consists of the Project Manager, Deputy Project Manager, and Task Leaders for Rail Engineering & Coordination, Power, Regulatory & Stakeholder Coordination, Economic Analysis, Quality Control, Project Controls, and the Assistant Task Leader for Power. Rounding out the Core Management Team are Project Executive, Quality Manager, and Safety & Security Manager.

Reference Section 6 Team Organization/ Resource Allocation for a more in-depth discussion on our management structure, and a comprehensive look at our team structure through our organization charts.



Section 2

PROJECT OFFICE: The project office will be the Jacobs Morristown, NJ office, which is a full-service engineering office conveniently located within 20 miles of NJ TRANSIT's Newark headquarters. Jacobs and our subconsultants certify that a full-time office is maintained during the entire project period.

Key Staff Availability

We want NJ TRANSIT to know that we have the appropriate personnel to properly staff each task of this project. We based the following Key Staff availability percentages on current backlog and assignments, along with each person's current availability for this contract.

Name	Role on this Project	Firm	Other Project Commitments	Percent % Available
Project Management Team				
Roger Copeland, P.E.	Project Manager / Power Leader	Jacobs	0%	100%
Diaa Elmaddah, P.E., Leed®, AP	Deputy Project Manager	Jacobs	0%	100%
Stanley Rosenblum	Project Executive	Jacobs	0%	100%
Russell Ferretti, P.E., CMQ/OE, CQA	Quality Manager	Jacobs	0%	100%
Gerard Ruggiero, CSP	Safety Lead / Construction Safety - Railroad	Jacobs	0%	100%
Richard Sirabian, P.E.	Rail Engineering & Coordination Lead	Jacobs	0%	100%
Michael Walton, P.E., DGCP	Assistant Power Leader	Burns	0%	100%
Frank DiPalma	Regulatory & Stakeholder Coordination Leader	Jacobs	0%	100%
Seth Parker	Economics & Financial Analysis Leader / Negotiations for Power Sales	Levitan	0%	100%
Bruno Fiorentino, P.E.	Quality Control Leader	Burns	0%	100%
Michael Pytlik	Project Controls Leader	Jacobs	0%	100%
Rail Engineering & Coordination Team				
Modeling				
F. William Lipfert, Jr.	Rail Power Analysis / Operations Modeling	LTK	50%	50%
Electric / Traction				
Daren Petroski, P.E.	Sr. Traction Power Leader	Burns	35%	65%
Robert McPherson, P.E.	Sr. Traction Power Engineer	Jacobs	45%	55%

Section 2

Kalaivanan Uthirapathy, B.Eng., C.Eng, MIET	Static Frequency Converter / Substation Engineer	Jacobs	30%	70%
Communications / Signals				
William Wiedmann, MIRSE	Signals Leader	Burns	35%	65%
Frank Velazquez	Signals	Jacobs	40%	60%
William George	Communications	Jacobs	50%	50%
Robert Rosa, P.E.	Energy Management / SCADA Coordination / Power SCADA	Jacobs	45%	55%
Railroad Operations				
Manuel Cabrera	Rail Coordination / Force Account	Jacobs	60%	40%
Site / Civil				
James Homoki, P.E.	Site / Civil Lead and Acquisition Identification	Jacobs	60%	40%
Kenneth Bienkowski, P.E., AVS	Utilities Engineering / Relocation	Jacobs	45%	55%
Thomas Decker, P.E.	Hydraulics / Drainage Engineer	Jacobs	80%	20%
Michael Kaminski, P.E.	Sr. Structural Engineer	Jacobs	25%	75%
Power Team				
Power Process				
Kent McAnally, P.E.	Lead Power Process Engineer	Jacobs	25%	75%
Herbert Tull, P.E.	Lead Mechanical Engineer	Jacobs	0%	100%
Joseph Saltarelli, P.E.	Mechanical Engineer	Jacobs	25%	75%
Power Electrical				
Darrell Widner, P.E.	Lead Electrical Engineer	Jacobs	25%	75%
Michael Lewis, P.E.	Electrical Engineer	Jacobs	25%	75%
Kalaivanan Uthirapathy, B.Eng, C.Eng MIET	Substation Engineer	Jacobs	30%	70%
Anthony Marsh, P.E.	Relay and Coordination Engineer	Jacobs	0%	100%
John Beaudry, P.E.	Lead I&C Engineer	Jacobs	25%	75%

Morgan Sutton, P.E.	Electrical Engineer	Jacobs	50%	50%
Cybersecurity				
Eric Persson, Comp TIA Network+, CISSP, CACE	Cybersecurity	exida	40%	60%
Russell Ferretti, P.E., CMQ/OE, CQA	Quality Manager	Jacobs	0%	100%
Transmission / Distribution				
Asif Bhangor, CPEng., RPEQ	Transmission Engineer	Jacobs	50%	50%
Daryl Scott, MIE, CPEng., RPEQ	Distribution Engineer	Jacobs	50%	50%
Randy Winks, P.E.	RR Coordination / Integration (Wires) and Constructability – Transmission Lines	Burns	35%	65%
Anthony Zeloyle, P.E.	RR Coordination / Integration	Jacobs	45%	55%
Structures				
Gabriel Serna, P.E.	Structural Engineer	Jacobs	25%	75%
Cesar Vallenilla, Ph.D., P.E.	Structural Engineer	Jacobs	25%	75%
Robert Witte, Jr. LEED® AP	Architecture	SSA	70%	30%
Stephen Donohoe, PMP	Construction Safety (Facility) / Safety in Design Coordinator	Jacobs	35%	65%
Regulatory & Stakeholder Coordination Team				
PJM Connection				
Edward Tsikirayi	PJM Regulations & Interconnection	Levitan	25%	75%
William (Mike) Williams	PJM Coordination/Administration / O&M Cost Estimating	Jacobs	25%	75%
Regulatory Interface				
Michael Rafferty	PSE&G Interface, NERC, & NPCC / Cost Benefit Analysis / Utility Liaison	Jacobs	25%	75%
John Graham, Esq.	Regulatory Interface - FERC	SCC	25%	75%
Gas Supply				
John Bitler	Gas Supply	Levitan	40%	60%

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Third Party Coordination				
Jon Livingston	Third Party Coordination - Agency Liaison	Jacobs	25%	75%
Jayne Yost, AICP	Third Party Coordination - FTA Reporting Compliance	Jacobs	40%	60%
Jeffrey Stiles, P.P., AICP	Third Party Coordination - Public Involvement	Jacobs	60%	40%
Economic Analysis				
Financial Structure				
Charles Wedel, CPA	Financial Structure	Jacobs	0%	100%
Economic Analysis				
Alex Mattfolk	Power Price Forecasts, Plant Operational Modeling	Levitan	25%	75%
Matthew DeCourcey	Fuel Price Forecasts	Levitan	25%	75%
Economic Screening				
Philip Curlett, P.E.	Economics Screening Analysis	Levitan	40%	60%
Cost Estimating				
William (Steve) Jones	Capital Cost Estimating	Jacobs	45%	55%
Venket Tiruchirappalli, P.E.	Cost Estimating	SJH	60%	40%
Quality Control				
Kevin Fox, P.E., CEM, LEED(R) AP	Quality Control - Power	Jacobs	25%	75%
Dale Legg, P.E.	Quality Control - Rail / Constructability Lead	Jacobs	25%	75%
Constructability				
Steven Eichinger, P.E., LEED® AP	Constructability - Electrical	Jacobs	45%	55%
Philip Semler	Constructability - Rail	Jacobs	60%	40%
Rodney Carpenter	Cogeneration Construction Specialist	Jacobs	25%	75%
Risk Management				

Michael Albergo, P.E., PMP, LEED® AP BD+C	Risk Management Facilitator / Lead	Jacobs	50%	50%
Richard LaRuffa, P.E., CVS	Risk Management – Rail and Value Engineering Leader	Jacobs	40%	60%
Richard Carlson, Ph.D.	Risk Management - Regulatory / Economics	Levitan	40%	60%
Peer Review				
Peter Rasmus	Peer Review Leader	Jacobs	25%	75%
Project Controls				
Scheduling				
David Morgan, CPE, CPM	Scheduling Leader	Jacobs	0%	100%
Document Controls				
Alla Kudravitsky	Document Control	LKG-CMC, Inc.	0%	100%
Veronica Hollis	Configuration Management	LKG-CMC, Inc.	0%	100%
Interface & Integration Management				
Mehul Gandhi, P.E., PMP, PSP	Interface & Integration Coordinator	Jacobs	25%	75%
Procurement				
Stanley Grill	Procurement Specialist	Jacobs	0%	100%
David Cimino	Bid Support	Jacobs	25%	75%
Roderick Schwass, LEED® AP	Grant Management	Jacobs	30%	70%
DBE Compliance				
Randi Markman	DBE Compliance Officer	Jacobs	25%	75%
Technical Support				
Environmental Support				
James Dowling, PP, AICP, AVS	Federal / State Environmental Review	Jacobs	50%	50%
Thomas DeMichele, LSRP	Environmental Remediation	Matrix	25%	75%
Steve Ricucci	Environmental Permitting	Jacobs	50%	50%

Section 2

Kimberly Glinkin, PP, AICP, LEED® AP	Environmental Planner - Air / Noise	Jacobs	50%	50%
Paul McEachen	Archeological Resources	RGA	50%	50%
Miles Cheang	Environmental Planner - GIS Mapping	Jacobs	40%	60%
Surveying / Land Support				
Rick Voss, PLS	Surveying and Right-of-Way	GTS	30%	70%
Tammy Schlagbaum, ASLA	Landscape Architecture	Jacobs	30%	70%
Corrosion Prevention				
Michael Shelton, PE	Corrosion Prevention	Jacobs	25%	75%
Geotechnical & Subsurface				
Christopher Ellis, PE	Geotechnical Engineering	Jacobs	50%	50%
Frank Carroza	Soil Borings	JBD	40%	60%
Donald T.M. Heck, P.E.	Subsurface Investigation Support	Matrix	25%	75%
Kenneth Kerr, P.E.	Subsurface Utility Engineering	InfraMap	45%	55%

Anticipated Workload

Jacobs prides itself on dedicating the proper resources to the respective projects. Moreover, we avoid changing personnel promised to the client by managing the professionals' workload to accommodate the project schedule and client's requirements. Jacobs makes a regular practice of reviewing our company resources and project deliverables. Key personnel, support, technical, and administrative personnel assigned on projects are dedicated to those projects in order to meet each client's expectations and deliverable dates.

Our cohesive and responsive organization has clear lines of authority to working levels accompanied by well-defined project controls and strong management checks and balances. Jacobs utilizes a variety of software tools, supporting both data management and engineering functions. Many of these software tools are linked and provide excellent management tools with visibility into schedules, performance, problems, issues, resolutions, and document tracking.

Our Project Manager and Project Executive, if necessary, can draw upon the vast resources within Jacobs to add more staff or specialty, if necessary.

Our approach to managing projects is structured in a way that we only use the personnel required to meet the specific demands of the project, and the size of the Team will fluctuate in response to the workload, allowing you to receive the maximum return for each consultant dollar spent.

Section 2

Depth of Local Resources and Distance to NJ Newark Offices and Project Site					
Firm	Office Locations	Local Resources	Approx. Personnel Required for Project	Miles from NJ Transit Newark Office	Miles from Project Site
Jacobs (NJ, NY & PA)	Morristown, NJ	538	80	20	25
Burns Engineering Group Inc. (Burns)	Iselin, NJ and Philadelphia, PA	160	24	85 18	80 10
Levitan & Associates	Boston, MA	13	7	200 Appx.	200 Appx.
LTK Engineering Services, Inc.	Newark, NJ and Lebanon, NH	22	2	0.1 277	5 272
InfraMap Corp.	Windsor, NJ	13	7	49	50
exida Consulting, LLC	Sellersville, PA	80	80	80	80
GTS Consultants, Inc.	Freehold, NJ	17	5	44	44
Jersey Boring & Drilling	Fairfield, NJ	40	5	19	18
LKG-CMC, Inc.	Glendale, CA	3	3	N/A*	N/A*
Matrix New World Engineering, Inc.	Florham Park, NJ	70	6	14	21
Richard Grubb & Associates	Cranbury, NJ	37	6	37	42
SJH Engineering, P.C.	Princeton, NJ	45	1	37	37
Sowinski-Sullivan Architects	Sparta, NJ	24	5	37	41
Sullivan Cove Consultants, LLC	Severna Park, MD	5	1	199	201

**LKG-CMC, Inc.'s staff will be located on site.*

DBE PARTICIPATION

Jacobs is fully committed to meeting the 18% goal for DBE participation. We have selected the DBE firms specifically to provide added value to our Team. We have also included a DBE Compliance Officer, Randi Markman, who will work with our Project Controls group to monitor the DBE usage and ensure compliance through the required reporting processes. Mentioned below are the DBEs that we are using to achieve the 18% goal.

Section 2

FIRMS THAT MAKE UP THE JACOBS NJ TRANSITGRID TEAM

We have handpicked several consultants with the best qualifications and expertise to round out the Jacob Team in helping you accomplish your goals and objectives on this very important and exciting project. *Supporting Jacobs, we have added Burns Engineering, Inc. (Burnsp); Levitan & Associates, Inc. (Levitan); and LTK Engineering Services (LTK); InfraMap Corp. (IMC); exida Consulting, LLC (EXC); and several well-respected DBE firms that we have collaborated on numerous infrastructure projects across the state: GTS Consultants, Inc. (GTS); Jersey Boring & Drilling (JBD); LKG-CMC, Inc. (LKG); Matrix New World Engineering, Inc. (MNW); Richard Grubb & Associates (RGA); SJH Engineering, P.C. (SJH); Sowinski Sullivan Architects (SSA); and Sullivan Cove Consultants (SCC).*

The following provides an overview of the roles that members of the Jacobs Team will serve on the NJ TRANSITGrid project.

JACOBS

Jacobs will serve as the prime consultant leading this Team to best serve you in achieving your goal of developing the NJ TRANSITGrid – a first-of-its-kind microgrid system capable of providing reliable power to support certain critical transit infrastructure supporting rail systems operated by NJ TRANSIT and Amtrak. Jacobs will be the single point of contact for all contractual matters, provide the Project Manager and the Deputy Project Manager, and be responsible for schedule, budget, quality assurance, and safety. We will develop the Project Management Plan, the Design Control Plan, the Integration and Interface Plan, the Validation and Verification Plan, the Quality Management Plan, the Health and Safety Plan, and all other plans and protocols that establish the procedures and processes used to execute the work. The overall design execution of the project falls under Jacobs' domain. Furthermore, we will lead the power process, power electrical, and transmission and distribution design elements, as well as the lead engineer for the civil, structural, geotechnical reports, communications, and SCADA design. In addition, we will serve as the lead for the regulatory and stakeholder coordination. Jacobs will be responsible for developing the financial and organizational structure options for managing the plant and maximizing revenue. The Jacobs staff that will work on the NJ TRANSITGrid project are a combination of our seasoned railroad engineers and our seasoned power plant engineers.

- Jacobs supported Burns on the NJ TRANSIT Microgrid Study as part of the Superstorm Sandy Recovery Program Task Order assignments, as well as provided Value Engineering services for the improvements to the Mason Substation.

BENEFITS:

- Our intimate knowledge and understanding of the "NJ TRANSIT way" and the expectations of you and your Project Manager maximizes the ability to deliver the project on time, on budget, and consistent your project goals.
- Jacobs extensive working experience with PSE&G, NJBPU and PJM, will drive timely decision making, and provide NJ TRANSIT a level of predictability in scheduling and budgeting for the NJ TRANSITGrid.
- Jacobs expertise in all aspects of planning, designing, procuring, constructing, and operating power plants positions NJ TRANSIT with the knowledge required to make the best decision, the know how to avoid the unexpected, and the fortitude to deliver the project flawlessly.

A significant benefit to having Burns on the team is their recent experience working with Sandia National Labs on the Superstorm Sandy Recovery program task order assignment involving a comprehensive assessment of the economic, technical, and operational feasibility of the NJ TRANSITGrid. They, therefore, have firsthand knowledge of what NJ TRANSIT is looking to accomplish as well as an understanding of the challenges for the NJ TRANSITGrid project. They can apply this information to progressing the project.

THE Burns GROUP

Burns Engineering, Inc. (Burns) is a major subcontractor to Jacobs on this project and their role is to support Jacobs in the development of technology options and design for the microgrid, and lead the rail electric traction and signal and train control design. Burns will also serve as the Quality Control Leader for the project. While each firm is responsible for checking and verifying their work, Burns will provide independent quality checks on work performed by Jacobs; and Jacobs will perform quality checks on work performed by Burns. Quality Assurance will be the sole responsibility of Jacobs.

Recently, Burns worked on the Penn State University Microgrid Excellence center. This center, the first of its kind, will help advance the development of microgrid technologies as part of the Navy Yard's grid modernization and resiliency projects

Burns brings power and microgrid experience to the team, and provides the full complement of transit system consulting services to railroad and transit clients and construction contractors throughout the country. Burns develops solutions in the following areas: vehicle maintenance facilities for heavy rail, light rail, trolley, and bus systems; traction power systems; power distribution systems; signal and communications systems; security systems; track; and station / passenger facilities. Burns offers design management and construction management services and provides full-service engineering including mechanical, industrial, AC electrical power and lighting, communications, security, traction power, civil, structural, track, and train control. Burns also provides specialized project management oversight and cost and schedule risk assessment services. The combination of both power and railroad expertise is crucial to the NJ TRANSITGrid project.

Levitan understands PJM regulations and the dynamics of the NJ power and gas markets. Levitan recently guided a major interconnection request through the PJM process and found ways to cut costs for their client.

LEVITAN & ASSOCIATES, INC.
MARKET DESIGN, ECONOMICS AND POWER SYSTEMS

Levitan & Associates, Inc. (Levitan) will provide the economic screening of the different technology options, the cost-benefit of different alternatives, plant operational modeling, and the power price and fuel price forecasts. In addition, they will serve as the lead for all economic analysis related to the power plant and the generation of electricity.

Levitan is an energy management consulting firm that applies mathematical, economic, and engineering expertise to craft enlightened solutions to complex financial, regulatory, public policy, and market design problems in the power and fuels industries. They provide rigorous quantitative analysis in such matters as forecasting the operational and market price impacts of conventional and renewable resource entry or attrition; the costs and benefits of cogeneration, demand-side program, and microgrid options; the valuation of generation and transmission assets; the design and implementation of power procurement strategies; and the relative costs and benefits of resource adequacy solutions. Furthermore, Levitan has the ability to identify competitive options and transaction structures that confer value in wholesale and retail energy markets. Levitan formulates innovative and flexible power and fuels solutions and has a solid will provide a direct benefit to the NJ TRANSITGrid project, so we will know exactly what has to be done early on and provided to PJM to get our team through the process right the first time, thus not delaying the project track record testifying before state commissions, FERC, and judicial bodies. Levitan's experience in navigating the regulatory agencies and their recent microgrid experience will provide a direct benefit to the NJ TRANSITGrid project, so we will know exactly what has to be done early on and provided to PJM to get our team through the process right the first time, thus not delaying the project.

Levitan prepared the economic analysis that led New York University to install a microgrid system that provided the campus with the power while the rest of lower Manhattan was blacked out after Superstorm Sandy. The system saves money and reduces emissions.

LTK

LTK Engineering Services

LTK Engineering Services (LTK) will be solely responsible for the power load analysis. They will coordinate with NJ TRANSIT and Amtrak to obtain the necessary information required to develop the power load requirements for the project. LTK will also handle any NJ TRANSIT and Amtrak rail vehicle interface issues.

As part of the Amtrak Northeast Corridor Energy Usage and Demand Study, LTK is using its TrainOps® simulation software to simulate two 2014 operating plans, reflecting peak season and shoulder season auxiliary power demand. Additional usage and demand is included in the form of yard loads, switch heater loads, and signal power loads.

LTK provides engineering services for appraisals, economic feasibility studies, and design and supervision of construction, as well as engineering and management services to the transportation industry. LTK's services include systems and operations planning, rolling stock engineering and procurement assistance, and systems engineering services covering traction electrification, communications and ITS, signal and train control, fare collection systems, and shop and maintenance facilities. LTK brings to every project a thorough knowledge of the transportation industry and its needs based on more than a half-century of experience consulting for major transportation service providers. LTK provides a full-range of vehicle and systems engineering and management services required for effective and efficient transportation project planning, management, and operations. LTK has worked for both NJ TRANSIT and Amtrak on traction power and operational modeling projects and they bring this and their rail vehicle expertise to the TRANSITGrid project.

Section 2

exida is an important asset to the team because of their experience in assessing and developing cybersecurity solutions in transportation, electric utility, and other industries that rely heavily on the use of industrial automation and control systems; experience with the Department of Homeland Security (DHS), Transportation Security Administration (TSA), National Institute of Standards and Technology (NIST), and the American Public Transportation Association's (APTA) guidelines, recommended practices, and standards; and experience with National Energy Reliability Council (NERC) standards and Federal Energy Regulatory Commission (FERC) rulings on power utility security. They will be able to put NJ TRANSIT's mind at easy that their microgrid system will be hardening and protected from attacks.

exida Consulting LLC (EXC) will be responsible for all aspects of cybersecurity including hardening of the system (policy / procedure, segmentation, redundancy / spares, physical protection, monitoring / audit, change control, security controls. ECX is an industrial control system (ICS) and SCADA cybersecurity consulting and certification firm with approximately 80 partners and employees worldwide that focus on the unique requirements of industrial automation and process control systems. In addition, ECX is renowned for its certification and consulting in safety critical / high availability automation systems. The company's main offices are located in Sellersville, PA. Their staff of professionals have at least 15 years experience in industrial automation and control system safety and/or cybersecurity design, implementation, and assessment. Cybersecurity in the power plant industry is a major focus in the current environment; exida's expertise in this area coupled with their SCADA and automation expertise will be critical elements of the safety and security aspects of the NJ TRANSITGrid project.

DBE Consultants

Sullivan Cove Consultants, LLC (SCC) will serve as the key legal advisor for interactions with FERC and BPU, while Jacobs will provide staff with the technical expertise and relationships with BPU, FERC, NERC, and NPCC.

Several of Sullivan Cove's consultants have either worked as lawyers at FERC or handled cases there. In addition, Sullivan Cove has worked with numerous regulatory state commissions regarding energy related issues. They are a prominent U.S. law firm with 40 years experience in energy and public utility law practice, and 12 years in the federal and state arena. Currently a DBE in Maryland, SCC has recently applied for their DBE status with Port Authority of New York and New Jersey and is awaiting approval.

In connection with the implementation of the Maryland Offshore Wind Energy Act of 2013, Sullivan Cove is currently involved in the entire regulatory process from initial planning with the MDPSC staff through adopting the final regulations at the Commission hearings.

GTS Consultants Inc. (GTS), a certified DBE firm, will be supplementing the Team by providing survey, right-of-way, and concept planning support. Specifically, their work with Jacobs and NJ TRANSIT is extremely extensive. GTS has provided survey services with Jacobs/NJ TRANSIT on the following projects: The Tunnel Project (ARC), Morrisville Yard, Lackawanna Cutoff, Main and Bergen Connection, the Secaucus Transfer project, and County Yard. Currently, GTS is under contract to Jacobs for the task order contract within the Meadowlands Maintenance Yard (MMC). GTS's proven experience working with NJ TRANSIT and Jacobs coupled with their knowledge of boundary surveying, geodetic control networks, and topographic mapping has been integral to the success of the above project.

Section 2

L KG-CMC, Inc. (LKG) is a certified DBE that will be responsible for document control and configuration management on this project. They are a comprehensive project controls and document control / configuration management consultant with extensive experience in complex transit, highway, public works, education, airport, and other infrastructure projects nationwide.

- LKG has provided document control on all NJ TRANSIT design-build projects.
- They have a working system of controls that can be put in place right at NTP for the Jacobs Team to start work.
- They put personnel on site in the client's offices/project site.

Matrix New World Engineering, Inc. (MNW), a DBE certified firm, will administer the subsurface investigation and lab testing, prepare the geotechnical data report and site-specific plan, as well as provide environmental site remediation support for this project. They will engage a DBE firm Jersey Borings to support the investigation program for soil drilling and laboratory testing. MNW specializes in environmental and engineering services ranging from initial site assessments to remedial investigations and remedial designs. In addition, they provide the preparation of documents required under the NEPA; asbestos and lead-based paint surveys and designs; underground storage tank management programs; construction support services; remediation system design; operation and maintenance; wetland surveys; design and mitigation; environmental permitting, land use regulation, and development; and regulatory compliance issues.

MNW are currently working with us on NJ TRANSIT County Yard project, which is in the limits of where NJ TRANSIT wants the associated control and management. Therefore, they are familiar with inter-connection to the Regional Commercial Power Grid and all structural and infrastructure components and control elements necessary to maintain a defined level of rail operations for NJ TRANSIT and Amtrak between New York Penn Station and NJ TRANSIT County Yard along the NEC and between NJ TRANSIT County Yard and Hoboken Terminal.

Jersey Boring & Drilling (JBD), a certified DBE, will be providing soil borings and laboratory testing. Jersey Boring and its affiliated firm, Jersey Essay Labs, provide services throughout the Northeastern United States. Together, they team to provide geotechnical and environmental drilling, concrete core drilling, as well as material testing and inspection services to the construction industry. They have rigs capable of performing varied drilling needs, and their testing lab, Jersey Essay Labs, is certified by AASHTO, ASTM, and CCRL.

JBD is currently working with us on our NJ TRANSIT Superstorm Sandy Recovery program providing soil borings and laboratory testing services.

Section 2

RGA is presently conducting a historic architectural resources background study (HARBS) and Phase IA archaeological survey, and effects assessment report in connection with the NJ TRANSITGrid project in support of a NEPA EIS. The results of these studies, combined with that of the soil boring program, will create a comprehensive assessment of the potential for significant archaeological resources to be affected by the project. This will provide for minimal gaps, if any, with the archaeological needs of this project.

Richard Grubb & Associates (RGA), a certified SBE/DBE firm, will be providing archeological resources, as well as historic and SHPO related services. They are a full-service cultural resource management firm that complies with federal, state, county, and municipal cultural resource and historic preservation regulations. RGA has a multi-disciplinary staff of cultural resource professionals that meet or exceed the Secretary of Interior's Qualifications Standards (36CFR61) for archaeology, architectural history, and history. RGA also has a full-scale archaeological laboratory and qualified staff to ensure compliance with 36CFR79, Curation of Federally-Owned and Administered Archaeological Collections. Under the Superstorm Sandy Program, RGA is currently providing archeological resources services for this area.

Sowinski Sullivan Architects (SSA) is a DBE certified, architecture firm that will provide architectural services for the power plant and associated facilities. The firm's focus is Transportation Architecture and is currently engaged in transit facility design from Connecticut to Pennsylvania with work for all major regional passenger railroads south of Massachusetts. More than 80% of the firm's project base is for transportation facilities, with the majority of that work in the area of stations and intermodal facilities. SSA Executive and Senior Management have worked directly for or very closely with NJ TRANSIT in the past, and they understand the pressure that is placed on staff because of the operational demands, capital funding constraints, and public expectations. The management of our firms will keep a strong pulse on this project through Client Expectation and Client Satisfaction Surveys, and internal quality assurance audits. SSA brings an understanding of NJ TRANSIT's architectural requirements from their recent NJ TRANSIT project work. SSA will work with our power plant engineers for the power plant and associated facilities design.

- As a subconsultant to Jacobs, SSA is currently providing services on NJ TRANSIT's Superstorm Sandy Recovery Program and County Yard.
- SSA has also worked on NJ TRANSIT's Pullman Substation and the Henderson Substation.

Project Descriptions

On the next two pages is a project matrix that lists several projects from our team members with areas of related work items.

Following the matrix are full project descriptions from our Team.

FIRMS' EXPERIENCE ON PROJECTS WITH SIMILAR DISCIPLINES TO NJ TRANSITGRID

PROJECT NAME	PROJECT DESCRIPTION & Location and Page #	Firm(s)	Microgrid	Power Study	Co-Generation	Substations / OCS	Signals & Communications	Environmental	Site / Civil	Geotechnical/Structures /Facilities	Resiliency/Reliability/Maintainability	Third Party Coordination	Security / Safety	Commissioning & Testing	Regulatory (NERC / FERC / PJM / NJDEP / FTA / FRA)	Financial / Economics
Confidential Client, Macrogrid PJM Blackstart Addition, Ohio	**Section 2: Page 1 of Project Descriptions**	**Jacobs**		**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
US Military Academy, Microgrid Master Planning, West Point, NY	**Section 2: Page 5 of Project Descriptions**	**Jacobs / Burns/ MNW / GTS/ JBD/ IMC / SSA**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**		**X**		**X**	**X**
New Jersey Army National Guard, Microgrid Master Plan, Sea Girt, NJ	**Section 2: Page 4 of Project Descriptions**	**Jacobs / GTS / MNW / SSA**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**		**X**		**X**	**X**
Beacon Power, 20MW Fly Wheel Based Frequency Regulation Plan		**Jacobs**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**
University of Texas at Austin, Microgrid Upgrades Austin, TX	**Section 2: Page 2 of Project Descriptions**	**Jacobs / RGA**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
University of Oklahoma, Utilities and Microgrid Design		**Jacobs / MNW / SSA**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
University of California at Santa Cruz - CHP Upgrades		**Jacobs**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
North Carolina State University Microgrid, Raleigh, NC	Section 2: Page 7 of Project Descriptions	Jacobs	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Texas A&M University Campus Microgrid Renovation, College Station, TX	Section 2: Page 3 of Project Descriptions	Jacobs / MNW	X	X	X	X	X	X	X	X	X	X	X	X	X	X
University of Minnesota, Microgrid Design, Minneapolis, MN	Section 2: Page 6 of Project Descriptions	Jacobs / SJH	X		X	X	X	X	X	X	X	X	X	X	X	X
NJ TRANSIT - A/E Task Order Contract for Superstorm Sandy Recovery Program	Section 2: Pages 8, 9, & 10 of Project Descriptions	Jacobs /LKG	X		X	X	X	X	X	X	X	X	X	X	X	X
NJ TRANSIT, Design, Engineering ,and Construction Services for County Yard Improvements	Section 2: Pages 19, 20, 21, & 22 of Project Descriptions	Jacobs / GTS / MNW / SSA				X	X	X	X	X	X	X	X	X		
Amtrak, Ivy City Substation and Transmission Line	Section 2: Page 17 & 18 of Project Descriptions	Jacobs				X	X	X	X	X	X	X	X			
NJDOT, Route 7 WittPenn Bridge (Vertical Lift Bridge) Over the Hackensack River		Jacobs / RGA					X	X	X	X	X	X	X	X	X	X
MTA-MNR, Design of Three New Substations on the Upper Harlem Line and New Circuit Breaker Houses for the Harlem River Lift Bridge	Section 2: Page 13 of Project Descriptions	Jacobs / MNW / SSA				X	X	X	X	X	X	X	X	X		

PROJECT NAME	PROJECT DESCRIPTION & Location and Page #	Firm(s)	Microgrid	Power Study	Co-Generation	Substations / OCS	Signals & Communications	Environmental	Site / Civil	Geotechnical/Structures /Facilities	Resiliency/Reliability/Maintainability	Third Party Coordination	Security / Safety	Commissioning & Testing	Regulatory (NERC / FERC / PJM / NJDEP / FTA / FRA)	Financial / Economics
NYSDOT, Empire-Hudson Line Signal Reliability Improvements, NYSDOT Railroad Retainer Agreement	Section 2: Page 14 of Project Descriptions	Jacobs					X		X		X	X	X			
Amtrak, Hellgate Line Catenary Modifications	Section 2: Page 16 of Project Descriptions	Jacobs					X	X		X	X	X	X			
SEPTA, Wayne Junction Traction Power Substation Rehabilitation Design-Build		Jacobs		X		X	X	X	X	X	X	X	X	X		
PANYNJ, PATH Harrison Substation Number 9 Replacement, Harrison, NJ	Section 2: Pages 11 & 12 of Project Descriptions	Jacobs / MNW				X	X	X	X	X	X	X	X		X	
NJ TRANSIT - Portal Bridge Capacity Enhancement Project, Contract No. 08-042, Kearny and Secaucus, NJ		Jacobs / SJH		X			X	X	X	X		X	X		X	
MTA - LIRR Eastside Access Project, New York, NY		Jacobs /LKG				X	X		X	X	X	X	X	X		
Amtrak, Relocation of Catenary Sectionalizing Switches at PS 18 in Penn Station, New York, NY		Burns				X	X		X	X		X				
Amtrak, Washington Union Terminal Substation 25A, Washington, DC		Burns				X			X							
Amtrak, Zoo to Paoli Transmission Line, Philadelphia, PA to Paoli, PA		Burns				X		X	X	X	X		X			
NJ TRANSIT, Hudson-Bergen Light Rail Transit System, Post-Hurricane Sandy Train Control Recovery, Jersey City, NJ	Section 2: Page 28 of Project Descriptions	Burns									X					
NJ TRANSIT, Power Generation System to Increase System Resiliency and Reliability, Newark, NJ	Section 2: Pages 23 & 24 of Project Descriptions	Burns									X					
PANYNJ, Holland Tunnel Supervisory Control System (SCS) Replacement, Jersey City, NJ and New York, NY	Section 2: Page 29 of Project Descriptions	Burns				X	X				X		X			
PANYNJ, World Trade Center Site Wide "Last Mile" Network Infrastructure Project, New York, NY		Burns					X				X		X			
Philadelphia Industrial Development Corporation, Smart Micro-Grid Energy Master Plan for the Philadelphia Navy Yard, Philadelphia, PA	Section 2: Pages 25, 26, & 27 of Project Descriptions	Burns	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SEPTA, Overhaul of Morton and Lenni Substations, Morton and Lenni, PA		Burns				X			X	X	X		X			

PROJECT NAME	PROJECT DESCRIPTION & Location and Page #	Firm(s)	Microgrid	Power Study	Co-Generation	Substations / OCS	Signals & Communications	Environmental	Site / Civil	Geotechnical/Structures /Facilities	Resiliency/Reliability/Maintainability	Third Party Coordination	Security / Safety	Commissioning & Testing	Regulatory (NERC / FERC / PJM / NJDEP / FTA / FRA)	Financial / Economics
SEPTA, Media/Sharon Hill Light Rail System, Communications Based Train Control System, Delaware County, PA		Burns					X				X		X	X		
SEPTA, Positive Train Control (PTC), Philadelphia, PA		Burns					X				X		X	X		
Cornell University, Microgrid Energy Master Plan, Ithaca, NY	Section 2: Page 31 & 32 of Project Descriptions	Levitan	X	X	X	X		X			X				X	X
NJBPU, Long-Term Capacity Agreement Pilot Program for the NJ Board of Public Utilities	Section 2: Page 33 of Project Descriptions	Levitan		X				X				X			X	X
New York University. Cogeneration / Microgrid Project, New York, NY	Section 2: Page 34 & 35 of Project Descriptions	Levitan	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PJM Interconnection Process / PJM Markets	Section 2: Page 30 of Project Descriptions	Levitan		X								X			X	X
Economic Cost-Benefit Analysis for PSE&G and Other Utility Ratepayers		Levitan										X			X	X
Hudson Transmission Project - Analytical Support to NYPA on Transmission Planning and Bulk Power Market Issues		Levitan		X								X			X	X
Massachusetts Water Resources Authority - Strategy to Lower Energy Costs & Optimize Back-up Generation at Deer Island		Levitan		X	X			X			X	X			X	X
MBTA, AC and DC Power Load-Flow Short-Circuit and Protective Coordination Study		LTK	X	X											X	
NJ TRANSIT, Multi-Level Commuter Rail Car Procurement	Section 2: Page 38 of Project Descriptions	LTK									X				X	
National Railroad Passenger Corp. (Amtrak) Northeast Corridor Energy Usage & Demand Study		LTK		X												
Peninsula Corridor Joint Powers Board (PCJPB)/Pacific Gas and Electric, San Francisco to Tamien Electrification Power Quality Study		LTK		X		X										
NJ TRANSIT, Raritan Valley Line Third Track Feasibility Study	Section 2: Page 39 & 40 of Project Descriptions	LTK						X								X
NJ TRANSIT Rail Operations, Atlantic City Rail Line Operations Study	Section 2: Page 36 & 37 of Project Descriptions	LTK						X			X	X				X

Project Descriptions

Confidential Client | Macrogrid PJM Blackstart Addition

As part of the PJM electrical grid emergency preparedness, our client was selected to provide blackstart electrical services from two existing combined cycle energy facilities. The two new General Electric LM2500 gas turbine generators were connected through expansion of the 345 kV air insulated collector buses with the addition of a new 345 kV breaker, air switches, and generator step-ups, along with the control and relaying additions and modifications to existing protection schemes. This required detailed layout of all equipment and corresponding foundations, underground power, and control raceways; modeling and designing ground grid and lightning protection modifications; and careful phased construction planning to allow for work around energized 345 kV and 765 kV substation equipment throughout the construction phase.

This project included modifications to the isochronous / droop governor controls, bus differential, distance, and other relaying schemes to connect the new source to the existing substation. The LM2500 generator was uniquely designed in this case to be able to "soft start" the entire plant electrical grid and autotransformers up to the 765 kV system, **including exciting approximately 1800 MVA of transformers with the single 20 MW source.**

The development and construction of these two blackstart plants can be used to restart the PJM electrical transmission grid in the event of a catastrophic outage. The aggressive schedule allowed the customer to recover capital much faster than projected, increasing the ROI. Despite having a fast-tracked schedule, both site projects were completed on-time and within budget.

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Confidential Midwest Location*

RELEVANT PROJECT DETAILS

- *Complex generation frequency and voltage control solutions*
- *PJM grid connected (765kV)*
- *640MW and 1280MW facilities adding ~20MW each*
- *EPCm turnkey delivery in 9 months*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Construction Management*
- *Planning*
- *EPCm (Design-Build)*

SCOPE OF SERVICES

- *Civil Engineering*
- *Structural Engineering*
- *Electrical Engineering*
- *Architecture*
- *Cost Estimating*
- *Construction Scheduling*

START / END DATES

- *2013-2014*

CONSTRUCTION VALUE

- *$52 million*

KEY STAFF

- *Roger Copeland, PE*
- *Herb Tull, PE*
- *Darrell Widner, PE*
- *Morgan Sutton, PE*
- *Gabe Serna, PE*
- *Kevin Fox, PE*
- *Rodney Carpenter*

Project Descriptions

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Austin, TX*

RELEVANT PROJECT DETAILS

- *Fully self-generating campus including advanced load control and frequency control systems*
- *Maximum resiliency through N+2 substation interconnection*
- *Highly efficient utility system, resulting in continuous cost avoidance*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Feasibility Studies*
- *Design Services*
- *Planning*
- *Construction Manager at Risk*

SCOPE OF SERVICES

- *Design Services for New Construction, Alterations, Renovation, Maintenance, and Repair Projects*
- *Construction Estimates*
- *Interconnection and Interoperability Standards and Guidelines*
- *Life Cycle Cost Analysis*

START / END DATES

- *1998-Ongoing*

CONSTRUCTION VALUE

- *Varies by Project; $100K - $42M*
- *Total Value in Excess of $100M*

KEY STAFF

- *Roger Copeland, PE*
- *Kevin Fox, PE*
- *Kent McAnally, PE*
- *Joe Saltarelli, PE*
- *Darrell Widner, PE*
- *Morgan Sutton, PE*
- *Rodney Carpenter*

University of Texas at Austin | Microgrid Upgrades

We have been involved in expanding and improving the efficiency of the University of Texas at Austin's campus and combined heat and power plant since 2000. Since 1977, the University has added over 8 million SF of facilities, yet natural gas consumption is at the same quantity today as it was then. These efficiency gains, achieved in part through our two turbine projects, along with six years of demand-side management work, have resulted in annual avoidance of 100,000 tons of campus CO_2 emissions.

The current cogeneration facility, located in three buildings and adjoining areas between, consists of a total installed capacity of about 135 MW of electrical capacity that supplies a campus consisting of approximately 15 million square feet of space in 150 buildings with electricity, steam, compressed air, and distilled water.

The highlighted projects below, combined with other ongoing utility upgrade and maintenance projects on the campus, have afforded UT **the most advanced and efficient microgrid generation system of any higher education campus in the US. As they are fully self-generating and have an N+2 substation interconnection to ERCOT, the system is highly resilient and includes advanced SEL relaying technologies and concepts.** Our campus project work includes, but is not limited to:

Gas Turbine No. 10: Installed a new 32.5 MW gas turbine generator and waste heat boiler. We provided detailed design and construction administration services for the installation the combined heat and power system.

25 MW Steam Turbine No. 9: Installed a new 25 MW steam turbine and performed a heat balance of the power plant and chilling stations as an energy system, **saving more than $19 million over 20 years.**

Project Descriptions

Texas A&M University | Campus Microgrid Renovation

Jacobs provided full-service design, construction administration, and commissioning for this microgrid renovation, which included new combined heat and power (CHP) and electrical system design. The CHP system requires one-third less fuel than a typical power plant with similar output, resulting in a significant net reduction in greenhouse gases, generates up to 43.5 MW of critical electricity, and serves the district energy system by supplying steam and chilled water to the 5,000-acre campus.

Texas A&M forecast $500,000 in monthly savings from the CHP upgrade. **Due to Jacobs careful planning and timely executing, actual savings in Texas A&M's first month of operation exceeded $1 million,** funds that are able to go toward teaching, research, and other campus functions.

We studied all utilities delivered by University plants – such as electricity, chilled water, steam, heating hot water, and domestic hot water – and used multiple software platforms to optimize each with the power generation equipment. The project included:

- A back-pressure steam turbine generator to provide resiliency through additional power when needed. The system provides optimized electrical output year round, while also delivering efficient low-pressure steam to campus.
- A CHP addition that utilizes state-of-the-art emissions and control systems to minimize environmental impact of additional power generation.
- Retrofitting a completely new steam system into a plant built at the turn of the century, requiring careful coordination. 3D LASAR scanning provided accurate equipment locations.

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *College Station, TX*

RELEVANT PROJECT DETAILS

- *Optimized power generation system as part of the microgrid development*
- *Saved $1 million in the first month of operation*
- *Complex electrical interfaces and full ERCOT registration, identical to PJM process*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Feasibility Studies*
- *Full Service Design*
- *Construction Support Services*
- *Construction Manager at Risk*

SCOPE OF SERVICES

- *Life Cycle Cost Analysis*
- *Construction Estimates*
- *Interconnection and Interoperability Standards and Guidelines*

START / END DATES

- *2006-2011*

CONSTRUCTION VALUE

- *$71 million*

KEY STAFF

- *Roger Copeland, PE*
- *Kevin Fox, PE*
- *Kent McAnally, PE*
- *Joe Saltarelli, PE*
- *Mike Lewis, PE*
- *Morgan Sutton, PE*

Project Descriptions

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Sea Girt, NJ*

RELEVANT PROJECT DETAILS

- *Energy storage to meet load profile and generation dispatch*
- *Self-healing grid for maximum resiliency*
- *Integrated generation and demand management*
- *Superstorm Sandy recovery project*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Engineering*
- *Planning*

SCOPE OF SERVICES

- *Microgrid*
- *Smart Grid*
- *Electrical Engineering*
- *Self-Healing Grid*
- *Resiliency*
- *Grid Isolation*
- *Solar Photovoltaic*
- *Energy Storage*
- *Cost Estimating*
- *Energy Efficiency*

START / END DATES

- *2014-2015*

CONSTRUCTION VALUE

- *$9 million (recommended project cost)*

KEY STAFF

- *Herb Tull, PE*

New Jersey Army National Guard | Microgrid Master Plan

The National Guard Training Center (NGTC) at Sea Girt, a training center located on the east coast of New Jersey, was severely impacted by natural disasters, such as Superstorm Sandy. The prolonged power outage had negative impacts on the mission. We completed a microgrid feasibility study to improve resiliency and provide energy security. This included:

- **Energy Security:** Provided resiliency and energy security to allow NJ Army National Guard to execute its mission under adverse conditions.
- **Energy Efficiency and Financial Responsibility:** Moved the NJ Army National Guard toward Net Zero energy consumption.
- **Electrical Distribution Resiliency and Automation:** The distribution system was dated and in need of replacement. Jacobs recommended a complete distribution system upgrade to improve system resiliency by strengthening the distribution components and implement a self-healing grid to isolate system faults. Additionally, the distribution system required automation that will allow for the quick isolation of the Sea Girt grid from the electrical utility grid.
- **Energy Storage:** To bring stability to the renewable energy planned for Sea Girt, a 5 MWH energy storage system was recommended. The battery was sized to provide generation redundancy and maximize the economics.
- **Smart Grid Control System:** The control system will provide the integrated intelligence for centralized and remote microgrid operation. The controls integrate buildings, distribution system, and generation assets allow for optimized resources.

Project Descriptions

United States Military Academy | Microgrid Master Plan

We are providing microgrid, utility master planning, energy modeling, life cycle, and economic analysis services for the Cantonment Area of the United States Military Academy. The master plan involves the entire utility infrastructure of the campus including chilled water, heating hot water, steam, power generation, electric distribution, domestic hot water, wastewater, water, and storm drainage. The plan will improve the efficiency, safety, and reliability utility services while positioning them for next 40 years. West Point is also a net zero pilot installation; the plan will prepare West Point to be a net zero installation.

As part of the master planning process, we are investigating numerous technologies to reduce energy consumption and improve reliability. These technologies include a combined heat and power plant, a hybrid ground source central utility plant, steam to hot water conversion, centralized chilled water system, electrical grid isolation, solar photovoltaic, and a smart campus control system. The project includes a phased microgrid plan that will include cogeneration, solar PV, batteries, and a demand reduction control system that will allow the Cantonment Area to function when the utility grid is down. Additionally, a complete life cycle cost analysis will be completed comparing the recommended utility infrastructure upgrades versus maintaining the existing operating practices at West Point.

RESPONSIBLE FIRM

- *Jacobs Engineering Group Inc.*

LOCATION

- *West Point, NY*

RELEVANT PROJECT DETAILS

- *Microgrid planning study*
- *Includes grid isolation preparedness and storm hardening planning*
- *Includes integration of renewables*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Planning*

SCOPE OF SERVICES

- *Civil Engineering*
- *Electrical Engineering*
- *Mechanical Engineering*
- *Environmental*
- *Cost Estimating*

START / END DATES

- *2014-Ongoing*

CONSTRUCTION VALUE

- *N/A; Planning Only*

KEY STAFF

- *Roger Copeland, PE*
- *Herb Tull, PE*
- *Kevin Fox, PE*

Project Descriptions

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Minneapolis, MN*

RELEVANT PROJECT DETAILS

- *Core microgrid campus infrastructure*
- *Advanced SEL based protection and control for generation addition*
- *Transmission grid interconnection coordination*
- *Equipment right-sizing optimization saved $40 million*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Planning and Design*
- *Construction Administration*
- *Construction Manager at Risk*

SCOPE OF SERVICES

- *Civil Engineering / Survey (Sub)*
- *Structural Engineering (Sub)*
- *Electrical Engineering*
- *Mechanical Engineering*
- *Architecture (Sub)*
- *Cost Estimating*

START / END DATES

- *2012-Ongoing*

CONSTRUCTION VALUE

- *$56.5 million (est)*

KEY STAFF

- *Roger Copeland, PE*
- *Herb Tull, PE*
- *Kent McAnally, PE*
- *Joe Saltarelli, PE*
- *Mike Lewis, PE*
- *Morgan Sutton, PE*
- *John Beaudry, PE*
- *Darrell Widner, PE*
- *Gabe Serna, PE*
- *Kevin Fox, PE*
- *Rodney Carpenter, PE*

University of Minnesota | Microgrid Design

We are providing planning, design, analysis and equipment optimization, equipment pre-purchase, construction administration, and commissioning support services for the combined heat and power (CHP) addition to the University of Minnesota campus that will be the core of the microgrid operation on campus. The upgrade and rehabilitation of Old Main Building involves the complete abatement and demolition of seven large coal-fire steam boilers and installing a new 22 MW dual-fuel combustion turbine and a 250,000 pounds-per-hour high temperature heat recovery steam generator. This new facility will provide a portion of the critical power for the University and will be redundant to the existing service. **Project involves interaction with four separate electrical substations owned by Xcel Energy for utility interconnection and included discussion and coordination with potential MISO registration for FERC compliance.**

Landing the power on the University electrical system required substantial reconfiguration of the medium voltage system including a new utility connection, and several new connections from the generation equipment to the distribution buses at the 4th and Fulton switching stations. This will allow the University to utilize the generated electricity behind the meter during the majority of the year while maximizing uptime, increasing the ROI of the project.

Due to the right-sizing analysis performed by Jacobs, the CHP system developed for their campus is projected to have a life cycle cost savings of more than $40 million over 30 years compared to the original CHP concept.

Project Descriptions

North Carolina State University | Microgrid

This research institution is a member of the FREEDM Center, a think tank for microgrid research. We have been working to support NC State for eight years on utility upgrade projects to improve the campus' resiliency and competitiveness in this space. We have provided the design and start-up of multiple projects, including adding two gas turbines with heat recovery steam generators; upgrading / replacing three substations (110kV and 230kV primary); and upgrading distribution systems on campus.

Like NJ TRANSITGrid, this campus included utility interconnection to the PJM grid, blackstart systems, island control for the substations, and new SEL based protection systems.

Sullivan Substation: We provided a new 230 kV interconnection to the PJM system, substation structures with breakers and switches, a new 30/40/50 MVA transformer, and medium voltage switchgear. The existing substation loads were split between the new and the old system to provide the necessary redundancy. The protection system includes SEL relays with mirrored bit transfer trip schemes developed to coordinate with the addition of generation at the Cates Plant.

Cates Cogeneration Utility Plant: Jacobs added cogeneration and developed energy efficient chilled water improvements for the Cates Plant. This phase also included blackstart provisions for the gas turbines and bypass systems to allow rapid startup.

Centennial Smart Grid Master Plan: We developed a smart grid master plan to identify and prioritize projects that will improve the reliability of the electrical distribution system, enhance energy conservation, and support the University's goal of being a national leader in smart grid technology at the campus.

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Raleigh, NC*

RELEVANT PROJECT DETAILS

- *Microgrid implementation*
- *Phased construction*
- *Leader in smart grid research and resiliency*
- *230kV substation interconnection with PJM*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Planning*
- *Design*
- *Construction Support Services*
- *Design-Build*

SCOPE OF SERVICES

- *Civil Engineering*
- *Structural Engineering*
- *Electrical Engineering*
- *Architecture*
- *Environmental*
- *Cost Estimating*
- *Construction Scheduling*

START / END DATES

- *2005-Ongoing*

CONSTRUCTION VALUE

- *Varies; $70 million estimated total*

KEY STAFF

- *Roger Copeland, PE*
- *Darrell Widner, PE*
- *Kevin Fox, PE*
- *Kalaivanan Uthirapathy, PE*

Project Descriptions

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Various Locations, NJ*

RELEVANT PROJECT DETAILS

- *Provided engineering support to Sandia Labs during early phases of the microgrid study*
- *Familiarity with SSRP protocols*
- *Familiarity with FTA and FEMA resiliency requirements*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Planning*
- *Construction Phase Services*
- *On-Call Task Order Contract (CPFF)*

SCOPE OF SERVICES

- *Civil Engineering*
- *Mechanical Engineering*
- *Architecture*
- *Electrical Engineering*
- *Electronic Systems Engineering*
- *Transportation Engineering*
- *Feasibility Studies*
- *Cost Estimating*
- *Cost Estimating*
- *Value Engineering*
- *Energy Conservation & Management*
- *Environmental Engineering*
- *Industrial Engineering*
- *Project Administration*

START / END DATES

- *2013-2016*

CONSTRUCTION VALUE

- *$8.5 million for Sandy-related federal funds*
- *$3.5 million for regular task order assignments*

NJ TRANSIT | Architectural/ Engineering Task Order Contract for Superstorm Sandy Recovery Program

Under a three-year task order contract, Jacobs is providing full architectural and engineering design services to NJ TRANSIT for various improvement projects around the state. Funding will come from a variety of federal and state resources depending on the assignment and nature of the work. Services may require, but are not limited to, performance of planning, forecasting, engineering inspections, analyses and preparation of plans, estimates, specifications, and schedules.

Task #1: Damage Assessment, Repair Recommendations, and Design for the Meadows Maintenance Complex (MMC) and the Rail Operations Center (ROC) (Superstorm Sandy Related Temporary Flood Protection Improvements), Kearny, NJ

This project was the first Task Order assigned under our A/E Design Services Task Order Contract for 2013-2016. As a result of Superstorm Sandy on October 29 and 30, 2012, NJ TRANSIT's commuter rail system suffered immense damage. NJ TRANSIT was faced with dual challenges: Restore the rail systems, while at the same time increasing the system's resiliency – its ability to withstand and recover quickly from future storms. The FTA granted significant funding for the recovery program. The work associated with this Task Order Assignment had to be handled aggressively to meet the FTA funding requirements.

Because of the need for expediency, work began early in April 2013 under a Limited Notice to Proceed prior to a contract being in place. The work included preparation of short/near term resiliency projects for the upcoming 2013 hurricane season and completion of critical repairs in time for the 2014 Super Bowl.

The scope of this assignment included preparing damage assessments, formulating near term and long-term recommendations, and developing technical scopes of work for implementation of the recommended improvements selected by NJ TRANSIT to move forward. NJ TRANSIT assets evaluated included the MMC and Yard including renovations to the switching station, ROC, and Amtrak Substation 41.

Jacobs conducted a site investigation, prepared documentation, and designed flood barriers solutions that could be implemented temporarily for the 2013 hurricane season as well as final solutions for future hurricanes or floods. Architecturally and structurally, we performed a site investigation to assess storm damage to the maintenance shops and support structures within the rail yard. Damages were documented and temporary solutions or repairs were provided that could be implemented immediately. We also researched and studied long-term solutions to use floor barrier products that could be installed or implemented in areas of buildings on site that could limit or decrease the infiltration of flood water into the yard buildings. Jacobs developed solutions to protect, man doors, large overhead rail doors, foundation walls, building expansion joints, and other areas of the building that could allow water into the building. FEMA flooding information and design criteria in ASCE 7 and ASCE24 were used to determine levels

Project Descriptions

of protection in developing floodproofing solutions. Subconsultant(s) under this assignment: GTS Consultant and Sowinski Sullivan Architects.

Task #2 Power and Communications Assessment of NJ TRANSIT Headquarters at One Penn Plaza, Newark, NJ and the General Office Bldg (GOB) in Maplewood, NJ

The scope of services for this task included the assessment of the emergency generator at the NJ TRANSIT's Headquarter Building that was damaged as a result of being submerged in salt water flood conditions resulting from Superstorm Sandy. Work also included an evaluation of the emergency generator at the GOB in Maplewood, which also failed during the storm. Jacobs performed siting studies for a new combined Emergency Operations Center (EOC). The NJ TRANSIT's GOB in Maplewood was selected and conceptual layouts were developed. Scopes of work were written after assessing the specified areas for further consideration by NJ TRANSIT. Subconsultant(s) under this assignment: GTS Consultant and Sowinski Sullivan Architects.

Task #3 Relocation of the UPS & Battery Back-Up, Kearny, NJ

During Superstorm Sandy, the first floor of the ROC was flooded with approximately four inches of water. Although the depth of the water was minimal, the flooding caused the malfunction of the two 225kva Uninterrupted Power Source (UPS) units leaving the ROC electrical systems vulnerable to spikes and interruptions in power supply. The malfunction of the UPS resulted in the ROC Data Center going down when commercial and emergency generator power failed. Other electrical equipment such as batteries, transformers, and panel boards were damaged in addition to the UPS units.

Jacobs prepared design plans to relocate and replace two 225kVA UPS units at NJ TRANSIT's ROC in Kearny, NJ. The ROC is critical to the operations of the entire NJ TRANSIT rail system and following Superstorm Sandy needed to be made more resilient and redundant to prevent any future outages to the system. Jacobs is currently redesigning the ROC UPS system to raise and separate the equipment and power feeds to eliminate single points of failure within the facility. Subconsultant(s) under this assignment: GTS Consultant and Sowinski Sullivan Architects.

Task #4 – A/E Design Services for FTA Tier III Transit Microgrid Alternatives Analysis Evaluation for Resiliency

NJ TRANSIT is undertaking an effort to add resiliency to the Trans-Hudson Service in the aftermath of Superstorm Sandy. Jacobs and Burns Engineering have been providing engineering support to Sandia Laboratories in the evaluation of alternatives for microgrid technologies and other resiliency measures. Our work scope included providing Sandia with the unique power demands and operating requirements of NJ TRANSIT, Amtrak, PATH, and the HBLR. This information was used by Sandia to select technologies that would be suitable to handle large swings in power consumption. We also evaluated routes for the overall power distribution system to feed the NEC, the M&E, Mason Substation, PATH, and HBLR. Significant importance was placed on

KEY STAFF

- *James Homoki, PE*
- *Dale Legg, PE*
- *Thomas Decker, PE*
- *Michael Kaminski, PE*
- *Stanley Grill*
- *William George*
- *Richard LaRuffa, PE, CVS*

Project Descriptions

developing ways to minimize impacts to the communities served by the HBLRS. Subconsultant(s) under this assignment: Burns Engineering Group.

Task #5 - Design Emergency Operations Center

Design phase of the NJ TRANSIT EOC to be located at NJ TRANSIT's GOB in Maplewood, NJ. NJ TRANSIT is currently conducting EOC functions and operations (when needed) from two trailers housed at its Orange Annex. If required, they can be deployed and made mobile. NJ TRANSIT's Police Department's Office of Emergency Management is responsible for the coordination, management, and operations of the EOC. NJ TRANSIT is seeking to construct a permanent EOC at its GOB in Maplewood, NJ. Subconsultant(s) under this assignment: GTS Consultant and Sowinski Sullivan Architects.

Task #6 – NJ TRANSIT 21 Century HBLRT Audit

Jacobs is currently conducting an audit of the maintenance and repair records of the entire HBLRT system for compliance with the maintenance requirements in this multi-phased DBOM contract. Subconsultant(s) under this assignment: Sowinski Sullivan Architects.

Task #7 – NJ TRANSIT MMC Yard Power, Kearny, NJ

This project involves assessment, design, and installation of replacement and/or repairs of wayside power systems and devices, switch heater systems and devices, yard lighting, yard pit lighting systems, transformers, power distribution systems, and associated conductors and controls. The MMC and Yard are NJ TRANSIT's primary facility for maintenance of all rolling stock. Any loss or reduction in the processing capacity of this facility has a direct and immediate impact on rail service because of the reduction of rolling stock that would be available for service. These systems were damaged as a result of being inundated during Superstorm Sandy. Replacements and repairs will be installed at a higher elevation where possible, and made resilient by the use of products that are more resistant to water damage. Subconsultant(s) under this assignment: GTS Consultant, Sowinski Sullivan Architects, and Matrix New World.

Task #8 – NJ TRANSIT MMC Building Perimeter Pumps Generators, Kearny, NJ

This project involves the design and installation of systems and devices to prevent or reduce flooding from entering the MMC along the building perimeter. Specifically, vulnerabilities in the foundation system and at openings within the building envelope, including openings for rolling stock, will be targeted. These resiliency improvements will protect the facility during repeat storms, so the MMC can continue to operate normally or to allow the rapid resumption of services once a storm is over. Also, it involves the design and construction of providing high-volume pumps and associated generators / power supply at the MMC. During Superstorm Sandy, water backed up through the building drainage system and inundated the work pits. The pumps are intended to protect these key areas, so the specialized equipment and controls remain dry during a repeat storm or can be pumped out rapidly afterwards if necessary. Subconsultant(s) under this assignment: GTS Consultant, Sowinski Sullivan Architects, and Matrix New World.

Task #9 - Value Engineering Study for Improvements to Mason Substation, Kearny, NJ

Jacobs conducted a value engineering work shop on the 30% design documents prepared for the proposed $92 million reconstruction / replacement of Mason and Building 9 substations and related facilities at the MMC that were damaged as a result of Superstorm Sandy in October 2012. A future connection to the microgrid was also proposed. Jacobs recommended alternatives that could provide more than $20 million in potential project cost savings. One of the recommendations was to eliminate the 7,500 kV emergency power generating plant due to the microgrid connection. This recommendation was implemented and resulted in over $5 million in capital cost savings – eliminating a 7,000 sf building and associated fuel storage from the congested area, as well as eliminating life cycle costs to operate and maintain (3) 2,500kW generators. Subconsultant(s) under this assignment: Burns Engineering, Sowinski Sullivan Architects, and Matrix New World.

Project Descriptions

Port Authority of New York and New Jersey | PATH Harrison Substation Number 9 Replacement

Jacobs is providing architectural and engineering services for the design of a new PATH Substation No. 9; the existing substation had been submerged under a few feet of water and rendered completely unusable after Superstorm Sandy flood waters receded. Repairs were made to the substation but, due to the extensive nature of the repairs and patchwork, the reliability and maintainability of equipment was compromised and now poses a risk to continuous operation and a satisfactory level of customer service. As such, the replacement of Substation No. 9 is critical to PATH operations.

The scope of work calls for Stage III design services for a new two-story, approximately 20,000 SF, traction power substation elevated above the 100-year flood line, related site, utilities and infrastructure, Stage IV post-award services, as well as the development of a detailed O&M Manual.

Services include the commissioning of the new Substation No. 9 as well as the de-energizing, de-commissioning, and demolition of the existing Substation No. 9 building and outdoor switchyard after the new substation is commissioned into service. Specific scope items final design for furnishing, installation, and/or commissioning of:

- Substation building and site

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Harrison, NJ*

RELEVANT PROJECT DETAILS

- *Complexity of electrical substation along Northeast Corridor*
- *Latest technology including the use of energy storage systems*
- *PSE&G tie-in and substation within the building*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Planning*
- *Construction Phase Services*
- *Post-Award Services*
- *Traditional Design-Bid-Build*

SCOPE OF SERVICES

- *Architecture*
- *Mechanical Engineering*
- *Electrical Engineering*
- *Site / Civil Engineering*
- *Commissioning*
- *HVAC / Plumbing / Fire Protection / Fire Alarm / Electric Hoist / Lighting Systems*
- *Building Information Model (BIM)*
- *Structural Engineering*
- *Permits and Approvals*

START / END DATES

- *2014-2018*

CONSTRUCTION VALUE

- *$32 million (est)*

KEY STAFF

- *Diaa Elmaddah, PE*
- *Thomas Decker, PE*

Project Descriptions

- Electrical equipment including, but not limited to, 27KV switchgear lineup for PSE&G service as well as for PATH service; traction power transformer / rectifier units and related 1000 VDC switchgear; DC power system including battery charger and battery system, lighting, grounding / lightning systems, fire alarm system, SCADA system, and associated equipment.

- Electronics systems including SONET equipment; Analog and Digital Video Surveillance; Recording and Storage Systems; Telephone VoIP systems; and Access Control and Alarm Monitoring Systems.

- HVAC and plumbing/fire protection, fire alarm, electric hoist, and lighting systems.

Stage III services consist generally of preparing and delivering final design and contract documents generated from a Revit Model (Building Information Model – BIM), specifications and a final construction cost estimate, as well as services during bidding process. Jacobs will provide structural design of all underground structures, foundations and grade beams, grade level slab(s), and retaining walls. In addition, we will coordinate and comply with the PATH Harrison Station Replacement Project, PSE&G, Amtrak, and all other agencies and departments with jurisdiction over the project as well as filing for and securing all related permits and approvals required to proceed to Stage IV of the project.

For the Stage IV post-award services, Jacobs will answer field RFIs, attend periodic construction meetings, review the contractor's BIM model for content and updates as well as the 4D models provided by the Contractor, and prepare PACCs as required. The Stage IV duration is estimated at three years.

Project Descriptions

MTA Metro-North Railroad | Design of Three New Substations on the Upper Harlem Line and New Circuit Breaker Houses for the Harlem River Lift Bridge

Jacobs was the prime consultant for the design of three new DC substations on the Upper Harlem Line for Metro-North Railroad. The substations are required to accommodate the new M7 fleet of cars and to improve low-voltage conditions on the line. The project required designing a typical prefabricated substation that will be utilized at ten locations on the line. The substations have two 2 MW rectifier lineups. Design included SCADA system interface, DC power distribution ductbanks, and feeder cables to the existing tracks. New 13.8kV feeders were brought to the sites where needed.

New sites were prepared for the substations. The sitework required new access roads, grading and drainage improvements, design of structural supports for the substations, acquisition of property, and maintenance easements.

The project also required design of two new circuit breaker houses for the Harlem River Lift Bridge (one on each side of the bridge) that carries Metro-North over the Harlem River between Manhattan and the Bronx. The new prefabricated circuit breaker houses replaced the existing outdated facilities. The new unit on the Manhattan side houses a new DC switchgear lineup consisting of four circuit breakers and other related equipment including a DC power supply, battery system, and SCADA equipment. This unit is located on a structural slab adjacent to the existing circuit breaker house.

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Westchester and Putnam Counties, NY and New York, NY*

RELEVANT PROJECT DETAILS

- *Project involved power substations and rail substations*
- *Included resiliency, reliability, maintainability, and third party coordination*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Planning*
- *Feasibility Studies*
- *Construction Phase Services*
- *Traditional Design-Bid-Build*

SCOPE OF SERVICES

- *Site / Civil Engineering*
- *Geotechnical / Structural / Facilities*
- *Security / Safety*
- *Systems Engineering*
- *Commissioning & Testing*
- *Environmental*
- *Electrical Engineering*
- *Traction Power*
- *Architecture*
- *Environmental*
- *Cost Estimating*
- *Construction Scheduling*

START / END DATES

- *2009-2015*

CONSTRUCTION VALUE

- *$60 million*

KEY STAFF

- *Diaa Elmaddah, P.E.*

Project Descriptions

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Various Locations, NY*

RELEVANT PROJECT DETAILS

- *Designed 64 miles of fiber optic cable and associated railroad signals*
- *Coordinated with Amtrak, CSX, NYSDOT, and local electrical utilities*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Planning*
- *Construction Phase Services*
- *Traditional Design-Bid-Build*

SCOPE OF SERVICES

- *Survey 64 Track Miles*
- *Develop Civil Plans*
- *Develop Cable Plans*
- *Develop Signal and Crossing Design Plans*
- *Develop Specifications and Support Contractor Bid*

START / END DATES

- *2014-Design; Construction Phase Services are Ongoing*

CONSTRUCTION VALUE

- *$36 million*

KEY STAFF

- *Robert Rosa, P.E.*

New York State Department of Transportation | Empire-Hudson Line Signal Reliability Improvements, NYSDOT Railroad Retainer Agreement

The 64-mile Empire-Hudson Line Signal Reliability Improvement project involved the replacement, upgrade, and modifications to the systemwide power distribution, signaling, and communication infrastructures to support and improve system reliability. The provided systems are also PTC-compatible.

Jacobs has been responsible for developing signal/cable layout plans, single line diagrams, interlocking plans, and grade crossing warning system plans in conformance to Amtrak requirements. Additional details related to the scope include:

- Develop site impacts that impacted installation of 8’x10’ CIH’s and develop installation details
- Electronic track circuit system, verify, and design block point sections at slide fence detectors and electric locks at sidings, implementation of “block clear” aspects
- Interlocking design was composed of replacing search light signals with color light signals, providing block clear
- Grade crossing designs to include replacement of motor gates / arms, 8” warning lights with 12“ LED lights, data recorders, and crossing detection equipment, GETS XP4, and Predictors
- Communication design to provide new fiber optic communication systemwide, complete with nodes and splice panels.
- Drawings were designed under Amtrak standard CADD system (MicroStation).

Project Descriptions

In addition, Jacobs designed civil and structural plans for the 64-mile project consisting of routing of new cable for the signals, communications, and power systems. Construction / installation plans for plowing were developed to tie in the direct burial cable application to the signal houses and system signal cases. Structural details were developed for bridges, culvert crossings, cross track, and jack and bore. Design exception requests were developed for systems that did not comply with Amtrak's guidelines.

Jacobs developed all of the civil and structural plans and worked hand-in-hand with procurement to advance the solicitation to award the contract.

Project Descriptions

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *New York, NY*

RELEVANT PROJECT DETAILS

- *Complex electrical rail system along the Northeast Corridor*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Construction Phase Services*
- *Traditional Design, Bid, Build*

SCOPE OF SERVICES

- *Catenary Design*
- *Traction Power Design*
- *Structural Design*
- *CPM Scheduling*
- *Staging*
- *Constructability*
- *Cost Estimating*

START / END DATES

- *1998-2011*

CONSTRUCTION VALUE

- *$55 million (est)*

KEY STAFF

- *Anthony Zeloyle, PE*

Amtrak | Hell Gate Line Catenary Modifications

We provided engineering services for modifications to the Hell Gate Line in New York. Services provided included catenary design, traction power design, CPM scheduling, and cost estimating for the elimination of hanging beams, main messengers, and bridle wires along 14 miles of Amtrak's Hell Gate Line north of New York City.

Extensive track modifications and re-alignments required close coordination to maintain railroad operations. New catenary structures were required along the length of the line to support the catenary and to support new railroad feeders. The catenary was also re-profiled to allow high-speed train operations between New York City and Boston as part of Amtrak's new high speed rail modifications.

Jacobs also provided construction support services during which Jacobs made every effort to be responsive to all questions and requests for information that arose during the construction period. This service was available for issues brought forward by Amtrak, the construction contractor and his subcontractors, and any related or impacted federal, state, county, or municipal entity.

Extensive track modifications and curve re-alignments required close coordination to maintain railroad operations. New catenary structures, approximately 100 new structures, were required along the length of the line to support the proposed catenary systems and to support new railroad feeders. The catenary was also re-profiled and re-graded to allow high-speed train operations between New York City and Boston as part of Amtrak's new high-speed rail modifications. A new interlocking (MANOR) was installed to provide flexibility in train operations. The new interlocking included universal crossover, snowmelter unit substation, interlocking lighting, RTU house, control panel, SCADA, and a 60Hz powerhouse.

Project Descriptions

Amtrak | Ivy City Yard Substation and Transmission Line

We worked with Amtrak to implement a massive stimulus project under the ARRA. We provided Amtrak with nationwide program and construction management services for 286 infrastructure improvement projects across 45 states. We provided services for the construction of a 138-12kV 25 Hz single phase substation at Ivy City Yard in Washington, DC and an extension to the 138kV transmission line between Landover Substation in Maryland and the Ivy City Yard. The work included:

- **Transmission line work:** foundation drilling, concrete pole erection, and wire installation
- **Substation civil/site work:** demolition, grading drainage, relocation, and installation of utilities, fencing, and access road construction
- **Substation construction:** transmission line terminations, installation of motor operated disconnect switches, traction power transformers, disconnect switches and circuit breakers, 12kV cabling, 12 kV feeders, substation control building complete with relay control panels, auxiliary power systems, lighting, grounding, wiring terminations, SCADA, and all associated equipment

Since this project involved work in portions of the Ivy City Yard for the substation and along the NEC for the Transmission Line, safety was our priority. We successfully advanced the project in a safe manner by working with Amtrak and the contractor to thoroughly review work plans and procedures. Extensive coordination efforts with road and government authorities were required to construct the transmission line over open roads and waterways. Document control was critical to provide Amtrak with the required information to start-up the new substation facility.P

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *Washington, DC*

RELEVANT PROJECT DETAILS

- *Developed 30 percent design of Amtrak rail yard reconstruction projects*
- *Performed comprehensive rail yard field investigations*
- *Updated construction staging plans to maintain operations during construction*
- *Developed accurate construction estimates*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Construction Management and Inspection*
- *Program Management*
- *Traditional Design-Bid-Build*

SCOPE OF SERVICES

- *Material and Service Procurement*
- *Railroad Coordination*
- *Project Controls*
- *Cost Engineering*
- *Quality Assurance*
- *Document Control*

START / END DATES

- *2009-2011*

CONSTRUCTION VALUE

- *$19.6 million*

KEY STAFF

- *Gerard Ruggiero*

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Project Descriptions

NJ TRANSIT | Design, Engineering, and Construction Services for County Yard Improvements (NJT Contract No. 13-041)

Jacobs has been contracted to perform design services for the County Yard Improvement Project and Train Storage Facility, including overnight storage and light maintenance facilities for Electric Multiple Unit (EMU) trains consists, five storage tracks, two pedestal tracks within a service and inspection (S&I) facility, crew quarters, and other railroad appurtenances. The scope also includes new high-level Jersey Avenue Station platforms, and electrification of Track 5 (existing Conrail Delco Lead). The improvements to 5 miles of the Delco Lead will be two-fold — first to provide an 80 mph alignment to the proposed Mid-Line Loop and second to provide added resiliency in the form of additional "safe harbor" storage for the NJ TRANSIT fleet along the NEC during a future catastrophic event.

In advancing this project from project definition / conceptual planning through final design, construction bid services, and construction services — our approach will be focused on achieving the following project objectives:

Key Project Objectives

- Approach design with the understanding of achieving short-term objectives of increasing storage and the longer-term objective of removing trains from the NEC by 2017.
- Provide adequate overnight storage capacity to accommodate the number of eastbound train starts and provide for operating flexibility to maximize on-time performance and minimize train conflicts.

RESPONSIBLE FIRM

- *Jacobs Engineering Group*

LOCATION

- *North Brunswick, NJ*

RELEVANT PROJECT DETAILS

- *Investigated double-tracking this section to offer storage space (about 22,000 feet, i.e. 260 cars) for rolling stock during a catastrophic storm*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Project Management*
- *Force Account Coordination*
- *Design*
- *Planning*
- *Construction Phase Services*
- *Traditional Design, Bid, Build*

SCOPE OF SERVICES

- *Rail Systems Integration / Track*
- *Electrical Traction / Power / Signals*
- *Communications / Cable / Conduit Routing / Installation Layout*
- *Public Utility Coordination / Relocations*
- *Surveying / Right-of-Way – By GTS*
- *Civil / Drainage*
- *Permitting / Environmental / Contaminated Material*
- *Historic / SHPO*
- *Public Outreach*
- *Operations Analysis / Staging*
- *Contractibility Analysis*
- *Contract Packaging*
- *Structural*
- *Geotechnical – By Matrix*
- *Soil Investigations*
- *Cost Estimating*
- *Value Engineering / Risk Analysis*

Project Descriptions

START / END DATES

- *2014-Ongoing*

CONSTRUCTION VALUE

- *$230 million*

KEY STAFF

- *Richard Sirabian, PE*
- *Thomas Decker, PE*
- *James Dowling, PP, AICP, AVS*
- *Steven Ricucci*
- *Michael Kaminski, PE*
- *Kenneth Bienkowski, PE, AVS*
- *Tamara Schlagbaum, ALSA*
- *William George*
- *Dale Legg, PE*
- *Richard LaRuffa, PE, CVS*
- *Robert Witte, LEED® AP (SSA)*
- *Donald Heck, PE (Matrix)*

- Make sure the improvements in County Yard are fully integrated with the design for Mid-Line Loop flyover.
- Accommodate future freight traffic on the Millstone Branch.
- Upgrade the Delco Lead track to passenger train operating standards (80 mph track speeds, ATC based signal system, overhead catenary, etc.), either as a double or single track with passing sidings.
- Improve platform access by designing new high-level station platforms and eliminating the existing low-level platforms.
- Maintain train operations through construction and maintain a safe environment for passengers, crews, and maintenance of equipment employees.
- Incorporate safety and security into the design of the yard and facilities to minimize risk and allow for a secure yard and facility.
- Advance the project consistent with the schedule expectations of NJ TRANSIT and the requirements of the funding sources.
- Identify innovative and cost saving concepts that increase the cost-effectiveness and return on investment for the project.
- Minimize environmental permits and permitting requirements.

Proposed Yard Layouts

Several yard / interlocking alternatives were considered to achieve the ten objectives identified above. Alternatives developed considered current and future train operational requirements to make sure the needs of NJ TRANSIT are met under both alternatives. In any yard layout, increasing the track centers of Yard Tracks was evaluated to permit the installation of catenary poles to simplify the staging of the installation of the yard and its catenary and the design of the catenary structures.

As part of the expansion, the operating needs of Conrail on site and its freight customers in the service area must be accounted for, using a philosophy of “Do No Harm.” The continuation of the existing operation is Conrail’s continued ability to enter and exit the Millstone Branch at County Interlocking, access Track 1 on the NEC and not impede NJ TRANSIT and Amtrak commuter train traffic.

Yard Design

The yard is designed to hold ten 12-car trains, with two trains per track on five tracks. The facility will be designed to allow the following work to be performed in a safe and efficient manner: 1) The daily FRA mandated walking inspection would be easily performed since the roadways will be paved and lighted; 2) Toilet servicing will be performed by utilizing a “honey wagon” to service each train. In-ground systems like water hydrants will be provided. A separate facility will be provided to dump the honey wagons; 3) Car cleaning, inspection, and minor repairs will be performed in the yard.

Adequate track centers will be provided such that one side of every train will be accessible by the toilet servicing truck. Paved roadways with overhead lighting will provide a safe means for train crews to move from and to the trains from their crew quarters.

S&I Facility

We reviewed the needs of NJ TRANSIT and developed a design that works best for this facility. We can duplicate or modify the proposed S&I facility footprint. The shop as presently designed appears to be capable of doing much more than S&I work. It appears that one of the largest tasks would be the cleaning of HVAC evaporators. We do not see any reference to changing out rooftop A/C units or trucks. The repairs to overhead catenary systems on the cars would be accommodated with the facility design. We envision a facility with pits, depressed side floors, platform access to the car interiors, and rooftop access (including fall protection) from a rooftop platform.

These building functions must be arranged on a very tight and constrained site while keeping in mind the need to create a smooth operational flow between related work elements. Capabilities to maneuver equipment in a safe and timely manner results in an efficient shop work environment. The general layout of the shop areas and proximity of the support areas will be developed to facilitate maintenance activities.

Delco Lead

Existing Delco Lead is a 10 mph stub-ended freight track, not currently in active use by Conrail, to serve several industrial customers in the distance between Jersey Avenue and the proposed Mid-Line Loop. The Delco Lead track forms an extremely vital rail link to be constructed between the expanded County Interlocking at MP 33 and the Mid-Line Loop at MP 38, which is about 5 miles to the south (railroad west) of Jersey Avenue Station. It needs to be upgraded to passenger train operating standards (60 mph track speeds, ATC-based signal system, overhead catenary, etc.).

We have investigated double-tracking this section to offer storage space (about 22,000 feet, i.e. 260 cars) for rolling stock during a catastrophic storm, and also to provide a passing siding to provide maximum operational flexibility.

Jersey Avenue Station

Today, the WB NEC Jersey Avenue Station, unlike all other stations on the NEC, sports a very simple low-level platform, black topped, with little shelter. It is the only NJ TRANSIT station not handicap accessible on the NEC from Trenton to New York. All other NEC stations have "high-level platforms" (HLP) serving EB and WB sides of the NEC. The EB Jersey Avenue Station platform parallels the Millstone Running Track. Both the EB and WB station platforms are separated by the station's parking lot.

In conjunction with the expanded County Yard, EB and WB NEC Jersey Avenue new high-level station platforms will alleviate the inconvenience to passengers; who now board and depart trains at the existing Jersey Avenue Station on the Millstone Branch. As proposed in the County Yard project design plans, there will be two new high-level platforms on the NEC. These station platform improvements will be fully ADA compliant and vastly benefit NJ TRANSIT customers, while longer platforms will enable access of full-length 12-car trains and provide greater capacity.

Contract Packaging

Jacobs is working closely with NJ TRANSIT to develop a strategic contract packaging and a construction schedule that can be staged with little to no impact to current operations. Of course, this strategy will be fully coordinated with NJ TRANSIT's funding availability.

The Jacobs Team has assessed the project components, physical and potential funding constraints, and possible constructability approaches and strategies. It is our understanding that some funding from Superstorm Sandy could be applied to aid in the construction of additional storage capacity coupled with and the quick removal of rolling stock off the NEC in the event of a weather related or operational / contingency emergency, and to sync up with the Mid-Line Loop Project, as necessary. We have identified potential packages in a prioritized manner to

Project Descriptions

enable the project to advance in a logical sequence with minimal operational and contract package interference and maximum schedule advancement including 1) Delco Lead Improvements, 2) Yard Expansion, 3) S&I Facility, and 4) Jersey Avenue Station.

Construction Staging

The construction of County Yard requires detailed construction staging, dependent on required operational flexibility. We have developed a construction staging scheme based on our knowledge of the site and several assumptions regarding the goals of NJ TRANSIT. Due to the number of variables controlling operations at the Jersey Avenue Station and County Yard, the proposed construction staging can be consolidated by coordinating with all rail operators utilizing the site.

The staging for the construction of County Yard and the Delco Lead involves a multi-staged construction approach to the County Yard site. This multi-staged approach allows for County Yard, the S&I Building, and the Delco track to be constructed independently of the Jersey Avenue Station platforms. Construction in this manner allows for NJ TRANSIT to focus on construction activities, which would improve overall rail storage capacity, and provides resiliency against a Superstorm Sandy type event.

Environmental/NJDEP Land Use Permits

There are quite a few environmental constraints along the project corridor that we have identified as part of this proposal effort. Four major streams either cross or are adjacent to the project area. In addition, there are numerous pockets of freshwater wetlands and ditches along Delco Lead and in the vicinity of the proposed S&I Building. NJDEP permits will be necessary to advance the construction of the proposed project. At a minimum a Flood Hazard Area (FHA) Individual permit including impacts to the Riparian Areas, a Wetlands Individual Permit (including mitigation), Wetlands Transition Area Waiver for linear projects, a Reforestation Permit, and Stormwater Management (SWM) will be necessary.

NJ TRANSIT will advance a National Environmental Policy Act (NEPA) review separate from this effort. In February 2013, the FTA finalized new rules concerning the applicability of NEPA Categorical Exclusions (CE's) to certain categories of transit projects.

Surveying – GTS Consultants

GTS provided ground survey and mapping for approximately 5 miles of the NEC to support the design of a new rail yard and new rolling stock storage tracks. Survey and mapping tasks included ground control for aerial topographic mapping, installations of a control survey baseline and benchmarks, surface and subsurface utility survey, location of wetlands and stream cross-sections, storm and sanitary sewer as-built survey, and terrestrial LiDAR (stationary 3D LASER scanning) to develop catenary wire locations and profiles. In addition, GTS developed the existing right-of-way and property lines for the rail corridor and adjoining properties.

One significant challenge encountered on this project was the presence of high-speed train traffic immediately adjacent to survey work areas. Rather than using conventional survey, GTS performed 3D laser scanning (terrestrial LiDAR) to capture the alignment and profile of rails and catenary wires on the NEC in previously unmapped segments. This data was important to design track turnouts and catenary connections to the new yard and lead tracks. Another challenge was record-keeping to manage the volume of information from field survey, public records research, and record utility information. Jacobs and GTS professionals coordinated closely to inventory and incorporate the various components into the project base mapping.

Geotechnical Engineering / Subsurface Investigations – Matrix

Matrix is providing geotechnical engineering services for this project as a subcontractor to Jacobs. The purpose of the geotechnical engineering study is to evaluate the suitability of on-site soils related to proposed improvements. Matrix will prepare boring logs from the subsurface investigation. A Geotechnical Data Report summarizing the subsurface conditions is to be prepared.

Project Descriptions

NJ TRANSIT | Power Generation System to Increase System Resiliency and Reliability

In response to Superstorm Sandy in October 2012, NJ TRANSIT is evaluating the feasibility of a microgrid system to power rail transit operations between northern New Jersey and Manhattan in the event of an outage. While proven to work well on large campuses and military bases, using a microgrid to provide power to a transit system presented a new and unique challenge.

Using many years of transit engineering expertise coupled with recent experience developing advanced microgrids, Burns was uniquely able to assist NJ TRANSIT. Hired to work with Sandia National Labs, Burns undertook a comprehensive assessment of the economic, technical, and operational feasibility of a “TransitGrid.”

A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations, and innovative operating strategies. Burns evaluated distributed energy resources that would support non-traction power loads at outlying passenger facilities including cogeneration, solar PV, fuel cells, battery storage, and demand response.

In addition, Burns assessed fuel supply and related equipment, as well as electrical distribution upgrades and interconnection points that would deliver resilient power throughout NJ TRANSIT system’s critical infrastructure from Newark to Jersey City. Burns reviewed and provided input on technology upgrades and integration strategies including metering, relaying, smart microgrid communication, network operations center, and large regional substations to ensure resilient design and operation.

RESPONSIBLE FIRM

- *Burns Engineering*

LOCATION

- *Newark, NJ*

RELEVANT PROJECT DETAILS

- *Worked with Sandia Labs to assess technical and economic feasibility of a TRANSITGrid*
- *Preliminary engineering to establish potential solutions to technical challenges*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Time & Material*

SCOPE OF SERVICES

- *Preliminary Engineering*
- *Constructability Review*
- *Operations Review*
- *Field Investigations*
- *Cost/Financial Analysis*

START / END DATES

- *2013-2014*

CONSTRUCTION VALUE

- *$700 million*

KEY STAFF

- *Bruno Fiorentino, PE*
- *Michael Walton, PE*
- *Daren Petroski, PE*

Project Descriptions

Additionally, Burns worked with the local utility and the State of New Jersey to determine the impact of the generation assets and other distributed energy resources on the regional electric grid, and considered alternative business structures, financing and asset ownership, and operation to most cost-effectively design, build, and operate these assets.

Project Descriptions

Philadelphia Industrial Development Corporation | Smart Micro-Grid Implementation for the Philadelphia Navy Yard

Burns is currently working on the Phase 2 implementation of one of the country's most advanced smart microgrids at the Philadelphia Navy Yard. The Philadelphia Industrial Development Corporation (PIDC), owner and economic developer of the historic, 1,200-acre Philadelphia Navy Yard, projected doubling of building square footage over the next 10 years along with the challenge of accommodating a 200% growth in electrical power demand from 26 MW to more than 70 MW. The Navy Yard electrical grid is already considered one of the largest non-municipal unregulated grids in the nation. A "business as usual" approach to planning and managing this growth would require massive capital expenditures, result in costly system inefficiencies, and require the PIDC to charge noncompetitive electric rates to tenants. Instead, PIDC challenged Burns with a breakthrough concept to repurpose the "capital liability" of improving the antiquated energy infrastructure into a "capital asset" with return on investment, providing the campus with competitive differentiation to attract and retain tenants. PIDC knew it needed an Energy Master Plan (EMP) to achieve this.

PIDC hired Burns Engineering to plan and implement a smart microgrid for the 1200-acre campus. Burns provided planning, energy consulting, and engineering while also acting as client and stakeholder liaison for over 60 stakeholders. The project complexity was increased due to the necessity to align many factors with competing demands. Examples include: increase capacity yet minimize financial outlay; increase capacity but reduce carbon footprint; lower consumption yet expand facilities; self-generate while still on the grid; remain a utility customer while becoming a utility provider; and modernize expensive infrastructure while lowering costs to tenants. Gathering, processing, and coordinating the input and needs of roughly

RESPONSIBLE FIRM

- *Burns Engineering*

LOCATION

- *Philadelphia, PA*

RELEVANT PROJECT DETAILS

- *70 MW advanced microgrid design and implementation*
- *Coordination with local gas and electric utilities*
- *PJM interface*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Overall Program Management*
- *Fixed Lump Sum*

SCOPE OF SERVICES

- *Client and Stakeholder Liaison*
- *Microgrid Planning & Design*
- *Energy Master Plan*
- *Assessment of Power Generation & Energy Storage Technologies*
- *Preparation of Design-Bid-Build Documents*

START / END DATES

- *2011-Ongoing*

CONSTRUCTION VALUE

- *$46 million*

KEY STAFF

- *Bruno Fiorentino, PE*
- *Michael Walton, PE*

Project Descriptions

60 stakeholders, some of which have polar opposite needs, required an engaging, complex, and far-reaching stakeholder process including: utilities, owners, tenants, real estate developers, policy agencies, education and research institutions, and regulatory agencies. Rethinking the traditional utility business model, considering distributed energy resources and microgrids, leverages third-party capital and energy asset ownership; enables shared community generation; provides aggressive incentives to encourage efficiency and demand management; and creatively funds efficiency projects through such mechanisms as on-bill financing and energy services agreements. Establishing the best business strategy in an environment of uncertainty and rapid change requires complex and extensive modeling to assess multiple scenarios. The EMP analyzed thousands of data points and variables related to fuel, peak loads, distribution grid parameters, technology, building energy usage, weather, energy markets, demand growth rates, and the cost of capital. The key model outputs and decision metrics centered on scenario ROIs, total capital outlays, leveraged equity, and risk. Optimizing multiple existing as well as emergent energy, communication, and control technologies was a complex yet essential challenge of the EMP. Technologies fundamental to the plan include distributed energy resources (CHP cogen, solar PV, and energy storage), energy-efficient systems, smart meters, and a communication backbone to support and manage metering, grid operations, and generation assets.

Working with more than 60 stakeholder groups, including utilities, tenants, policy entities, university research institutions, developers, and owners, Burns and PIDC established the following goals of the EMP: 1) provide a competitively priced and more sustainable energy supply to all customers; 2) foster the growth of the “Smart Energy Campus;” 3) attract a continuing diverse base of businesses to the Navy Yard; 4) attract energy innovation and testing and serve in part as a “living lab;” and 5) attract third-party capital and employ and maintain sustainable, self-funding business models. To help PIDC achieve these goals, Burns identified and assessed numerous viable options, and then applied rigorous analysis on hundreds of technical, financial, operational, and risk factors to select the best option. The resulting EMP is a comprehensive energy, infrastructure, technology, and business plan that will guide the PIDC in the ownership, management, and expansion of its unregulated grid into a state-of-the-art advanced microgrid consisting of a diverse array of distributed energy resources.

The innovative microgrid uses electric grid market signals, algorithms, and machine-to-machine communication systems to self-adjust energy systems, regulate building loads, and dispatch energy generation and storage systems to optimize costs, reliability, and power quality. The microgrid provides a resilient platform for distributed energy resources and enables multidirectional power flows, building-to-grid and vehicle-to-grid optimization, volt-var management, frequency regulation, increased power quality, and real-time situational and market awareness. The system’s key components include:

- **Advanced metering infrastructure** — smart meters, meter data management, and network communications including LAN, WAN, and communications backbone.
- **Network operating center** — command, control, and situational awareness of all microgrid assets including generation, distribution substations and feeders, energy storage, and system loads.
- **Demand response programs** — active load management systems consisting of integrated communications and control technology, and weather information able to take grid operating and market conditions to control peak demand by more than 13 MW.
- **Distribution automation** — incorporated into smart substations, includes real-time switching of loads from overloaded feeders and distribution assets to other systems and equipment.
- **Grid expansion** — rerouted feeders and new smart substations.

Project Descriptions

- **Energy-efficiency programs —** to reduce electricity usage 20% and greenhouse gas density by 13%.
- **Self-generation —** 6 MW of gas-fired generation; 1 MW of solar PV and energy storage; 0.8 MW of fuel cells.

The smart microgrid enables PIDC to take advantage of a new utility business model that reduces investment required to $46 million, instead of the originally estimated $95 million. By implementing the smart microgrid, PIDC working to successfully achieve its energy, economic, and environmental goals, and maintain the nationally unique “Smart Energy Campus” brand. The collateral benefit is that it brings Philadelphia closer to its goal of becoming America’s greenest city. The new smart microgrid will also serve as a guide to both utilities and industries throughout the U.S. that are facing capacity limits, aged infrastructure, demand growth, and disruptive technologies.

Project Descriptions

RESPONSIBLE FIRM

- *Burns Engineering*

LOCATION

- *Jersey City, NJ*

RELEVANT PROJECT DETAILS

- *Response to post-Superstorm Sandy recovery efforts*
- *Familiarity with HBLRTS systems*
- *Developed mitigation strategies*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *On-Call Contract*

SCOPE OF SERVICES

- *Emergency On-Site Response Team*
- *Signals Engineering*
- *Damage Assessment*
- *Recovery Measures and Mitigation Strategies*

START / END DATES

- *2012-2013*

CONSTRUCTION VALUE

- *$50,000*

KEY STAFF

- *William Wiedmann, MIRSE*

NJ TRANSIT | Hudson-Bergen Light Rail Transit System, Post-Hurricane Sandy Train Control Recovery

After Superstorm Sandy in October 2012, the Hudson Bergen Light Rail Transit System (HBLRTS) called upon Burns to help restore three vital control points in their system. One control point was flooded with over four feet of water, while the others had various problems with water-damaged electronics and wayside equipment.

Working alongside HBLRTS employees and subcontractors, Burns quickly and successfully directed the restoration to allow the light rail to run normally scheduled service soon after the hurricane. The flooded interlocking was quickly restored to service by identifying all operationally vital equipment and removing all the unnecessary damaged equipment. The vital signal equipment was either rehabilitated or replaced and rewired. All equipment was tested before restoration of service to ensure safe operation. The flooded control point was restored to service with limited operability by Christmas 2012 to allow HBLRTS to continue operating on schedule.

Recovery measures included vital logic processor assessment and communications restoration, wayside switch troubleshooting and testing, damage assessment, recovery estimating, and mitigation strategies to avoid future occurrences.

As a follow-up, Burns is working with HBLRTS to develop construction documents for the replacement of all the switch machines in the Jersey City yard.

Port Authority of New York and New Jersey | Holland Tunnel Supervisory Control System (SCS) Replacement

Burns led the electronic engineering effort for the replacement of the Holland Tunnel's existing Supervisory Control System (SCS) with a new SCADA system. The project included the integration of the new system with the various existing communication, alarm, monitoring, and control sub-systems throughout the Holland Tunnel Facility that are required for tunnel operation and maintenance. The project increased the capacity of the nodes on the local SONET communications system that utilized the Port Authority single mode fiber optic network, for enhanced systems monitoring and control capabilities. The SCADA system requires a data network in order for the devices to communicate with each other. The SONET communication network utilizes GE Junglemux devices operating at OC-3 capacity. This system has eight nodes in various locations of the tunnel facilities that were utilized for the SCADA data network. The Junglemux hardware was near its capacity, so six of the eight nodes were expanded.

The project upgraded the existing telephone system and emergency patron call box system to provide digital voice transport and incorporate patron emergency pushbutton alarms into the new SCADA-based SCS. The project also included a complete replacement of the supervisory cabling infrastructure (copper and fiber optic), data infrastructure for a back-up control room, and the development of an advanced video wall system for the tunnel's supervisory control room. The new video wall will provide a streamlined display of images and data from several systems, including the SCS, ACS, and CCTV systems, allowing staff to more efficiently oversee tunnel operations and respond to system alarms.

RESPONSIBLE FIRM

- *Burns Engineering*

LOCATION

- *Jersey City, NJ and New York, NY*

RELEVANT PROJECT DETAILS

- *Large-scale communications infrastructure design*
- *Design of control and data acquisition system*
- *Included supervisory control room and back-up control room designs*
- *Design extensively identified and utilized existing infrastructure to minimize construction cost and increase project practicality*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Design*
- *Planning*
- *Construction Phase Services*
- *Time and Material as Part of On-Call Services*

SCOPE OF SERVICES

- *Electronics Engineering*
- *Communications Systems Engineering*

START / END DATES

- *2012-Ongoing*

CONSTRUCTION VALUE

- *$1 million*

KEY STAFF

- *Kevin Shertz, PE*

Project Descriptions

RESPONSIBLE FIRM

- *Levitan & Associates*

LOCATION

- *Various Locations, NJ and NY*

RELEVANT PROJECT DETAILS

- *660 MW HVDC Hudson Transmission Project (HTP) from NJ to New York City to access PJM cost-effective long term power supplies*
- *765 kV PATH PJM backbone transmission project to relieve power flow congestion across PJM*
- *HTP provided more than 200 jobs, primarily in NJ*
- *HTP improved reliability and lowered costs in New York City*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Planning*
- *Interconnection Process*
- *Feasibility Study*

SCOPE OF SERVICES

- *Transmission Planning and Bulk Power Market Support*
- *PJM Interconnection Process Support – Feasibility Study, System Impact Study, Facilities Study*
- *Stakeholder Committee Meeting Support*

START / END DATES

- *HTTP: 2007-2009; in service June 2013*
- *PATH: 2010-2011*

CONSTRUCTION VALUE

- *HTP estimated direct construction cost: ~$850 million*
- *PJM upgrade costs: ~$180 million*

KEY STAFF

- *Edward Tsikirayi*

PJM Interconnection Process | PJM Interconnection Process

Levitan has assisted clients in navigating the PJM interconnection process by providing expert advice on the interconnection process rules as well as shepherding projects through the various stages of the interconnection process: Feasibility Study, System Impact Study, and Facilities Study. Levitan advised the New York Power Authority (NYPA) on PJM Market Rules and Dynamics, the PJM DFAX methodology for transmission cost allocation, Capacity Export Charges and Credits and Incremental Capacity Transfer Rights for the 660 MW HVDC Hudson Transmission Project (HTP).

We reviewed the economic viability of HTP for NYPA, including sourcing power from the PJM market, and represented NYPA at various PJM committees and working group meetings and at larger meetings with PJM, the cable developer, and PSE&G, the transmission owner to shepherd the project through the PJM interconnection process. The HTP back-to-back converters and switchyard are shown above.

Levitan provides transmission planning and bulk power market support to clients for new generation projects as well as for HVDC and AC transmission projects. For example, Levitan provided transmission planning support to the Virginia State Corporation Commission Staff regarding the application of the Virginia section of the Potomac-Appalachian Transmission Highline (PATH-VA), a 765 kV PJM backbone transmission project, for a Certificate of Public Convenience and Need. Levitan's support included reviewing the PATH application and pre-filed testimony, assessing the reasonableness of the assumptions and data inputs, replicating the application load flow study base case, conducting an independent transmission alternative solution analysis, assessing the reasonableness of the PJM RTEP process regarding transmission and generation deliverability, and submitting written and oral testimony.

Project Descriptions

Cornell University | Microgrid Energy Master Plan

Cornell faced increasing electric and thermal loads with an aging central heating plant (CHP) centered around coal-fired boilers. A master planning initiative was begun in 2002 to address future energy needs in a volatile market for fuel and electricity, increasing levels of environmental regulation and awareness, and a desire to provide a high-degree of system reliability and to safeguard the University's core mission. Cornell selected the Gryphon International Engineering Services and Levitan to provide engineering and economic services to develop a plan that ultimately led to an $82.3 million project.

Two 15 MW Solar Titan gas turbines with heat recovery steam generators were added to the existing CHP, along with a 3.2-mile dedicated gas lateral and a new 115 kV substation and a dump condenser. The facility has adequate electric capacity and appropriate switchgear to meet most of the campus electric load in isolation from the utility, if necessary. Steam from the HRSGs flows through a pre-existing backpressure steam turbine for additional electric output. Once the new equipment was in proven operation, Cornell was able to retire its coal-fired boilers, meeting a goal adopted by the University to permanently reduce its carbon footprint.

Levitan developed a comprehensive technical / financial model of the campus energy system that allowed the calculation of life-cycle costs for alternative CHP expansion concepts, while considering a range of load growth and market conditions. Our model used a probabilistic add-in module to capture load and fuel price volatility in the short-run and different scenarios for loads and prices in the longer run. In the Phase 1 screening process, a wide range of technologies and energy sources were considered, including closed-loop biomass and wind, as well as continued use of coal and

RESPONSIBLE FIRM

- *Levitan & Associates*

LOCATION

- *Ithaca, NY*

RELEVANT PROJECT DETAILS

- *Multi-phase screening analysis of alternative central heating and power plant configurations*
- *Complete displacement of coal-fired steam*
- *Island operation in the event of a grid blackout*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Master Planning*

SCOPE OF SERVICES

- *Analysis of historical and projected thermal and electrical loads*
- *Development of multiple scenarios with different fuel and energy price, load growth outlooks*
- *Phase 1 screening analysis using Monte Carlo simulation for load and price variability and steam unit availability*
- *Phase 2 decision-tree analysis with time-phased investments dependent on uncertain future events*
- *Natural gas supply and transportation strategy analysis and negotiation support*
- *Analysis of alternative gas turbine bid offerings*

START / END DATES

- *Levitan: 2004-2006*
- *Construction: 2006-2009*

CONSTRUCTION VALUE

- *$82.3 million*

KEY STAFF

- *Phil Curlett, PE*

Project Descriptions

expanded use of natural gas. In Phase 2, a decision tree was developed to allow for the probabilistic comparison of near-term decisions while considering related future expansion options, based on market and load conditions that might arise. This analysis indicated that the near-term addition of one or two gas turbines offered lower total present value of utility costs over the entire study period than the use of package boilers and purchased power or the replacement of the existing coal boilers with a large circulating fluidized bed coal boiler.

Once the gas turbine-based configuration was selected and approved, Levitan supported Cornell in negotiations with an interstate pipeline company to provide a 3.2 mile, high-pressure dedicated lateral to the CHP site and a transportation agreement, thus providing the CHP with access to high reliability, relatively low cost natural gas. Levitan also provided additional technical / financial modeling to help Cornell evaluate the offerings of gas turbine vendors.

New Jersey Board of Public Utilities | Long-Term Capacity Agreement Pilot Program

Levitan was retained by the NJ BPU as its Agent to administer the Long-Term Capacity Agreement Pilot Program (LTCAPP), created by the NJ legislature and signed into law by Governor Christopher Christie to benefit ratepayers by facilitating the development of 2,000 MW of base load and mid-merit capacity. Levitan worked closely with the BPU to implement LTCAPP in an impartial, objective, and transparent manner with strict oversight on communications, adherence to the procurement process, and regulatory adherence.

Levitan structured the LTCAPP process, solicited bidder interest, and developed the Standard Offer Capacity Agreement (SOCA) through multiple rounds of drafts and stakeholder comments. The SOCA balanced ratepayer, generator, and utility interests, set pricing formulas consistent with PJM market rules, and facilitated project financing via industry-standard structures.

Levitan determined the eligibility of interested generators based on defined criteria of plant technology, development experience, and financial strength. We qualitatively and quantitatively evaluated bids from eligible generators and assessed the proposed projects based on power market economics, environmental criteria, community impact, and risk / certainty of completion.

Levitan recommended three SOCA awards to selected generators. The BPU accepted Levitan's recommendations and awarded SOCAs for almost 2,000 MW of new in-state gas-fired combined cycle capacity. Levitan supported the BPU in the face of legal challenges to the LTCAPP law and resulting SOCA awards.

RESPONSIBLE FIRM

- *Levitan & Associates*

LOCATION

- *Various Locations, NJ*

RELEVANT PROJECT DETAILS

- *Administered the LCAPP program*
- *Worked with stakeholders to develop the Standard Offer Capacity Agreement*
- *Established detailed prequalification criteria to determine generator eligibility*
- *Conducted rigorous multi-stage qualitative and quantitative criteria analysis to identify the best proposed projects from the standpoint of NJ ratepayers*
- *Recommended nearly 2,000 MW of approved projects*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Studies*

SCOPE OF SERVICES

- *Bidder Screening Analysis*
- *Project Management*
- *RFP Development / Distribution*
- *Life Cycle Cost Estimate*
- *Forecast Air Emission Reduction*
- *Detailed Economic, Air Emissions, and Risk Analyses of Projects*
- *Regulatory Support During Legal Challenges*

START / END DATES

- *2011 - 2013*

CONSTRUCTION VALUE

- *N/A; Study Only*

KEY STAFF

- *Seth Parker*
- *Phil Curlett*
- *Alex Mattfolk*

Project Descriptions

RESPONSIBLE FIRM

- *Levitan & Associates*

LOCATION

- *New York, NY*

RELEVANT PROJECT DETAILS

- *Conducted a screening analysis of feasible designs and configurations to identify the most cost-effective option*
- *Provided financial and regulatory services*
- *Microgrid mode "kept the lights on" after Superstorm Sandy while the rest of lower Manhattan was blacked out*
- *Project saves NYU $5-$8 million annually*
- *Reduces NOx, SO_2 and CO_2 emissions in New York City*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Analysis of Design-Build Versus Alternative Delivery Options*
- *Planning*

SCOPE OF SERVICES

- *Project Screening Analysis*
- *Life Cycle Cost Estimate*
- *Utility and State Regulatory Support*
- *Forecast Air Emission Reduction*
- *Detailed Financial Pro Forma Projection to Obtain Board Approval*
- *Fuel Supply Assistance*
- *Tax-Exempt Financing Assistance*

START / END DATES

- *Levitan 2005-2008*
- *Construction 2008-2011*

CONSTRUCTION VALUE

- *$125 million*

KEY STAFF

- *Seth Parker*

New York University | Cogeneration / Microgrid Project

NYU had to upgrade or replace its aging and inefficient 7-MW diesel-based cogeneration system in its Greenwich Village campus that served a limited proportion of NYU's load. In addition, state regulators told NYU that it needed to shut down the old system due to air pollution emissions. NYU selected the Vanderweil Power Group and Levitan to provide economic and engineering services for what ultimately became a $125 million project.

The system consists of two 5.6-MW Solar Taurus 60S gas turbines and generators (installation shown above) plus "Cleaver-Brooks" boilers feeding a 2.4-MW steam turbine generator, along with expanded power, hot water, and chilled water distribution systems. The turbine exhaust feeds another pair of heat exchangers to make high-temperature hot water or 2,400-ton steam-driven chiller to make cold water for air conditioning. The entire system is run from a fully digital control system that maintains peak performance and efficiency that approaches 80% in normal operation. The plant is capable of producing 20,000 lb/hr of steam, and when an auxiliary boiler is fired up, it can produce another 40,000 lb/hr.

The new system supplies power and chilled water to 26 buildings while high-temperature hot water is supplied to 37 buildings. The connection to the ConEd grid was upgraded with a new transformer vault and six new transformer banks and protective relays to insulate the microgrid from fluctuations in the utility grid. The system is normally linked to ConEd in a synchronous interconnection, and power flows back and forth as the campus's loads change, but it is also capable of disconnecting and going into island mode. The system also helps NYC meet its greenhouse gas emissions target. After completion, the system was covered by a landscaped plaza.

Project Descriptions

Prior to Superstorm Sandy, NYC had not been hit by a full-strength hurricane in more than 25 years. On 10/28/2012, the storm combined with a low-pressure system in the Atlantic and made landfall in the NY / NJ metropolitan area. Sandy's storm surge came over the banks of the East River and took out ConEd's 14th Street substation. When the transformers exploded, voltages throughout Manhattan began dropping rapidly, and the NYU microgrid protective relays automatically tripped, disconnecting from ConEd, and putting the microgrid into island mode as the rest of lower Manhattan went dark. Full power was not restored for a week. Not only did the cogeneration plant operate as planned, but that portion of the campus rapidly became an oasis for staff, students, and surrounding community members without electricity. It later became a command center for emergency workers throughout Manhattan as the city recovered.

Project Descriptions

RESPONSIBLE FIRM

- *LTK Engineering Services*

LOCATION

- *Atlantic City, NJ*

RELEVANT PROJECT DETAILS

- *Client-centric project*
- *Knowledge of impacts working within operating railroad environment*
- *Knowledge of NJ TRANSIT Infrastructure and operations*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Feasibility Study*

SCOPE OF SERVICES

- *Conceptual Design*
- *Assessments*
- *Review of Alternative Rail Technologies for Light Rail and DMUs*
- *O&M and Capital Cost Estimates*
- *Supplemental Environmental Screening*
- *Network Simulation for Capacity and Reliability Assessment*

START / END DATES

- *2010-2012*

CONSTRUCTION VALUE

- *N/A; Study Only*
- *Study: $771,000*

KEY STAFF

- *Bill Lipfert*

NJ TRANSIT | Atlantic City Rail Line Operations Study

LTK was selected as the prime consultant for the Atlantic City Rail Line (ACRL) Operations Study, funded by the DRPA. The Study has its genesis in a 05/12/2009 announcement that the DRPA would be launching a detailed examination of expanded and enhanced Atlantic City Line service. The announcement included investigation of development of a PATCO Woodcrest Station Transfer Station, supporting more convenient transfers between PATCO and NJ TRANSIT and enhanced access from I-295. DRPA indicated that the study would "identify track improvements to facilitate more frequent, reliable service, and a better connection to the Atlantic City Airport Terminal," making the study — and the ACRL — part of a comprehensive transportation plan for South Jersey.

The ACRL is operated by NJ TRANSIT between Philadelphia and Atlantic City, using trackage with a complex ownership history. The longest-term historical operators have been the Pennsylvania Railroad west of the Delaware and the Pennsylvania-Reading Seashore Lines east of the Delaware. Today, the ACRL shares trackage with Amtrak and SEPTA on the NEC between 30th Street Station, Philadelphia, and Shore Interlocking. The ACRL parallels the PATCO High-Speed Line right-of-way between Haddonfield and Lindenwold, NJ.

NJ TRANSIT managed the Study, including assessment and evaluation of infrastructure and potential operational improvements for the ACRL. The objectives of the study were to:

- Build on the funded plans for a new River Line Transfer Station in Pennsauken, recognizing that the single track operation through this area requires diligent nearby capacity mitigation to make sure the new station stop does not degrade overall system throughput;

- Examine opportunities to increase ridership and the line's role in serving as a vital transportation link connecting southern New Jersey with Atlantic City and Philadelphia;
- Pursue a transfer station opportunity between the ACRL and PATCO at the high ridership Woodcrest Station, with its direct highway access to I-295; and
- Provide increased multimodal opportunities at a new Galloway / Pomona station in conjunction with the Atlantic City Airport.

NJ TRANSIT has outlined five scenarios to be developed and analyzed as part of the Study:

- Add Pennsauken, Woodcrest, and Pomona / Atlantic City Airport Stations and associated infrastructure improvements needed to maintain current single track capacities operate existing level of service;
- Add the three new stations, increase level of ACRL operations to nominal hourly service, with an increase in eight all-stops daily trips from the present 28 (Monday-Thursday service level);
- Add the three new stations, increase level of ACRL operations to a medium level of practical capacity given lower cost double tracking and lower cost modification of all applicable and feasible stations to have dual platform edges;
- Add the three stations and modify all existing stations, install double track at all feasible locations, increase track speeds where appropriate, and determine maximum level of rail service that could be operated given the remaining cost-prohibitive single track constraints and external constraints (including Shore Interlocking, Amtrak NEC Capacity, and Atlantic City Terminal capacity; possibly including Woodcrest Station, Lindenwold Station, and Delair Bridge single track constraints); and
- Remove all capacity constraints within the NJ TRANSIT-owned territory to define the ultimate level of service.

As part of each of these five operational scenarios, LTK performed physical feasibility assessment, conceptual design, review of alternative promising rail technologies (light rail, DMU, etc.), capital and O&M cost estimates, and supplemental environmental screening. Capacity and reliability assessments were performed using LTK's TrainOps® network simulation tool.

Project Descriptions

RESPONSIBLE FIRM

- *LTK Engineering Services*

LOCATION

- *Various Locations, NJ*

RELEVANT PROJECT DETAILS

- *Client-centric project*
- *Interfacing of vehicles within the NJ TRANSIT's system*
- *Design criteria development*
- *Preliminary and conceptual engineering*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Feasibility Study*

SCOPE OF SERVICES

- *Industry Review*
- *Conceptual Specifications*
- *FRA Compliance*
- *Vehicle Procurement (329) Multi-Level Rail Cars*
- *Proposal Reviews*
- *Car Builder Reviews and Negotiations*

START / END DATES

- *2003-2014*

CONSTRUCTION VALUE

- *$28 million*

KEY STAFF

- *David Diaz*
- *Pat Sheeran*
- *Pallavi Lai*

NJ TRANSIT | Multi-Level Commuter Rail Car Procurement

LTK led the effort to assist NJ TRANSIT's program to procure 329 multi-level cars for service throughout the New Jersey commuter rail system, including the NEC. The project began in 2000 with LTK staff members analyzing the feasibility of multi-level commuter car operation on the corridor. LTK conducted an industry review and prepared conceptual specifications and sketches for the vehicles.

This assignment required the development of a new vehicle concept that addressed the unique NJ TRANSIT operating conditions, such as tunnel restrictions and high-level, as well as low-level platform stations.

Compliance with the latest FRA regulations and APTA standards was verified. The multi-level cars feature four doorways per vehicle side and efforts were made to maximize seating capacity while maintaining passenger comfort, and enhancing passenger flow. LTK worked with NJ TRANSIT to analyze its requirements, as well as with potential car builders and vehicle subsystem suppliers to review and assess the feasibility of alternative arrangements and designs for this application.

LTK's involvement on this program has covered the full-range of pre-award and procurement management and technical support, including proposal review process and car builder negotiations.

Subsequent to the above contract, LTK received an award for providing technical support for additional 100 Bombardier multi-level cars in 2010. Among the enhanced features, the noteworthy are LED destination signs and exterior speaker announcements. The last car delivery was scheduled for March 2013.

Project Descriptions

NJ TRANSIT | Raritan Valley Line Third Track Feasibility Study

LTK developed a long-term Raritan Valley Line (RVL) infrastructure master plan that provides for pragmatic solutions to accommodate growing ridership, while not precluding shorter term capital improvements. Such a plan logically focuses on the possibility of a third main track for a portion of the RVL between Raritan and Cranford stations to support zone express overtakes of local trains in the peak direction.

LTK is using its TrainOps® automated Train Performance Calculator (TPC) / String Chart approach in concert with NJ TRANSIT Rail Service Planning to develop workable operating plans for each of the options, varying stopping patterns, overtake locations and, in one case, maximum authorized speed (MAS). The work is being performed to ensure compatibility with planned improvements east of the CP-Aldene connection of the RVL to the Conrail Lehigh Line, including Lehigh Line Third / Fourth Track, Hunter Flyover, Westbound Newark-Waterfront Connection, and others. LTK is also documenting the signal block clearing times / minimum supportable headways of each RVL signal location for a variety of stopping patterns, then developing sketch concept plans for improved signal system throughput that will also allow trains closer together for the third track scheduled overtakes.

Working iteratively with the operations planning activities, LTK is evaluating the required infrastructure improvements from both a constructability and cost perspective. Sketch level design for the alternative schemes has been developed allowing the evaluation of capital costs associated with the required improvements. The goal is provide NJ TRANSIT with a clear understanding of the engineering challenges, construction considerations, and projected capital cost associated with each operating scenario.

RESPONSIBLE FIRM

- *LTK Engineering Services*

LOCATION

- *Various Locations, NJ*

RELEVANT PROJECT DETAILS

- *Client-centric project*
- *Knowledge of NJ TRANSIT operations and system*
- *Infrastructure improvements*

SERVICES PROVIDED / PROJECT DELIVERY TYPE

- *Feasibility Study*
- *Construction Assistance Support*

SCOPE OF SERVICES

- *Analysis and Evaluation of Long-Term Capacity Enhancements to the Line*
- *Cost Benefits for Restoration of a Third Track to Portions of the Rail Line*
- *Evaluating Plans for Improved Signal System for the RVL Line*
- *Evaluation of Infrastructure Improvements*
- *Consideration of Historic and Environmental Issues*

START / END DATES

- *2011-2012*

CONSTRUCTION VALUE

- *N/A; Study Only*
- *Study: $216,000*

KEY STAFF

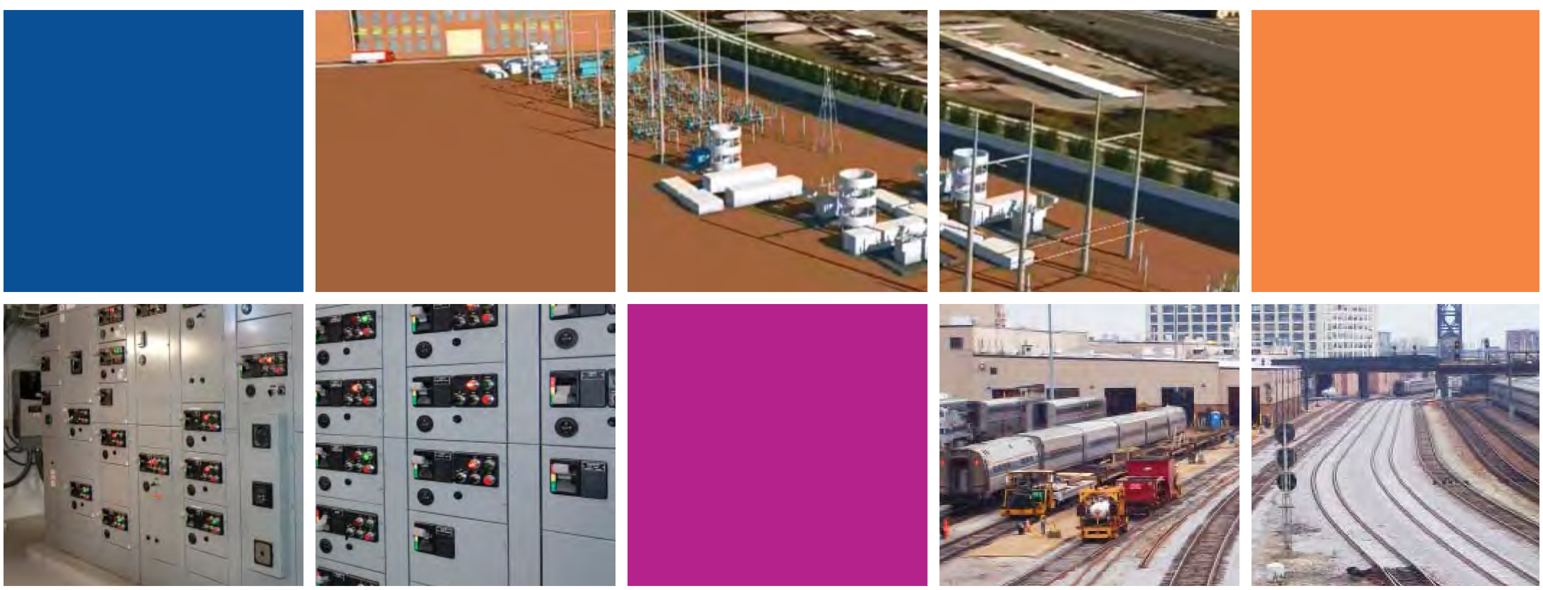
- *Bill Lipfert*

Project Descriptions

Known environmental issues in and around the area proposed for RVL improvements are being screened. Environmental sensitivities in several areas, which are being considered in the evaluation of potential track locations include:

- Wetlands adjacent to the right-of-way east of North Branch, southwest of Somerville, east of Bridgewater through Bound Brook, and east of Middlesex Borough along the Bound Brook;
- Contaminated sites in the vicinity of the right-of-way at Fisher Scientific west of Raritan, American Cyanamid in Bridgewater;
- Historic properties and districts located throughout the entire corridor that may be contributing resources to the lines designation as part of the Central Railroad of New Jersey Historic Rail Corridor, such as in Somerville, Westfield, and Cranford; and
- Floodplains adjacency and crossings of the 100-year floodplains of the North Branch of the Raritan (North Branch), Raritan River (throughout the Raritan / Bridgewater area), Rahway River (Cranford), and Elizabeth River (Union.)

3 Qualifications of Individuals



Section 3

Section 3 | Qualifications of Individuals

The Jacobs Team is comprised of individuals with the expertise, experience, and relationships to successfully deliver for you the NJ TRANSITGrid Project consistent with your project performance goals, schedule, and budget. Our Team will provide you with the expertise to right-size the project and select the best technology, the experience to advance the project through procurement and construction in Phase 2, and the relationships and knowledge to navigate through the PJM, NERC, FERC, and NPCC process and secure approvals from third parties such as Amtrak.

CERTIFICATION STATEMENT:

I, Stanley J. Rosenblum, Project Executive, certify that all Jacobs's personnel and the staff members of our subconsultants are employed by their respective firms or will be on board and assigned in the manner indicated on our organization chart.

- Mr. Russell Ferretti, proposed Quality Manager, has accepted a position with Jacobs and will be employed by September 1, 2015.

Stanley J. Rosenblum | Project Executive

Detailed **resumes** of the work history, education, and training for **key staff** are located **at the end of this section**. Following the key staff bios below is a chart listing the rest of the people on the organization chart and their roles and strengths.

Section 3

Broad knowledge, strong communication skills, and unbiased analysis of options makes Roger a trusted partner in the NJ TRANSIT's decision making process.

"Roger leads his team to consult with us, as opposed to direction via fiat regarding changes to our system, which has been both refreshing and educational. By taking the position of teaching us how to fish as opposed to catching us a fish, we get an expertly engineered product consistent with our requests and the ability to implement future designs of a similar nature with a far better understanding of how and why this approach is selected. Our experience with Roger at North Carolina State University has been nothing short of exemplary." (Eric C. Dean, PE, MPA, Manager Power Systems Engineering, North Carolina State University)

Project Manager & Power Task Leader: Roger Copeland, PE

EXPERTISE: Roger is an electrical engineer with over 17 years of experience specializing on energy projects including natural gas-fired power generation plants of 100mw in size with associated transmission and distribution elements. He has served as a Project Manager on projects with total investment cost greater than $100 million. His projects have incorporated cutting edge reliability and security features into the overall design of the power plants. Roger's background with one off power generation and microgrid applications brings the industry specific leadership and lessons learned to this NJ TRANSITGrid application. Roger has the big picture understanding of large-scale generation challenges, equipment, and contracting limitations, and the hands-on experience of not only designing, but also starting up and troubleshooting some of the most complex microgrid solutions ever applied. His experience includes serving as a Project Manager on numerous microgrid, thermal energy, cogeneration, combined heat and power, and boiler plants. He has served as a Project Manager for medium to high voltage distribution plants, including gas insulated substations and the design and commissioning of large and medium size electrical generating plants. Roger brings a unique set of management skills since he has been responsible for all stages of development, including the conceptualization, planning, design, procurement and construction, and testing and commissioning of energy projects. Roger also has extensive experience working with the different regulatory authorities that oversee and approve connectivity to the commercial grid.

ROLE/RESPONSIBILITIES: Roger will serve as the Project Manager responsible for the performance of the entire Team. He will be responsible for executing the Project Management Plan, and establishing a strong partnership with your Project Manager and project team. In his capacity as the Power Task Leader, he will be responsible for defining the technology options and presenting these options in an understandable manner to your decision makers and internal stakeholders. He will be responsible for the engineering of the power plant, and transmission and distribution system. Roger will support you with external stakeholders' decision makers and will be the overall external point of contact for the Jacobs Team.

Benefit to NJ TRANSIT: As a published thought leader in the microgrid marketplace, Roger is the right choice to lead this unique project application. Roger will apply this vast experience base in projects ranging from 5MW - 100MW to your application by leading his team to not only think outside the box, but understand where the limits of the box are – ensuring logical project progression to successful operation. Roger will provide you with the confidence that you have all the information needed, and an unbiased assessment of technology options to make the right design choice. His full range of experiences and his extensive attention to detail also provides you with a Project Manager who will stay ahead of the curve and address project issues before they become project problems. Roger will make sure you are fully prepared and totally understand the pros, cons, and risks of various options to make smart decisions, and avoid "buyer's remorse" on the technology option selected. Roger's extensive experience working in an alternative delivery environment, and in supporting the PJM process benefits you by reducing the time required for regulatory reviews and eleventh hour surprises related to technology requirements.

Deputy Project Manager: Diaa Elmaddah, PE, LEED® AP

Clients that have worked with Diaa have stated his strengths are on his complete understanding of the work, dedication, follow-through, and early and consistent communications.

EXPERTISE: Diaa has over 20 years experience working for the Long Island Rail Road, Metro-North, PATH, and NYC Transit Authority. He has over 10 years experience working on commuter rail projects on active commuter rail lines. Furthermore, he is a structural engineer with extensive project management experience. As a well-rounded professional engineer, Diaa has experience working on passenger rail design and engineering involving civil, structural, geotechnical, and construction of electrical power. His background includes extensive experience on projects involving underground structures, retaining walls, flood mitigation design, rail shops and yards, building design, and rail systems. He has experience working on alternative delivery projects, and is fully knowledgeable of the risks and constraints working on live railroads. His projects have required extensive coordination with railroad operations and the development of outage plans and flagging requirements.

ROLE/RESPONSIBILITIES: Diaa will serve as the Deputy Project Manager responsible for making sure the coordination of all rail aspects of the project happens, including communications with NJ TRANSIT rail and light rail operations. He will serve as the Jacobs Team point of contact on all rail coordination issues. All project related rail issues will be managed through him. Reporting directly to Diaa will be the Rail Engineering Task Leader, Richard Sirabian. Diaa will be responsible for managing the Project Controls, Quality Control, and administrative requirements of the project. He will make sure the Jacobs Team is fully aware of all deliverables and deadlines and provide Roger with a daily report on the progress of the project. Roger will work closely with Diaa and collaborate with him to support strategies to drive scope, schedule, and budget. Also reporting directly to Diaa is the Project Control Task Leader, Michael Pytlik, and the Quality Control Task Leader, Bruno Fiorentino. He will be responsible for making certain that the Jacobs Team remains fully compliant with all the deliverables. Diaa will provide day-to-day support to Roger for overall administrative and reporting requirements.

BENEFIT TO NJ TRANSIT: Diaa has a comprehensive understanding of the railroad operating environment and the ability to integrate rail engineering into this environment. His expertise allows him to flag issues early in the development and design stage and help to avoid conflict with rail operations or the long-term maintenance or safety needs of NJ TRANSIT. You will benefit from Diaa's involvement, as he will minimize the potential for eleventh hour changes caused by the failure to properly communicate or explain design or construction impacts to rail operations.

Diaa's design-build experience will help focus on constructability and force account issues, thereby mitigating the potential of the misalignment of the construction concept with the constraints of rail operations, particularly as it relates to the transmission and distribution lines. Minimizing this will save you from potential change orders and/or claims. Diaa, working closely with Roger, will assure full communication between staff focused on the power plant and staff engaged in the civil, structural, and rail design aspects of the project. This will promote design integration and interface between the two components of this project.

Rich has been your trusted partner for 25 years. His commitment benefits you as he will serve as your advocate within our Team.

Rich understands the quality expectations and design preferences, which benefits you by allowing you to focus on issues of preference and not being concerned with the quality of the rail design.

Rail Engineering Task Leader: Richard Sirabian, PE

EXPERTISE: Rich has been responsible for the preliminary engineering, design, and construction phases of some of your most iconic projects, including the Frank Lautenberg Train Station, Portal Bridge, the NJ Sports & Exposition Authority Meadowlands Rail & Roadway Improvement Project, Montclair Connection, and North Jersey Coast Line Electrification and Modernization Project from South Amboy to Long Branch. He has over 25 years experience working on your projects. Richard is a licensed civil engineer, with experience in managing all aspects of rail engineering design.

ROLE/RESPONSIBILITIES: Rich will have direct responsibility for the design and engineering of the rail scope. Rich will report directly to Diaa. As the Rail Engineering and Coordination Task Leader, Rich will provide the engineering direction and interface with the rail discipline leaders (modeling, electric traction, communications/signals, structures, and site/civil). He will support Diaa and Dale Legg (Constructability Leader) and Phil Semler (Constructability- Rail) in the constructability reviews. He will work closely with Diaa to make sure the rail work is fully coordinated with the overall project and the needs of NJ TRANSIT, Amtrak, and the light rail provider. Rich will be responsible for assessing the cost-effectiveness of the design, as well as the inclusion of safety into all design elements of the project.

BENEFIT TO NJ TRANSIT: Rich's extensive understanding of your rail system and his strong knowledge and partnerships with your staff he has developed over 25 years will provide a level of trust and partnering needed to maximize the teamwork needed for the success of this project. Rich will provide the design oversight and execution of design standards you requires on your rail projects. His familiarity will benefit you by assuring that design excellence will be realized. Rich provides NJ TRANSIT with an individual who knows how you think, and will shape decisions in your best interest.

Assistant Power Leader: Michael Walton, PE, DGCP

Mike provides the critical continuity between the Sandia work and this project.

EXPERTISE: Mike is a New Jersey professional engineer with over 12 years of electrical design and project management experience. His technical expertise includes power systems, voltage distribution, substations, and control and load analysis. He has experience working on microgrid studies and designs. His most recent assignment was Project Manager on the NJ TRANSIT Microgrid Alternatives Analysis. Mike is a registered Distributed Generation Certified Professional (DGCP).

ROLE/RESPONSIBILITIES: As the Assistant Power Task Leader, Mike will provide Roger the support needed to oversee the development of the technology option and the 20% design effort. He brings the history of the project development and the understanding and background of the distribution components of the project to the leadership level. Mike will oversee and make certain the design will avoid conflicts and bottlenecks in the distribution and remote substation applications.

BENEFIT TO NJ TRANSIT: Mike's experience will enable a smooth transition from the Alternatives Analysis (AA) to the next phase of the microgrid. Having led the AA, Mike has extensive understanding of not only your infrastructure, but also the key people who will be working on this project. You will benefit from Mike's knowledge through the continuation of trusted partnerships, resulting in consensus building, and on-time decision making. He will also make certain the full value of prior work is included in our project, so we will maximize past investments and not be paid again for the same level of effort. In addition, Mike has extensive experience overseeing all phases of the project and will provide excellent leadership and management during the construction phase of the project.

Regulatory & Stakeholder Task Leader: Frank DiPalma

Frank's knowledge of regulatory third party decision makers provides you with a level of certainty over what to expect.

EXPERTISE: Frank has over 40 years of working in the regulated utility market. He has served in executive leadership roles for utility companies; as an advisor to the regulatory authorities; and as a consultant on numerous public utility projects. Frank has an extensive background in energy utilities. He is skilled at developing and executing sound operational strategies to achieve full profit potential and customer satisfaction. He has direct experience in regulatory compliance, strategic alliances, labor relations, strategic planning, engineering and operations management, process improvement, project management, and construction. Frank has worked as a consultant to New Jersey Bureau of Public Utilities (NJBPU), and retains strong relationships with the NJBPU staff. He also held senior management positions during his almost 30-year career at PSE&G. Furthermore, Frank has been directly engaged and is fully knowledgeable of the PJM, NERC, and FERC processes.

ROLE/RESPONSIBILITIES: Frank will be responsible for developing and executing regulatory and stakeholder strategies. He will lead the effort for PJM interconnection, and serve as the regulatory strategist for NJBPU, FERC, NERC, and other regulatory oversight authorities. Due to his background, he will be a key point person in working with PSE&G. Further, Frank will be responsible for developing and submitting the PJM application, and leading the effort through each step of the PJM process. Frank will be supported by individuals who further enhance his relationships with these key external stakeholders. He will oversee the effort to secure a natural gas supply. Frank will support others, and be the individual responsible for making certain a strong communication, coordination, and outreach strategy to all stakeholders occurs. He will rely on others to develop the communication strategies for FTA, FRA, Amtrak, NJ TRANSIT internal decision makers, NJDEP, and others.

BENEFIT TO NJ TRANSIT: Frank's knowledge of the regulatory requirements and his strong working relationships with PJM will provide the insight and direction to avoid major missteps and allow for the streamlining of the interconnect application process. He is also well-respected at NJBPU and PSE&G, therefore he will be able to facilitate consensus building and coordination regarding regulatory issues concerning providing power to Amtrak. Frank's understanding of the gas business helps secure beneficial, long-term gas supply contracts, while his knowledge of energy projects allows him to recognize the potential consequences of demands that arise by NJBPU, PJM, and others. As a result, he is able to provide documentation to support positions taken by you and the consultant team. Frank understands the unique aspects that may arise during the life of this project. Because he understands both the technical and business side of the energy business, he serves as a strong voice toward the advancement of a microgrid project that meets your needs and the private utility market. The benefit of Frank's wealth of knowledge is it helps to meet the schedule, minimize the potential for PSE&G and PJM mandated commercial grid improvements, and frames the additional PJM driven costs that you can properly budget for.

Seth will drive the economic analysis and will eliminate unplanned financial risk on this project.

Economic Analysis Task Leader: Seth Parker

EXPERTISE: Seth has a long history of tackling economic, financial, contract, and regulatory issues for cogeneration and microgrid projects. Seth evaluated the economics of multiple technology and configuration options under various fuel and power scenarios and prepared the final pro forma and valuation documents for the New York University (NYU) Finance Committee and Board approval. The NYU microgrid was online during Superstorm Sandy and operated efficiently throughout the weather event. In addition, as the agent for the NJBPU, Seth and his firm, Levitan, were administers of the Long-Term Capacity Agreement Pilot Program (LTCAPP), created by the NJ legislature and signed into law by Governor Christopher Christie. He recommended almost 2,000 MW of new in-state, gas-fired combined cycle capacity proposed projects, all of which were approved by the NJBPU.

ROLE/RESPONSIBILITIES: Seth will be the lead person developing the economic screening analysis, supporting the cost estimations for the project, and preparing a detailed financial analyses of the preferred technology solution. He and Frank are responsible for making sure the NJ TRANSITGrid project is the most cost-effective, reliable solution and is advanced consistent with PJM rules and requirements.

BENEFIT TO NJ TRANSIT: Seth's extensive experience navigating the PJM & NJBPU channels and his strong relationships with PJM staff will help him to facilitate this project adherence to requirements and rules to gain timely regulatory approvals. For example, Seth served as an advisor to a large generator group during the reformulation of PJM's Reliability Pricing Model Capacity Valuation Mechanism, including gas turbine capital and operating costs, net revenue, financial charges, and other matters. He led Levitan's economic analysis of microgrid options that formed the basis of NYU's $100+ million investment that "kept the lights on" in the aftermath of Superstorm Sandy, while the rest of lower Manhattan was blacked out for a week. The microgrid system also lowers NYU's electricity costs and helps NYC meet its air emission reduction goals. Seth has represented the interest of PJM before FERC. Working with Frank will be various Levitan staff members, as well as Charles Wedel who will serve as a financial advisor and be responsible for the evaluation and development of different financial structures to support the project. Seth's involvement provides you with an increased level of understanding of the potential cost implications that will allow for appropriate briefings to stakeholders and a full assessment of project cost by the public sector going forward.

Quality Control Task Leader: Bruno Fiorentino, PE

Bruno will demand the highest level of quality execution and will bring his experience from the Microgrid Alternatives Analysis to this project.

EXPERTISE: Bruno has 30 years of diversified experience in engineering design and project management. Bruno's experience bridges both railroad and electrical demand projects. He has worked directly for Amtrak and commuter railroads on over 50 of their facility and infrastructure projects. Furthermore, Bruno has provided engineering support for you on the Microgrid Alternatives Analysis project. He led the engineering effort for the Philadelphia Gas Works 200 kw National Micro Turbine Project. As a leader of Burns, Bruno has extensive experience in leading the quality control coordination on projects.

ROLE/RESPONSIBILITIES: Bruno will be directly responsible for working with his quality team to develop the Design Control Plan, the Integration and Interface Management Plan, the Risk Management Plan, the Quality Plan, and all other aspects of the project that have a direct bearing on quality execution. Bruno will work directly with the Roger, Diaa, and Russell to assure completeness and validity of the quality and integration processes. Also, Bruno will be directly responsible for reviewing our approach to constructability and risk management. As the Quality Control Task Leader, Bruno will have no responsibility for conducting or reporting on quality execution and quality assurance. Russell Ferretti will be the Quality Manager responsible for quality assurance and reporting directly to the Stanley Rosenblum, Project Executive.

BENEFIT TO NJ TRANSIT: Bruno has an excellent track record of quality execution. He has full knowledge of railroad, power, civil, structural, and other components of the project. Bruno's experience will make sure that the documentation is complete, the processes add value, and the Jacobs Team will comply without significant backlash. Since Bruno has served as a task leader for many different aspects, he will be able to establish a quality review process specific for this job, and potentially allow the engineers to shift out to other assignments. In addition, Bruno has extensive experience reviewing the quality of subconsultants that have worked directly for Burns. Bruno also has extensive field experience that will greatly enhance constructability reviews. The high level of quality executed by the Jacobs Team will minimize the risk of future field change orders and timely and costly delays in project execution. It will also provide you with a higher level of trust that the project had a full quality review and audit and that the consultants, not you, have identified and resolved design issues.

Mike uses project controls to help the team drive decision making and risk aversion.

Project Controls Task Leader: Michael Pytlik

EXPERTISE: Mike has 15 years experience as a senior level Project Controls Manager. He has worked on complex projects for Amtrak, DRPA, and other public clients. He has served as a senior level Scheduler for transit, building and facility, and utility/industrial clients. Mike's core competencies include preparation and maintenance of master and progress schedules, look-ahead schedules, commissioning phase schedules, and daily progress measurement reporting. He has led interactive planning charrettes, delay analysis, and project risk control sessions. In addition, his computer skills include all major scheduling and project management software tools. Furthermore, Mike received specialized training for Primavera 6.0 Project Management software.

ROLE/RESPONSIBILITIES: Mike will be fully responsible for project controls. scheduling, cost analysis, document controls resources, and subconsultant firms will report directly to him. He will be responsible for developing a formal Critical Path Method (CPM) project schedule and developing and updating a baseline schedule. Additionally, Mike will review and recommend the most efficient and effective scheduling tool to be used. He will work closely with the project management team and establish a system of monthly progress and cost control reports. Mike will oversee the development of a records management controls system and make certain document controls are set up to allow for easy authorized access to the project site. He will work closely with David Morgan, Venket Tiruchirappalli, Steve Jones, and Michael Williams in developing all the schedules and cost estimates.

BENEFIT TO NJ TRANSIT: Mike has served as a Senior Scheduler and Project Controls Manager on design and construction projects. He will be able to integrate the design and construction schedules of the project, and will be a strong resource for you in the evaluation of the schedules submitted in the construction procurement stage of the project. Mike's experience as the EPCm Project Controls Manager for a direct combustion Turbine Generator gives him experience in Project Controls related to commissioning phase schedules and procurement engineering.

Rail Power Analysis/Operations Modeling Leader: William Lipfert

Bill's extensive knowledge of Amtrak and the Northeast Corridor (NEC) provides expertise to accurately project power needs and variances of the rail operations.

EXPERTISE: Bill Lipfert has devoted his entire professional career to operations planning, capacity analysis, and related software development in the rail industry. After spending the first part of his career at the Long Island Rail Road's Computer Systems Department working on network simulation models, he has served as an industry consultant on a variety of projects ranging from conceptual feasibility studies to detailed design efforts and construction contracts. Bill participates in both the technical and managerial aspects of projects. Bill was formerly responsible for creating and managing the development of the RAILSIM® Simulation Software Suite, including its Train Performance Calculator, Network Simulator and Electrical Load Flow Analyzer applications. He now manages the development of the LTK TrainOps® Simulation Software. He has performed simulation software training across the United States and internationally.

ROLE/RESPONSIBILITIES: Bill will be responsible for the power load analysis. He will coordinate with you and Amtrak to obtain the necessary information required in developing the power load requirements for the project.

BENEFIT TO NJ TRANSIT: Bill has been instrumentation in modeling the whole NEC and Amtrak for capacity analyses. Therefore, he has a good baseline and understanding of what the power loads for this project will be and has a lot of the information to hit the ground running. He will allow the project to save months in time usually dedicated to power studies. His prior extensive experience studying power loads on the NEC will also help serve as a baseline for comparative purposes.

Senior Traction Power Lead: Daren Petroski, PE – Amtrak and NJ TRANSIT Substations

Daren has extensive experience working on the Amtrak electric traction system and the Hudson Bergen Light Rail Line.

EXPERTISE: Daren has over 25 years experience in the design, estimating, and construction management of railroad systems, including Overhead Contact Systems (OCS), traction power substations, and signals and communications systems.

ROLE/RESPONSIBILITIES: Daren will be the responsible person for the design of substations and OCS. Reporting directly to Daren will be OCS and traction power staff that will support Daren in this effort. Daren will be responsible for coordinating with Amtrak, adhering to Amtrak design standards, and gaining Amtrak sign-off on all electric traction design efforts related to Amtrak. He will report directly to Rich Sirabian, and be responsible for the electric traction staff working on this project. He will oversee all quality control for the electric traction group.

BENEFIT TO NJ TRANSIT: Daren has strong working relationships with both Amtrak and NJ TRANSIT. He has worked on projects for you, Amtrak, and Hudson Bergen Light Rail. Daren's eight years as a contractor and extensive knowledge of the railroad will be relied on for constructability reviews, the assessment of track outages, and conflict resolution with your operations. Daren will be able to breakdown potential Amtrak review delays saving you and the project time.

Bob has extensive exposure to railroad operations and understands how to design SCADA systems to be maximized by railroad personnel.

SCADA Coordination: Robert Rosa, PE

EXPERTISE: Bob has over 26 years experience in industrial automation field specializing in design and implementation of Supervisory Control and Data Acquisition (SCADA) and industry control systems. His experience includes designing SCADA systems for railroad, cogeneration plants, and commercial and public facilities. He is an expert in designing both new systems and rehabilitating and upgrading existing systems. One of Bob's areas of expertise is in the design integration and testing and commissioning of SCADA and industrial control systems. Some of his recent experience includes being the Lead SCADA Engineer for the replacement of SCADA programmable logic controllers (PLC) hardware and interface for eleven PATH stations for the Port Authority of New York and New Jersey, and Project Manager for the Amtrak NEC Frequency Converter Controls Upgrade. In addition, Bob was a Lead Engineer that helped design and implement an automation system for a cogeneration plant at a campus facility in Mahwah, NJ.

ROLE/RESPONSIBILITIES: Bob will be the responsible party for leading the SCADA and industrial control design for the power plant and the integration of the power plant SCADA system with existing NJ TRANSIT rail operations power SCADA systems. He will establish the design criteria for the SCADA backbone, including the Energy Management Systems. Bob will also be responsible for the quality control of all SCADA design work.

BENEFIT TO NJ TRANSIT: Having worked on railroad and utility related projects, Bob has the experience and knowledge of developing the complete SCADA package required to manage the power plant and provide for an uninterrupted integration of the railroad and power plant SCADA systems. He has firsthand knowledge of how the operations staff needs to have the SCADA boards and system designed to allow for easy access and use. Bob's excellent system integration and start-up experience, particularly with new systems being integrated into existing SCADA networks will result in a seamless and flawless design of the SCADA systems on this project.

Cybersecurity Lead Engineer: Eric Persson, CompTIA Network+, CISSP, CACE

Eric is continually updating his knowledge base to maximize his ability to stay ahead of potential threats to systems such as the NJ TRANSITGrid. In addition, he is familiar with NERC standard best practices for power grid industrial controls systems.

EXPERTISE: Eric has over 20 years experience as a hands-on IT Manager for multi-national companies, and over 10 years experience in the field of process control cybersecurity and Industrial Networks. At exida, he is the Lead Senior Cybersecurity Engineer with primary responsibilities including performing cybersecurity vulnerability and risk assessments, developing and reviewing network architectures, cybersecurity, and Industrial networking course development and training, and assisting with the commissioning of network segmentation solutions. Eric is CompTIA Network+, CISSP, and CACE certified, and is actively working toward his GICSP certification.

ROLES/RESPONSIBILITIES: Eric will be responsible for providing the robust cybersecurity network you need for this project that applies best practices for typical power grid industrial control systems (ICSs), including those found in National Energy Reliability Council (NERC) Critical Infrastructure Protection (CIP) and the National Institute of Standards and Technology (NIST) Interagency Report (IR) 7628. In addition, he will strengthen the microgrid control system's defense-in-depth by applying segmentation strategies within the microgrid control system itself required to reduce the risk of widespread control system damage as a result of malicious activity or unexpected failures. Eric will work with the SCADA Coordinator, Bob Rosa, and the Project Manager, Roger Copeland, to verify all cybersecurity needs of the project are being addressed and applied through the project.

BENEFIT TO NJ TRANSIT: Eric is an expert in the cybersecurity field and his certification and background dealing with NERC standards and Federal Energy Regulatory Commission (FERC) rulings on power utility security embodies him with the knowledge and capabilities from analysis, design, implementation, and training phases to make sure the NJ TRANSITGrid is fully protected.

Lead Power Process Engineer: Kent McAnally, PE

Kent has served as the Senior Mechanical Engineer on numerous projects to plan, right-size, and determine the most cost-effective and efficient means for providing, replacing, or upgrading power systems.

EXPERTISE: Kent brings extensive experience in the design and analysis of power generating facilities, as well as other heavy industrial facilities and mechanical energy systems. His technical skills encompass all facets of engineering including feasibility analysis, conceptual design, process design, detailed design, equipment sizing, specification development, procurement, and field engineering.

ROLE/RESPONSIBILITIES: Kent will be the lead mechanical engineer and systems modeler responsible for analyzing the power load demands in consideration of alternative generation models such as combined cycle and heat recovery for the power aspects of the NJ TRANSITGrid. He will assess the equipment demands, the best alternatives and provide the Project Team recommendations related to right-sizing of the project. He will conduct all the thermal system modeling for the power facility. He will report directly to Roger on the project.

BENEFIT TO NJ TRANSIT: Kent is an expert at analyzing demands and developing solutions that are efficient, cost-effective, and meet the demands for power. He will be one of the key people to verify best use of available funding resources. His analysis will be based on life-cycle cost analysis and detailed evaluation and modeling of several options for the NJ TRANSITGrid.

Darrell utilizes his extensive experience in power systems design and interconnectivity to coordinate and collaborate with various design groups on both the power and rail sides of the project to gain consensus and coordinate interaction.

Lead Electrical Engineer: Darrell Widner, PE

EXPERTISE: Darrell has nearly 20 years experience in the design, construction, and start-up of industrial and utility power systems. He has worked with Roger on numerous power generation and substation projects and is an experienced team leader for the electrical production. In his capacity as the Lead Engineer or Senior Electrical Engineer on new, expansion and reconstruction utility projects, Darrell has conducted power system analysis, protective relaying scheme design, coordination studies, grounding system design and protective relay settings for power plants and transmission and distribution systems. He has specified power equipment such as transformers, switchgear, and motor control centers.

ROLE/RESPONSIBILITIES: Darrell will be the responsible party for the electrical design of the NJ TRANSITGrid and coordinate with Daren Petroski, Sr. Traction Power Leader. Darrell will be responsible for the quality of the electrical design work produced by his team, and will be responsible for coordinating with the mechanical, structural, and civil design groups. Darrell will lead the group responsible for the design of the transmission and distribution lines and work closely with Manny Cabrera to establish constructability and compatibility with you and Amtrak.

BENEFIT TO NJ TRANSIT: Darrell's experience with conceptualization and coordination studies will facilitate and address potential design conflicts prior to the initiation of design. His extensive power system design and knowledge of power equipment such as transformers, switchgear, and motor control centers will help facilitate the partnership within the team and drive efficiency in the design.

Kalai has extensive key front end planning experience for complex substations and will provide the design required between the transmission lines and the rail substation.

Lead Substation Engineer: Kalaivanan Uthirapathy, PE

EXPERTISE: Kalai has over 17 years experience in delivering projects for utilities globally under Power Generation, Transmission & Distribution (T & D), Oil & Gas, and Industrial Sectors representing OEMs, EPC contractors, and consultants. He has performed different roles in electrical system design and delivery life-cycle for Open Terminal (AIS) & Gas Insulated Switchgear (GIS) substations (voltages ranging from 6.3kV to 400kV),

Natural Gas & LSHS Based Power Plants, Captive Power Plants, and Oil & Gas fields. Kalai has extensive knowledge in Protection & Control (P&C) systems for Generation, Transmission & Distribution (T&D) systems, and Oil & Gas installations. Kalai provides support in design and development of electrical systems for industrial and utility clients and in particular for MV/HV/EHV substations.

ROLE/RESPONSIBILITIES: Kalai will be responsible for integrating the overall protection and control concepts in the design of the 230kV substation, the connection to Mason, PSE&G, the 138kV frequency converters and connection to Amtrak Kearny No. 41 and 42, and the line interaction to the HBLR systems.

BENEFIT TO NJ TRANSIT: Kalai's planning experience and turnkey expertise will provide you with the required systems integration that allows for a successful start-up operation.

Lead Transmission Engineer: Asif Bhangor, CPEng, RPEQ

Asif's extensive experience working with the major utilities and overhead lines for some of the world's most complex, congested applications will contribute to the successful installation of transmission and distribution lines within your right-of-way.

EXPERTISE: Asif has over 17 years experience designing transmission lines and substations. He has designed complex transmission lines and prepared the technical requirements and specifications on the lattice steel material, conductors, insulators, and other hardware material for a 120kms 220kV single circuit transmission line for Altima energy. Asif specializes in the structural/civil design for steel towers, foundations, substation gantries, steel poles, and other support structures involved in transmission network engineering. He has also designed double circuit transmission lines and transmission lines for transmission towers and steel poles.

ROLE/RESPONSIBILITIES: Asif will oversee the design of transmission and distribution lines. He will be responsible for the quality of the design and will coordinate with Manny Cabrera on the constructability of designing transmission line along the railroad right-of-way.

BENEFIT TO NJ TRANSIT: Asif's extensive transmission line design experience using different techniques will provide you with an individual who can consider the best method for building the lines within your right-of-way and property limits. His extensive experience will allow him to consider a work-around, should conflicts between the transmission line layout and the railroad occur. Furthermore, Asif has worked for a major manufacturer/contractor and designs the transmission lines from both a railroad and contractor construction perspective. The installation of the transmission lines is a critical component of the project and will require the highest level of cooperation between you and the contractor, which Asif will be instrumental in providing this support.

Gabe has comprehensive structural engineering experience with several building types allowing for an understanding of their behavior and interaction with foundations for vibrating machinery.

Lead Structural Engineer for Power Plant Foundation: Gabriel Serna, PE

EXPERTISE: Gabe has over 12 years experience in the design analysis of building electrical substation support structures. He is an expert in the dynamic design of structures to support high-speed vibrating machinery used for power generation.

ROLE/RESPONSIBILITIES: Gabe will be the Lead Structural Engineer for the foundation design of the power generation and substation foundations.

BENEFIT TO NJ TRANSIT: Gabe's expertise in power station structural design addressed one of the key issues you raised in the RFP related to the foundation design for the microgrid and the general soil conditions at the site.

Edward's work for major power companies on significant projects that required PJM expertise proves he has complete knowledge and command of the regulatory process.

PJM Expert: Edward Tsikirayi

EXPERTISE: Edward has extensive experience working with PJM and regulators. Edward served as the Project Manager in providing Long Island Power Authority with power markets and support services associated with LIPA's participation in NYISO, PJM, and ISO-NE. He has supported the New York Power Authority in their participation in the PJM interconnection marketplace.

ROLE/RESPONSIBILITY: Working with Frank DiPalma, Edward will be a key person for developing the PJM interconnection strategy, verifying compliance with the process, assessing requirements, and driving the negotiations with PJM. He will provide support to the Team to make certain the basis of design, design criteria, and economic forecast will be acceptable to PJM.

BENEFIT TO NJ TRANSIT: Edward's experience in guiding a major interconnection request through the PJM process will provide insight into potential areas of concern that can be managed prior to initiating and during the PJM request. Additionally, his management of the process will help facilitate streamlined reviews by PJM and avoid unnecessary interconnection costs.

Constructability Leader: Dale Legg, PE

EXPERTISE: Dale has over 42 years of design and construction experience. He has extensive experience in constructability on rail capital projects. He spent the first 5 years of his career as a contractor. A structural engineer, Dale has extensive experience in structural, building/facility, civil, and rail systems design and construction. He has performed the constructability analysis on the Portal Bridge, and served in a management role on numerous design-build projects.

ROLE/RESPONSIBILITIES: Dale will be the responsible for forming the constructability review team, and leading the constructability review(s). Dale will focus on the constructability of major interface points between the power grid and the railroad.

BENEFIT TO NJ TRANSIT: Dale is a proven constructability expert with experience on railroads, including NJ TRANSIT. His knowledge of a working railroad and his experience as a contractor allows him to understand the needs of both. His innovative approaches and concepts will prove useful should there be potential conflicts, particularly with the transmission lines. Dale has also performed work for Amtrak.

Dale's background in construction coupled with his many years of design enable him to look at projects from a big picture perspective…not only how a project is designed, but how it is actually built. His diligence regarding detail and his ability to coordinate and communicate across multiple disciplines gives him a unique ability to review and produce accurate, detailed documents.

Risk Management Facilitator/Leader: Michael Albergo, PE, PMP, LEED® AP

EXPERTISE: Michael has over 25 years experience in the planning, development, and engineering analysis of public works projects, with emphasis on transportation components. His experience includes project development from concept through construction, analysis of the supporting logistics, and risk management. He has worked with both public and private organizations to address their concerns during planning, design, and construction. Strong analytical writing and communications skills have enabled him to play a pivotal role in many of these projects.

ROLE/RESPONSIBILITIES: Michael will be responsible for facilitating the Risk Management workshops to identify risks, perform qualitative analysis, and develop mitigate measures. In addition, he will further develop and update the risk register the Jacobs Team has been working on to provide optional quantitative analysis to develop schedule and budget contingencies.

BENEFIT TO NJ TRANSIT: Michael's analytical nature and ability to easily grasp the potential risks a project may have and working through them in a group setting will be beneficial to you because there will be no surprises. Based on the thorough information Michael provides, you can make the best decision on what is needed to keep this project progressing forward.

Michael has worked with both public and private organizations to address their concerns during planning, design, and construction. He recently completed a risk assessment for NYC Transit's $500M+ Canarsie Tube Reconstruction and is currently serving as Lead Facilitator for a new bus rapid transit system proposed for Richmond, VA.

Value Engineering Leader: Richard LaRuffa, PE/CVS

EXPERTISE: Rich has served as Project Director or Project Manager, overseeing project teams with up to 40 staff members. Assignments included P/CM, construction claims analysis and prudency audits, Value Engineering (VE), Risk Analyses and Management, Constructability Reviews, CPM scheduling, and cost estimating on projects ranging from $0.5 million to $6 billion. Projects include highways, bridges, airports, rail and bus systems, transportation facilities, high-rise buildings, sewage treatment plants, refineries, and industrial and power generation plants.

Rich has conducted a large number of Value Engineering workshops throughout his distinguished career in engineering, where he has saved some clients like NYC Transit millions of dollars on their projects through his teams' recommendations. He will be utilizing his extensive local and international transit VE experience, experience with power generation and distribution facilities for transit properties, and extensive project management background on large, complex projects to lead the charge to make sure you are equipped with the best design recommendation for this first-of-its-kind project in NJ.

ROLE/RESPONSIBILITIES: Rich will be responsible for facilitating the VE workshops to identify risks, perform qualitative analysis, and develop mitigation measures. In addition, he will further develop and update the risk register the Jacobs Team has been working on to provide optional quantitative analysis to develop schedule and budget contingencies.

BENEFIT TO NJ TRANSIT: With his extensive local and international transit VE experience, experience with power generation and distribution facilities for transit properties, and extensive project management background on large, complex projects, Rich is able to organize a team that can identify methods and procedures developed during 10% and 20% design and comes up with more efficient ways to get the job done, which can save you time and money.

Quality Manager: Russell Ferretti, PE, CMQ/OE, CQA

EXPERTISE: Russell has over 48 years experience in various positions in project and construction management, engineering, and quality assurance in the transportation, power, and building industries in both public and private sectors. Russell has been involved with transportation agency capital program policy and procedure development and management. He has been instrumental in Railroad Quality Assurance/Quality Control Program Development & Implementation and has been a National Leader in Railroad Quality Assurance Program development and management.

ROLE/RESPONSIBILITIES: Russell will be responsible for the quality assurance on the project. He will review and approve the Quality Plan. The Plan will incorporate specific activities, protocols, and procedures that Russell deems critical for the successful delivery of the project. He will be the responsible party for assessing the quality performance of the entire Jacobs Team and issue the monthly quality certificate provided it is warranted. He will schedule and conduct internal quality audits, and be responsible for the control of quality records. Based on his audits, he will issue improvement performance notices and track compliance on a weekly basis. He will be an active participant in reviewing the plans related to design control, constructability, and other project control documents that guide the completeness of the project.

Russell is the perfect Quality Assurance Manager for this project as he has both an extensive railroad and power background. He has led quality assurance efforts for multi-faceted teams and knows how to motivate the team and assure full participation in following the established quality control process.

BENEFIT TO NJ TRANSIT: Russell has been the Quality Manager on many rail and power projects, so he has well-rounded knowledge and expertise of what it takes to make sure this project meets quality standards and requirements. Based on his extensive exposure to railroad operations and representing Metro-North on APTA Quality Service Task Force developing a quality program for the transit industry, Russell will have the team energized and fully committed. His diligence in auditing and his development of follow-up actions to improve quality performance has a direct impact on addressing issues related to personal quality efforts.

Safety & Security Task Leader: Gerry Ruggiero, CSP

EXPERTISE: Gerry Ruggiero has over 30 years experience working as a safety leader on commuter rail and intercity rail projects. His professional career has encompassed all aspects of rail system safety. He was worked as the Safety Construction Manager on Amtrak's ARRA project. During his career at MBTA, Gerry served as Assistant Director of Engineering and Construction Safety; Systems Safety Engineer; and Deputy Director of Safety. Gerry serves on AREMA's safety committee, and was appointed to serve on the FRA Railroad Safety Advisory Committee.

ROLES/RESPONSIBILITIES: Gerry will be the responsible person for safety on this project. His responsibility includes making sure all railroad safety rules and procedures are adhered to by the Jacobs Team. In addition, Gerry will also be responsible for writing the Health and Safety Plan (HASP) for the project team and educating the whole team on the HASP, so they are fully aware of the procedures contained within the plan. Furthermore, Gerry will be responsible for reviewing the design criteria and the engineering drawings to assess the level of safety contained in the design documents. Lastly, he will organize and chair a proposed Safety and Security Committee to promote the facilitation of safety concepts and to discuss safety issues that arise on the project.

BENEFIT OF NJ TRANSIT: Gerry brings a unique perspective to the safety position. His knowledge of railroad safety rules, his leadership in working with engineering staff on design and construction safety issues, and his engagement with FRA on safety issues will enable him to be proactive on safety issues at each stage of the project. He can assess the safety risk, plan to mitigate the risk, properly train and educate the Jacobs Team, and be a valuable member in making sure the construction phase of this project has a detailed safety assessment. He will bring a tremendous safety culture to this project.

Gerry's background encompasses all aspects of transit system safety, including heavy rail, light rail, commuter rail, bus and Para-transit. Due to his involvement in transit related organizations and his project experience, he has a comprehensive understanding of the safety and security challenges facing transit agencies.

Fully charged. Ready to go. Jacobs NJ TRANSITGrid Team

Section 3 | Qualifications of the Individuals

Other Staff Members

Following is a summary of the qualifications of the people listed on the Organization Chart in Section 5. Each person is only listed once based on when they first appear on the organization chart in Section 5.

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
PROJECT MANAGEMENT TEAM					
Stanley Rosenblum	Project Executive	Jacobs	36	N/A	• Jacobs National Rail Leader and was formerly with NJ TRANSIT. • Extensive experience in leading large transportation organizations, and spearheading planning, policy and legislative issues at the federal and state level. • Served as Acting Executive Director of NJ TRANSIT and as the public agency's Chief Operating Officer/Deputy Executive Director from 1998 through 2002.
DBE COMPLIANCE					
Randi Markman	DBE Compliance Officer	Jacobs	18	N/A	• Support Project Management team through subcontract administration. • Direct procurement of professional services for task order and multi-million-dollar civil engineering projects in the eastern U.S. • Manage and motivate a team of five Subcontract Administrators. • Manage relationships with Public Sector and Commercial Sector departments. • Ensure project compliance to public sector DBE/SBE (MBE, WBE) businesses objectives. • Reduce risk through close analysis of subconsultant insurances. • Initiate process improvements to expedite project launch through early engagement of consultants prior to signing of prime contract. Process recognized as best practice to be implemented company-wide.
RAIL ENGINEERING & COORDINATION TEAM					
Electric/Traction					
Robert McPherson, PE	Sr. Traction Power Engineer	Jacobs	22	PE in NJ, NY, PA, MD, WA, CA	• Responsible for design and construction of all aspects of rail transit systems including traction power supply and distribution (third rail and catenary), train control, communications and vehicles design. • He has a multi-faceted perspective of project delivery, having participated in the construction process on behalf of the owner, as the design engineer, and as the contractor. Robert has worked with various project delivery systems such as design-build, design-bid-build, and force account construction
Communications/Signals					
William Wiedmann, MIRSE	Signals Leader	Burns	39	Member, Institution of Railway Signal Engineers	• Specialized experience in the engineering design, installation, maintenance and operations of rail signal systems. • Possesses detailed understanding of signal engineering, maintenance, and installation. • Experienced in project and design engineering, and the development and review of bid proposals, design documents, and maintenance and test manuals and procedures. • Experienced in compliance verification of FRA procedures, personnel training, systems installation and maintenance, troubleshooting, and repair.
Frank Velazquez	Signals	Jacobs	28	N/A	• Signal and circuit design skills include positive train control (PTC), microprocessor vital - non vital software circuit logic, simulation testing, track signal routing (TSR), signal control lines, cable plans, specifications, tie-in circuits to existing system, automatic speed control (ASC), and highway grade crossings. • Formerly worked for MTA Long Island Rail Road and NYC Transit Authority, giving him specialized hands-on understanding of Train Control & Signaling Systems.
William George	Communications	Jacobs	30	N/A	• Areas of expertise include transit communications systems, RF (systems in all bands, LMR, Microwave, and Wi-Fi/WiMax, Wayside), radio and telephone communications infrastructure, passenger information systems (PA/VMS), access control and intrusion detection systems, TVM, command and control to include communications room layout, fire alarm and emergency management systems, and security programs.
Railroad Operations					
Manuel Cabrera	Railroad Coordination/Force Account	Jacobs	17	N/A	• Experience in managing Amtrak projects with in its infrastructure and knowledge of railroad operations. • Able to coordinate and work with other Agencies and Departments resolving issues and keeping project within schedule and budget. • Supervise all aspects of Force Account work through design, planning, scheduling and communication.

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
Site/Civil					
James Homoki, PE	Site/Civil Leader/Acquisition Identification	Jacobs	29	PE in NJ Certified Municipal Engineer	• Familiar with NJ TRANSIT procedures. • Experienced in coordinating all civil disciplines involved in the project. • Knowledge of surveying practices.
Kenneth Bienkowski, PE, AVS	Utilities Engineering/Relocation	Jacobs	22	PE in NJ, NY AVS – in US	• Experienced in all aspects and types of utility relocation. • Experienced in identifying utility companies/parties and coordinating with the impacted utilities. • Served as Lead Utility Engineer on the Portal Bridge Capacity Enhancement (PBCE) Project and on the Meadowlands Rail & Roadway Improvement Project for NJ TRANSIT. • Experienced in preparing relocations schemes for impacted utilities and coordination agreements between NJ TRANSIT and each utility company. • Adept at coordinating with utility companies, contractors, and government agencies.
Thomas Decker, PE	Hydraulics/Drainage Engineer	Jacobs	29	PE in NJ, NY, MD	• Extensive experience in hydrologic and hydraulic studies, drainage design, stormwater management, floodplain analysis, and regulatory permits. • Technical expertise and sound judgment regarding practical engineering solutions to drainage and permitting issues. • He has applied HEC-1, HEC-2, HEC-RAS, and drainage design computer programs extensively.
Michael Kaminski, PE	Sr. Structural Engineer	Jacobs	36	PE in NJ, NY	• Structural engineering, design, and inspection experience encompassing steel, concrete, and pipe support design. • Familiar with NJ TRANSIT Design Manuals and Procedures from numerous projects including Portal Bridge Capacity Enhancement project, Wesmont Station, Newark Drawbridge Rehabilitation, and Main-Bergen Connection and Main Line Improvements.
POWER TEAM					
Power Process					
Herbert Tull, PE	Lead Mechanical Engineer	Jacobs	35	PE in NC	• Construction site manager for Cogen and Generation projects. • Startup of power plant gas turbines, auxiliaries & switchgear. • Commissioning of Cogen plants and power plant equipment. • Design & implementation of upgrade projects in operating power plants. • Development of Smart Grid concepts and implementation plan.
Joseph Saltarelli, PE	Mechanical Engineer	Jacobs	39	PE in TX	• Extensive experience with on-site engineering and construction of energy and power systems. • Served as project engineer for central plant systems and is skilled in the design of combined heat and power plants and steam turbine generator systems. • Has been responsible for the supervision and inspection of contract construction operations and associated liaison and coordination with plant operators, owners, and contractors.
Power Electrical					
Michael Lewis, PE	Electrical Engineer	Jacobs	22	PE in MO, ID, NE, TX	• Expertise in power system design. • Nationwide interconnection design experience.
Anthony Marsh, PE	Relay and Coordination Engineer	Jacobs	32	PE in TX, SC	• Responsible as lead project engineer for relay and control designs, protection settings, functional testing, and commissioning for substation, transmission, and distribution systems. • As a mentor for other engineers concerning relay and control designs along with protection relay settings.
John Beaudry, PE	Lead I&C Engineer	Jacobs	35	PE in CA, OR	• 30 years experience in controls design and construction services. • Specific areas of expertise include microelectronics, control systems, systems integration, process engineering, strong technical skills, and construction coordination.
Morgan Sutton, PE	Electrical Engineer	Jacobs	7	PE in TX, OH, CA, LA	• 7 years of power generation, power distribution, protection and facilities experience. • This experience includes preparation of construction documents, system analysis, evaluations of existing systems and improvements, specifications, arc flash studies and development of protective relay settings.
Transmission/Distribution					
Daryl Scott	Distribution Engineer	Jacobs	31	MIE Aust, CPEng, RPEQ	• Daryl has had operational and senior management accountability for overhead and underground distribution, sub-transmission line and substation maintenance, design and construction activities in addition to various roles for distribution network operations, distribution network performance, inventory and fleet management.
Randy Winks, PE	Railroad Coordination /Integration (Wires)/ Constructability - Railroad Lines	Burns	26	PE in NJ, CA, CT, DE, MD, NY, PA, TX, VA	• Experienced in the project design of new catenary installations and modifications, and upgrades of existing systems. • Has worked for the major Northeast passenger rail authorities and has provided designs for eleven light rail projects for six different transit authorities. • As the lead engineer, his responsibilities have included the production of drawings, specifications, staging plans and construction support.

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
Transmission/Distribution (Continued)					
Anthony Zeloyle, PE	Railroad Coordination/Integration (Structures)	Jacobs	23	PE in NJ, MD, PA, DE	• Over 20 years experience in the design and layout of light rail, commuter rail and heavy rail electrification systems, structural engineering and civil engineering. • Experience includes catenary design, traction power design, and design and analysis of railroad catenary and transmission support structures, design of deep and shallow foundations, conduit systems to carry signal power, signal cables and traction power cables. • Has worked with NJ TRANSIT, SEPTA, Amtrak, Metra, NICTD, and MTA MNR.
Structures					
Cesar Vallenilla, PhD, PE	Structural Engineer	Jacobs	37	PE in TX	• With more than 30 years experience, Dr. Vallenilla has extensive design and project management expertise in structural engineering from design and specifications through construction phase services. • His design experience includes commercial office building, institutional, industrial and educational facilities. • He has directed projects from preliminary design, construction documents, through construction administration services. • He has performed analysis and design of structural steel, reinforced concrete, masonry, pre-cast and post-tensioned structures. • He has developed a number of programs to improve and generate a better communication between the owner, architect, contractor and consultants during all the phases of a project.
Robert Witte, Jr.,LEED® AP	Architecture	SSA	14	LEED® AP – in US	• Rob is SSA's Project Task Leader for all of the firm's renovation and rehabilitation projects throughout the transportation sector as well as those for educational and federal agencies. He is also the firm's Project Task Leader for all of NJ TRANSIT's Superstorm Sandy restoration/ remediation projects.
Stephen Donohoe, PMP	Construction Safety (Facility)/Safety In Design	Jacobs	36	PMP	• Responsible for leadership and risk management for Jacobs' at risk projects and grew the at-risk business to include design-build, EPCM, GMP and firm-fixed-price work delivery. • Outstanding safety leadership record and at risk projects have led the way toward zero incidents.
REGULATORY & STAKEHOLDER COORDINATION TEAM					
PJM Connection					
William (Michael) Williams	PJM Coordination/Administration/O&M Cost Estimating	Jacobs	44	N/A	• Bill is an experienced Jacobs' consultant with over 30 years of utility experience including 10 years as assistant manager of power production for a municipal utility. • He has been involved in assignments that have required significant interface at the utility, PJM and regulator levels. • He is heavily experienced in project management, materials management, budgeting, corporate strategic planning, information systems planning, maintenance management, root cause analysis, property records, organization and staffing assessments in the utility industries.
Regulatory Interface					
Michael Rafferty	PSE&G Interface, NERC, & NPCC/Cost Benefit Analysis/ Utility Liaison	Jacobs	42	N/A	• Michael is a seasoned Jacobs' management consultant with over 40 years of utility experience. • He has been involved in numerous assignments that have required significant interface both at utility and regulator executive levels. • He has testified in several merger due diligence cases on behalf of regulators and in a number of cases involving expert testimony related to operating utility parameters. • He has appeared before the NJBPU and has recently been involved in projects requiring interface with PSE&G.
John Graham, Esq.	Regulatory Interface - FERC	SCC	14	LEED® AP – in US	• John has practiced energy law in the United States and abroad for more than 40 years, mostly as an equity partner in large national law firms. • Together with his partners at Sullivan Cove Consultants, he has represented public utilities and utility customers before state and federal legislative and regulatory bodies, including the Federal Energy Regulatory Commission, and has represented, and is currently representing, the Maryland Public Service Commission in on-going energy regulatory matters involving provisions for the interconnection with the PJM grid.
Gas Supply					
John Bitler	Gas Supply	Levitan	42	N/A	• John has close to 40 years experience in the energy industry encompassing a wide range of fuel, power, and emissions control issues. • John advises utilities, power generators, state regulatory agencies, and end-users regarding fuel market trends, fuel and power procurement design and administration, gas supply and infrastructure developments, and emission control technologies and costs. • He is responsible for LAI's fuel market analysis and price forecasting activities and has submitted expert testimony before the FERC and state regulatory commissions throughout the U.S.
Third Party Coordination					
Jonathan Livingston	Third Party Coordination - Agency Liaison	Jacobs	18	N/A	• Jon Livingston has been with Jacobs for almost 15 years serving in a government affairs and outside sales role throughout the state of New Jersey. • Prior to that, Jon served in two gubernatorial administrations in New Jersey working with elected and appointed officials. • His day-to-day activities also included working with state departments and agencies along with the private sector, which consisted of utility providers as well. Jon has interfaced with NJ TRANSIT, Amtrak, and NJBPU on many occasions on important timely issues.

Section 3

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
Third Party Coordination (Continued)					
Jayne Yost, AICP	Third Party Coordination - FTA Reporting Compliance	Jacobs	15	AICP	• Jayne is a planning professional specializing in environmental, transit, and land use. • Specifically, she has researched and prepared environmental analysis documents in accordance with the NEPA, prepared master plan documents, white papers on policy issues, undertaken spatial and demographic analysis using GIS and provided grant/project management. • Jayne has strong, positive relationships developed through cooperative and successful project experience with multiple state and federal agencies including the USACE, US Maritime Administration, FRA, NJ Department of Agriculture, and the NJ SHPO.
Jeffrey Stiles, PP, AICP	Third Party Coordination - Public Involvement	Jacobs	32	PP in NJ AICP – in US	• Extensive experience in the management and technical direction of large multi-discipline rail planning assignments. • Directed major assignments involving the comprehensive evaluation of transportation, land use, and environmental projects. • Responsible for implementation of infrastructure investments in the billions of dollars. • Completed a number of assignments for transit operations, DOT's, and various MPOs throughout the country. • Assignments have included the evaluation of projects involving bus rapid transit, light rail transit, commuter railroads, local and commuter bus lines, and highways. Under his technical direction, projects have successfully identified implementable solutions to complex transportation problems. Jeff has extensive experience in the FTA's "New Starts" process.
ECONOMIC ANALYSIS					
Financial Structure					
Charles Wedel, CPA	Financial Structure	Jacobs	47	CPA	• Charles was chosen for this role on this project due to his extensive experience as former Chief Financial Officer & Treasurer for NJ TRANSIT. • Senior financial executive with a solid record of achievements in the transportation industry.
Economic Analysis					
Alex Mattfolk	Power Price Forecasts, Plant Operational Modeling	Levitan	4	N/A	• Alex has experience providing research support and quantitative analysis critical to investment decisions, project economics, and regulatory deliberations. • Alex has performed electric chronological dispatch simulation modeling for several clients and maintains and updates AURORAxmp model databases for PJM. • Alex has a detailed understanding of PJM markets and has represented clients at several PJM stakeholder groups
Matthew DeCourcey	Fuel Price Forecasts	Levitan	11	N/A	• Matt has advised numerous clients on issues relating to fuel price forecasting, fuels management, risk management, and the development of fossil plants. • Matt has worked with plant owners, utilities, and large consumers to develop and execute gas and power supply plans. • Matt has extensive experience working in the PJM market and understands the physical configuration of the gas pipeline system, its constraints, and the pricing dynamics relevant to NJ TRANSIT. • Matt has previous experience advising owners of microgrid and distributed generation facilities.
Economic Screening					
Philip Curlett	Economics Screening Analysis	Levitan	42	PE in MA	• Phil is an expert in the economic and financial modeling of infrastructure and utility projects, including cogeneration and microgrids. • He was responsible for technical, economic, and financial analysis in developing Cornell University's Master Energy Plan. • Phil prepared financial evaluations for power and cogeneration projects at the Massachusetts Institute of Technology, the Massachusetts Water Resources Authority, New York University, University of Rochester and other organizations. • Prior to joining Levitan & Associates, he participated in the development and financing of power generation, desalination, recycled paper, and transportation projects.
Cost Estimating					
William (Steve) Jones	Capital Cost Estimating	Jacobs	45	N/A	• He has extensive experience preparing cost estimates for a variety of clients including pulp & paper, chemical, power, semiconductor and pharmaceutical industries. • He has prepared lump sum bids for public water and wastewater projects. • He services as the chief estimator for an ENR Top 400 General Contractor.
Venket Tiruchirappalli, PE	Cost Estimating Support	SJH	19	PE in NJ, NY, WI Project Management Training P6 Rel 7, Oracle	• As a cost estimator, Venket has been responsible for providing reliable estimates for repair, renovation, and reconstruction projects throughout the New Jersey for government agencies. • His wide breadth of project experience includes transit stations, transportation lines, industrial facilities, electrical substations, schools, community centers, hotels, parks, and offices. • Venket is familiar with cost estimating during all phases of design, including conceptual planning, schematic design, design development, and 100% construction document phases.

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
QUALITY CONTROL					
Kevin Fox, PE, CEM, LEED® AP	Quality Control - Power	Jacobs	18	PE in MO, OK, TX, CT Certified Sustainable Development Professional (CSDP) LEED® AP – in US Certified Energy Manager	• Responsible for the design, construction administration and project management of mechanical systems for a wide range of projects, including central energy plants, cogeneration, cooling tower installations, campus utility master plans, biotechnology and research laboratories, student dormitories, commercial HVAC systems and telecommunication facilities. • Experienced in leading multi-disciplinary design teams for complex utility infrastructure projects, as well as the management and design of university plant, utility and renovation projects, detailed energy engineering analysis, HVAC load calculations and energy usage models, and computerized simulation of large-scale steam and water piping distribution systems.
Constructability					
Steven Eichinger, PE, LEED® AP	Constructability – Electrical	Jacobs	40	PE in NJ, CO, FL, NY, OK, PA, TX	• Extensive electrical engineering and contracting experience in the design and construction of electric utility distribution and substations, facility power distribution systems, emergency/stand-by power systems, uninterruptible power systems, lighting, fire alarm and detection, security systems, controls, telecommunication and data infrastructure, and energy/building management systems. • Diverse background and proven experience in the maintenance, operation, and installation of electrical systems and equipment. • Experienced in providing construction management services on a wide variety of projects. • Developed and presented numerous training seminars on electrical safety; fire alarm and detection system maintenance and operation; and building electrical/mechanical systems. • Performed forensic analysis for electrical accidents and electrical/mechanical equipment/system failures.
Philip Semler	Constructability - Rail	Jacobs	30	N/A	• Proven engineering experience in the construction, maintenance, and operation of railroad and transit systems. • His experience includes the construction of signal, communications, traction power, and electric systems in maintenance shops, mainline, yards, tunnels, facilities, and stations
Rodney Carpenter	Cogeneration Construction Specialist	Jacobs	31	N/A	• Over 20 years experience managing projects in the construction industry. • Managed underground utility and infrastructure, industrial and commercial buildings, oil and gas retrofits and outages, chiller plants, central heating and cooling plants, power generation plants, electrical distribution and substation upgrades from 15 KV to 765 KV. • His experience within the industry, particularly in the industrial and power markets, allows him to provide a wealth of knowledge and insight into the design and construction of his projects.
Risk Management					
Richard Carlson, PhD	Risk Management - Regulatory/Economics	Levitan	37	N/A	• Economics consultant and modeler with energy software product management, independent evaluator, and expert testimony experience. • Expertise in applied econometric and optimization modeling techniques. • Experienced in stochastic forecasting of power and fuel commodity market prices, load, and hydro and wind energy; real options valuation analysis of generation and transmission resources; wholesale power and natural gas procurement contracts evaluation and selection; power and fuels portfolio risk-reward optimization; wholesale electric market performance and market power; integrated resource planning; due diligence of power and natural gas issues; socio-economic cost-benefit analysis; regional economic impacts analysis.
Peer Review					
Peter Rasmus	Peer Review Leader	Jacobs	28	N/A	• Peter has specific capabilities in concept design, network planning, network modelling and analysis, connection of loads and generators into transmission and distribution networks, and generator compliance. • His experience includes the assessment of new connection proposals, assessment and determination of access standards of loads, generators and wind farms. • Peter has worked within the electricity industry for more than 25 years in various technical and leadership roles in networks related projects.
PROJECT CONTROLS					
Schedule					
David Morgan, CPE, CPM	Scheduling Leader	Jacobs	32	CPE CPM	• Served as the Scheduling Manager for Florida's Turnpike Enterprise for 16 years. David truly knows how to create, analyze, and update/maintain both design and construction schedules. • David has extensive experience working on a variety of projects for three different heavy/highway contractors. He understands how infrastructure projects are constructed. • David has provided both CPM scheduling and cost estimating support for final design on transit projects. As such, he is very familiar with the design development process. • David has program management experience in the transportation area. He realizes first-hand how a construction program is successfully managed.

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
Document Controls					
Alla Kudravitsky	Document Control	LKG-CMC, Inc.	26	N/A	• 26 years experience including 20 years providing document control in the transit industry.
Veronica Hollis	Configuration Management	LKG-CMC, Inc.	33	N/A	• 33 years experience in procurement processes, construction estimating, post-award project start-up, and document control and configuration management.
Interface & Integration Management					
Mehul Gandhi, PE, PMP, PSP	Interface & Integration Coordinator	Jacobs	12	PE in VA	• 11+ years of Project and Program Management experience supporting Higher Education, Healthcare/Research, Mission Critical, K-12 and Infrastructure clients. • Expertise in Project and Program Controls including CPM and Program/Master Scheduling, Financial Analysis, Risk Management, Delay/Impact Analysis and Claims Assessments. • Experienced in mobilizing projects and program including technology selection, set up and implementation. • Proven track record in client management, managing cross functional and multi-location teams and excellent customer service.
Procurement					
Stanley Grill	Procurement Specialist	Jacobs	35	N/A	• During the course of his career, Stanley has managed the acquisition of thousands of federally funded projects including ensuring compliance with all federal and local laws, rules and regulations. • Stanley is a recognized expert, primarily in the public transit industry in all aspects of procurement including compliance with federal regulations on federally funded projects. • Stanley is an active member of the American Public Transit Association's Public Transit Standards Oversight Committee and various procurement related sub-committees. • As a senior procurement executive, Stanley has been responsible for verifying that all acquisitions are conducted in an ethical manner and comply with federal requirements for fair and open competition in a transparent manner.
David Cimino	Bid Support	Jacobs	15	N/A	• Experienced senior level contracts manager with an impressive record of bidding and managing compliant, successful, multi-million dollar contracts, both domestic and international. • Broad experience utilizing proven contracting principles to drive business solutions, developing and facilitating corporate and customer policies while supporting, communicating and defending clients' missions and values. • Core competencies include evaluation and negotiation of complex contract terms and conditions, federal contracting policy, risk management, and change management.
Roderick Schwass, LEED® AP	Grant Management	Jacobs	29	LEED® AP – in US	• Rod is focused on assisting clients in the development of energy efficient, onsite energy and renewable energy projects and technologies, providing strategic business, technical and government policy support of clean energy technologies. • In addition to his energy project development and execution roles, Rod also directs federal advocacy efforts, providing strategic financial consulting services to clients in the industrial, commercial, institutional, utility and municipal sectors.
TECHNICAL SUPPORT					
Environmental Support					
James Dowling, PP, AICP, AVS	Federal/State Environmental Review	Jacobs	29	PP in NJ AICP – in US AVS – in US	• Jim has nearly three decades of significant experience in the fields of environmental analysis and urban planning, transportation planning, zoning analysis, urban design, and project management. • His work includes coordination and management of complex NEPA/SEQRA/CEQR/NJ E0215 environmental reviews; transportation infrastructure, Alternatives Analyses; transit station and Transit Oriented Development studies; numerous urban design and zoning studies for development sites throughout the country; institutional and cultural master plans; and coordination of environmental review and permitting issues with project architects and engineers. • In addition to his project management and environmental assessment skills, Jim has noteworthy experience in transit station area planning and is especially adept at developing land use-based strategies for addressing access, traffic and circulation, and traffic capacity issues.
Thomas DeMichele, LSRP	Environmental Remediation	Matrix	27	NJDEP LSRP	• Tom is a Licensed Site Remediation Professional (LSRP) with over 24 years of experience in environmental investigation and remediation services. • He has participated in complex environmental and engineering programs which have required detailed cost-control programs and multi-disciplinary staffing. • Investigations performed involved numerous environmental characterization studies relative to hazardous waste screenings, preliminary assessments (Phase I), site investigations (Phase II), remedial investigations and feasibility studies (Phase III), UST/AST investigations, and environmental impact statements (EIS). • Tom is a licensed N-2 Industrial Wastewater Operator, Subsurface Evaluator, and UST Closure in the State of New Jersey.

Section 3

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
TECHNICAL SUPPORT					
Environmental Support (Continued)					
Steve Ricucci	Environmental Permitting	Jacobs	11	N/A	• Steve's assignments have required in-depth knowledge of natural resource land use planning issues to conduct detailed environmental analysis using geographic information system (GIS) technology. • His other project assignments have included numerous wetland delineations, regulatory permit preparation, environmental impact assessment documentation, and landscape designs. • Taking advantage of his background in environmental studies and wetland delineation, Steve has been able to work closely with regulatory personnel to expedite environmental permitting packages including Letters of Interpretation, Jurisdictional Determinations, along with Individual and General Permit Applications to the NJDEP, NYS DEC, and the USACE. • In addition, his experience includes utilizing GIS for sustainable development, natural resource habitat, and transportation feasibility studies.
Kimberly Glinkin, PP, AICP, LEED® AP	Environmental Planner - Air/Noise	Jacobs	17	PP in NJ AICP in US LEED® AP – US	• Performed numerous noise analyses and final design studies for noise barriers. • Experienced with the FTA Guidance Manual and its associated spreadsheet models, and FHWA's Traffic Noise Model (TNM) and with the standards of NJDOT, PENNDOT, NYSDOT, FDOT, MassDOT, IDOT, Illinois Tollway, and NYC CEQR. • Performed microscale and mesoscale air quality screenings and studies for numerous transportation projects, using the EPA models SCREEN3, CAL3QHC, CAL3QHCR, and MOBILE6, and is well-versed in the new model MOVES2014. • Formerly with the Federal General Services Administration (GSA) Region 2, where she was responsible for assessing environmental compliance for all GSA actions relative to the requirements of NEPA and other local regulations.
Paul McEachen	Archeological Resources	RGA	20	Register of Professional Archaeologists	• Over 20 years experience conducting cultural resources investigations. • Extensive experience as Cultural Resources Team Leader for several railroad improvement projects, such as bridge rehabilitation/ replacement, track upgrades and improvements, tunnel repair/reconstruction, new station construction, and new parking deck/park and ride construction. Project sponsors include NJ TRANSIT, Amtrak, Conrail, Port Authority of New York and New Jersey, Delaware River Port Authority, and NJDOT. • Extensive knowledge of cultural resources regulations for State and federally-funded projects including compliance with Section 106 of the National Historic Preservation Act, NEPA, and Section 4(f).
Miles Cheang	Environmental Planner - GIS Mapping	Jacobs	10	N/A	• Miles is a Planner with experience in environmental studies for transportation and development projects. • His primary expertise is in the synergistic application of information technologies to planning activities, citing intensive experience with Geographic Information Systems (GIS), project-level CAD-GIS interoperability, and model development for air quality and traffic noise analysis. • Miles' associated software proficiencies include ArcGIS, MicroStation, and AutoCAD.
Surveying/Land Support					
Rick Voss, PLS	Surveying & Right-of-Way	GTS	43	PE in NJ	• Rick has extensive experience in all aspects of surveying, preliminary and final highway design, and site plan and subdivision document preparation. • He has been responsible for the development of right-of-way acquisition plans and agreements, preparation of construction staging and maintenance of traffic plans, utility coordination, and expert testimony for planning and zoning board approvals and property condemnation hearings.
Tammy Schlagbaum, ASLA	Landscape Architecture	Jacobs	30	LA in IN, OH, DE, IL, KY, NY, MN	• Her experiences encompass a broad range of projects including designs for streetscape improvements, transit facilities, parks and recreational facilities, residential and commercial site development plans, cemetery design, community master plans, and planting plans. • Tamara's experience also includes public facilitation, cost opinions, construction documents and bid specifications, as well as project supervision and inspection during construction.
Corrosion Prevention					
Michael Shelton, PE	Corrosion Prevention	Jacobs	37	PE in AK, WV, OR, TN, PA, TX	• 30 years as NACE-Accredited Corrosion Specialist. • Corrosion Expert – Department of Energy's Strategic Petroleum Reserve. • Corrosion Expert – British Petroleum, Prudhoe Bay Oil and Water Systems. • Corrosion Expert – Grand Coulee Dam Water Systems.
Geotechnical & Subsurface					
Christopher Ellis, PE	Geotechnical Engineering	Jacobs	21	PE in NJ	• Chris is a Geotechnical Engineer in the Morristown, NJ office responsible for developing subsurface investigation programs, preparing contract documents, inspecting and supervising soils related field work, and developing laboratory testing programs. • Chris has analyzed and designed a wide range of foundations types and retaining structures utilizing deep foundations including driven piles (H-Piles, pipe, and tapered piles), drilled shafts (caissons), and shallow foundations.

Name	Role on this Project	Firm	Years Experience	Professional License(s)	Key Qualifications/Why This Person Was Selected for this Position (1 to 2 sentences)
Geotechnical & Subsurface (Continued)					
Frank Carrozza	Soil Borings	JBD	27	NJ Licensed Test Borer and Well Installer	• Maintains OSHA training as well as most railroad certifications including NJ TRANSIT. • Extensive experience with many extremely large rail projects including NJ TRANSIT's Portal Bridge Capacity Enhancement and THE Tunnel Project; MTA's East Side Access Project; and Amtrak's Niantic River Bridge Replacement. • Personally coordinated and supervised the geotechnical investigation for the Second Avenue Subway in New York City, a multi-billion dollar, 8.5 mile long line project.
Donald T.M. Heck, PE	Subsurface Investigation Support	Matrix	23	PE in NJ, NY OSHA Construction Safety Program, 10 Hours	• Donald has also coordinated and inspected the drilling of soil borings, including soil classification for roadway and bridge foundations; and arranged and prepared boring and laboratory contracts for subsurface investigations. • Donald's project involvement have included site inspection; preparation and review of project cost estimates; construction, site grading, cross section, and drainage plans; and specifications.
Kenneth Kerr, PE	Subsurface Utility Engineering	InfraMap	19	PE in NJ, NY, PA, DE, MD, MA, FL, NC, TX, TN, GA PP in NJ Certified Municipal Engineer in NJ OSHA 40-hour HAZWOPER	• Ken has worked as Subsurface Utility Engineering (SUE) Project Manager on numerous Transportation and Rail improvement projects in NJ, PA, and NY requiring SUE services for NJ TRANSIT, Amtrak, SEPTA, LIRR, NYS&W, PATH, and ARC. • Ken is considered an expert in SUE and CI/ASCE 38.02 – Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, and has been a presenter for many professional associations and organizations including ASHE, ASCE, NYSPE, NYSATE, PIE, PSPE as well as engineering consulting firms and state DOT highway design groups. • Ken is on the ASCE committee responsible for creating the ASCE Standard for Utility As-Builts.

Resumes

Roger Copeland, PE

Project Manager / Power Leader

We selected Roger to lead this important NJ TRANSITGrid project for NJ TRANSIT based on his extensive experience in the power generation and control marketplace supporting various microgrid applications.

Roger is a Principal Leader and Sr. Electrical with extensive technical experience includes the design of numerous power generation, microgrid, thermal energy, cogeneration, combined heat and power, blackstart, and boiler plants and utility distribution systems for district energy companies, higher education campuses, healthcare districts, utilities, and municipalities. His experience also entails substation and medium voltage to EHV systems, including gas insulated substations and generating stations with focus on the application of innovative generator interconnection and control schemes, grounding schemes as well as complex relay protection schemes for electrical production, transmission, and distribution, including overcurrent protection, low and high impedance machine, transformer, and bus differential protection, distance relaying, permissive overreaching transfer trip schemes (POTT), directional power relaying, as well as all aspects of generator protective relaying.

Representative Projects

- **Confidential Client, Macrogrid PJM Blackstart Addition, OH**
  Project Executive / Technical Leader responsible for EPCm services for the installation of equipment required to restart two large power plants in the event of a grid wide outage to this 640MW and 1280MW power plant site utilizing a LM2500 gas turbines as the starting source for the larger power blocks to allow for grid restoration in the state of Ohio in the event of an outage like the Northeast outage of 2003. Staged isochronous control of the microgrid, as well as soft starting of the electrical system were unique challenges for these projects. Project utilized a unique starting methodology for grid restoration currently being developed for technical article. **Similar to the proposed NJ TRANSITGrid, this application was a first of its kind grid resiliency project in the PJM market.** Project Value $53M.

- **Texas A&M University, Campus Microgrid Renovation, College Station, TX**
  Sr. Project Manager / Sr. Electrical Engineer responsible for developing detailed design documents for the installation of a 32.5MW gas turbine, HRSG and 11MW back pressure steam turbine, and complete reconfiguration of the campus electrical systems, including the 138kV substation. Directly responsible for the overall concept for the electrical design and managed the installation of a gas turbine generator (GTG), a heat recovery steam generator (HRSG), and a steam turbine

PRIMARY QUALIFICATIONS

- *Industry leader in microgrid systems*
- *Generation control specialist*
- *High voltage substation and protection and control thought leader*

EDUCATION

- *BS, Electrical Engineering, Texas A&M University, College Station, 1998*

CERTIFICATIONS

- *Registered Professional Engineer: OK, TX, MN, NJ (pending)*
- *NCEES Record, 49403*

WORK HISTORY

- *Jacobs Engineering Group (formerly Carter & Burgess), 2006-Present*
- *Stanley Consultants, 1999-2006*

YEARS OF EXPERIENCE

- *With Current Firm: 9*
- *With Other Firms: 7*
- *Total Years Experience: 16*

Resumes

generator (STG) increasing total self-generation to 50MW. These units were registered for market participation in the ERCOT generation market. **Like TransitGrid, this project required extensive new electrical distribution infrastructure to provide the required resiliency.** This project alone saved Texas A&M University over $1M in the first month of operation. This project was awarded Gold Medal for Engineering Excellence by the Texas ACEC, Silver Medal for Engineering Excellence at National ACEC, 2013 ENERGY STAR CHP AWARD by the DOE, and 2013 Global District Energy Climate Award sponsored by IDEA and the International Energy Agency. Project Value $71M.

- **University of Texas at Austin, Microgrid Upgrades, Austin TX**
  Project Manager / Client Manager for the ongoing support of numerous upgrades to this 135MW campus microgrid. Projects have included design and installation drawings and specifications for the first of its kind General Electric 34 MW LM2500+G4 combustion turbine generator coupled to a heat recovery steam generator, a 27MW extraction condensing steam turbine generator, a 200MVA, 138kV campus substation and campus switchgear replacement, and a new campus cooling tower. **Similar to TransitGrid, UT Austin is now able to be fully self-sufficient, able to operate without interruption in light of utility problems.** Total Project Value over 10 years ~$80M.

- **North Carolina State University, Microgrid, Raleigh, NC**
  Principal Electrical Engineer responsible for the design and start-up for the addition of two gas turbines with heat recovery steam generators along with upgrades / replacements of three substations (110kV and 230kV primary) and distribution systems on campus. **Like TransitGrid, this project included utility interconnection to the PJM grid, blackstart systems, island control for the substations, and new SEL based protection systems.** Project was awarded the 2014 Honors Award for Engineering Excellence, North Carolina CEC. Total Project Value ~$70M.

- **University of Minnesota, Microgrid Design, Minneapolis, MN**
  Principal / Sr. Electrical Engineer responsible for planning and design of new combined heat and power based microgrid. This new 20.6MW system was right sized for the application to provide highly reliable thermal and electrical supply to this intensive research based institution. The project includes a complete renovation of the electrical distribution system and new transmission level interconnection with the regional operating utility. **Through our rigorous right sized engineering, this project is projected to save over $40M in life cycle costs over baseline.** Project value ~$105M (included extensive remediation and renovation of a historical building).

- **University of Oklahoma Utilities and Microgrid Design, Norman, OK**
  Project Director served as prime design engineer for the University of Oklahoma's (OU) new Utility Plant No. 4 (UP4) microgrid application. This included 15MW of combined heat and power (CHP) and 10,000 tons of cooling capacity, set to provide resilient utility supply to the core of the Norman campus. Generation connection required multiple interconnection locations and associated complex relaying and control packages. Project Value $70M.

- **Beacon Power, 20-MW Fly-Wheel Based Frequency Regulation Plant – Multiple Locations, NY**
  Senior Electrical Engineer responsible for providing first of its kind 20-MW flywheel-based frequency regulation plants. Services included overall plant design, PJM / utility interconnection, cost estimating, value engineering, and scheduling services to optimize the cost-effectiveness and environmental impact of the plant while designing a solution that will safely enhance the stability of the electrical grid. The design work was partially funded by the U.S. Department of Energy under a contract administered by Sandia National Laboratories. **This technology is also now being deployed for frequency control / load smoothing of large scale microgrids like the NJ TransitGrid.** Projects Value ~$50M.

Diaa Elmaddah, PE, LEED® AP

Deputy Project Manager

Diaa was selected for the role Deputy Project Manager/ Rail Engineering Coordination Leader due to his extensive experience in railroad design and multidisciplinary engineering design, coordination and management.

Diaa is a well-rounded professional engineer and project manager with more than 20 years of experience on projects involving civil, structures, geotechnical and buildings design. During the last 12 years Diaa's focus was commuter rail and inter-city transit. He served as design manager for large scale projects serving MTA LIRR, MNR, and NYC Transit. He has extensive experience in civil, structure, and geotechnical design demonstrated in his recent LIRR 2nd Track project and MNR rail shop facilities. He has managed and coordinated the design in several complex design-build multidisciplinary engineering rail projects that involved track alignment, rail systems, traction power, utilities and underground structures, retaining walls, flood mitigation and resiliency, facilities and yards, stations, security hardening, and fire and life safety. He has also performed in key technical roles on task-orders and on-call contracts with MTA NYC Transit and other transportation agencies.

Representative Projects

- **MTA MNR, Harmon Shop Replacement Program, Phase III, Croton Harmon, NY**
  Design Coordinator for this multidisciplinary design-build project. The project consists of providing design-build services for two new rail maintenance facilities in Westchester County, NY. The Consist Shop Facility is a three-story building that is 1,000 feet long for inspection of 10-car trains. The EMU Annex is 60,000-square-foot support shop for train maintenance work. Site improvements include track construction, new roads and utility upgrades. The project duration is 36 months and the design-build award value is $245M. Design is scheduled to complete in December 2015.

- **PANYNJ, PATH Substation No. 9, Harrison, NJ**
  Quality Reviewer for the structural design. The substation structure is a steel braced frame building supported on pile caps and piles designed for the substation equipment loads. The project encompass a new two-story, approximately 20,000 SF, traction power substation elevated above the 100-year flood line, related site, utilities and infrastructure, development of the O&M Manual, commissioning of the new Substation No. 9 as well as the de-energizing, de-commissioning and demolition of the existing Substation No. 9 building and outdoor switchyard after the new substation is commissioned into service. Design is on-going.

PRIMARY QUALIFICATIONS

- *Extensive design management experience in multidisciplinary complex rail projects*
- *Comprehensive understanding of civil design, rail systems and utilities design*
- *Extensive civil, structural, and geotechnical experience in rail infrastructure projects such as LIRR new 2nd track and rail transportation facilities design such as MNR Harmon shops*
- *Extensive design-build experience*

EDUCATION

- *MBA, Project Management, SIT, 2010*
- *MS, Information Management, Stevens Institute of Technology, 2003*
- *ME, Civil Engineering, Stevens Institute of Technology, 1998*
- *BE, Civil Engineering, Helwan University, Egypt, 1994*

CERTIFICATIONS

- *Registered Professional Engineer: NY, MI*

PROFESSIONAL ASSOCIATIONS

- *American Institute of Steel Construction (AISC)*

WORK HISTORY

- *Jacobs Engineering Group, 2014-Present*
- *Parsons Brinckerhoff, 2003-2014*
- *Thornton Tomasetti Group, 1998-2003*
- *Steven Institute of Technology, 1997-1998*
- *Bylander Misr Partnership, 1994-1996*

YEARS OF EXPERIENCE

- *With Current Firm: 1*
- *With Other Firms: 20*
- *Total Years Experience: 21*

Resumes

- **MTA LIRR, New Second Track on the Main Line Ronkonkoma Branch (Phase I), NY**
  Design Manager for this $35 million design-build project to add 12.6 miles of new track running parallel to the single tracked sections to provide double-track service between Ronkonkoma and Farmingdale. The first segment involves a 6-mile segment of rail between Central Islip and Ronkonkoma. The design team provided final design and construction support services for Segment 1 of the Second Track. The design included modular retaining walls, sheet piles, precast soldier piles and concrete lagging, site investigations and supplemental survey, drainage and storm water management controls; geotechnical investigation; permit preparation and acquisition; environmental compliance; final civil and structural design; culvert design, and utility design. The project also includes securing permit from NYSDEC and USACE and wetland mitigation and restoration design. The project started January 2014 and construction is scheduled to complete in October 2015.

- **MTA Capital Construction, Security CM-1278 Task #66 (CM-1409 Task #3), Penn Station Complex Fire and Life Safety and Consequence Management, New York, NY**
  Design Manager on a multidisciplinary engineering and risk assessment team tasked to perform a comprehensive threat, risk and vulnerability assessment (TRVA) and design of various mitigation measures to improve the consequence management during emergency events in the 34th Street Penn Station Complex. The work includes studing existing fire and life safety systems, TRVA, developing mitigation options and cost-benefit analysis, analyzing ventilation and computational fluid dynamics (CFD), analyzing emergency power and lighting, analyzing fire suppression, analyzing communication systems, conceptual design, and final design. Included coordination between the various stakeholders of the complex, namely LIRR, Amtrak, New Jersey Transit, NYCT and MTA Police Department. Project cost $40 million. The project started in February 2012 and design completed in March 2013.

- **MTA East Side Access, New York, NY**
  General Engineering Consultant Design Package Manager responsible for deliverables, schedule, and budget. Diaa managed a team of 20 multi-disciplinary staff involving over 2,000 design drawings. He was responsible for Manhattan Contract CM014 Grand Central Terminal (GCT) Concourse and Facilities Fit-Out (further divided to CM014A and CM014B): Package Manager. Contract CM014 consists of several parts, separated into distinct facilities by location and function to facilitate staging of construction activities. The elements included: the 350,000-SF ESA-GCT Concourse fit-out along with vertical transportation elements; 44th Street Ventilation Plant; 50 th Street Ventilation Facility fit-out; and North Transfer Station for Unified Trash Management. CM014A Package Design was completed in April 2011 and construction cost is estimated to be $50 million. The CM014B package design is ongoing and construction cost estimate: $240 million.

- **MTA MNR, Harmon Shop Replacement Program, Phase III, Croton Harmon, NY**
  Deputy Design Manager and Structural Task Lead for the project that comprised the design and construction of a new 126,000-SF coach shop, a new 85,000-SF locomotive shop and a new 3,000-SF locomotive wash, including all necessary track, bridge cranes, inspection and repair facilities, office areas, employee areas, employee overpass bridge extension, underground structures and parts storage areas at this MNR facility. The project encompasses multiple disciplines including industrial, civil, architectural, structural, HVAC, plumbing/fire protection, track, traction power, and electrical power, controls, communications and lighting. The superstructure of the buildings consists of steel columns, steel beams and girders, roof joists spanning 70 to 120 feet and galvanized metal decking. The lateral force resisting system consists of braced frames that are strategically located to provide the required stiffness and meets the clearances requirement in the shop area. Project cost $280 million.

Resumes

Richard Sirabian, PE

Rail Engineering & Coordination Leader

Rich has played key design and management roles in the study, planning, and final design of major mass transit projects. Rich has extensive engineering and management experience in a variety of rail projects; and he is cognizant of the technical, environmental, and community issues associated with railroad improvement projects. His responsibilities have encompassed track and special trackwork design, facilities and operations analysis, horizontal and vertical track alignment, railroad criteria and design standards, construction staging, and constructability analysis. Furthermore, he has performed alternatives analyses, quantity and cost estimates, and developed final design plans and contract documents for construction, procurement, and force account contracts, as well as leading the bid and construction phases of projects.

Representative Projects

- **NJ TRANSIT, Design and Engineering Services for the Replacement and Relocation of West Summit Interlocking on the Morris and Essex Lines, Summit, NJ**
  Project Manager responsible for overseeing all elements of design production and integration of electric traction and civil and structural engineering. The replacement and relocation of West Summit Interlocking is located in the City of Summit, Union County, NJ. The proposed project is comprised of the realignment of three tracks to facilitate the installation of the new Interlocking on the Morristown Line and the Gladstone Line. The existing interlocking will be replaced and relocated to provide a configuration that will provide for higher train speeds and more operational flexibility and efficiency. The new location will also provide easier access for Maintenance-of-Way (MW) forces, reducing the cost to maintain the physical plant. Additionally, the existing cable and conduit configuration will be removed from the south wall and relocated as necessary.

- **Amtrak, Conceptual Design Services for the Replacement of the Sawtooth Bridges, Harrison, NJ**
  Team Deputy Project Manager responsible for coordination of alternatives analysis and construction staging and scheduling. Jacobs is a member of the Portal Partners Tri-Venture Team, under contract with Amtrak to provide the Conceptual Design for Replacement and Expansion of Amtrak Bridge No. 7.80 and Amtrak Bridge 7.96, referred to as the Sawtooth Bridges, located in Kearny, NJ. The Sawtooth Bridges are at a significant location on the NEC, crossing NJ TRANSIT M&E Lines, PATH, and Conrail tracks. The project involves the development of a conceptual design to replace the existing pair of structures, each carrying two

PRIMARY QUALIFICATIONS

- *Led design interface integration for portal bridge to coordinate rail systems with civil and structural*
- *Served in leadership roles for major NJ Transit projects from concept through construction*
- *Extensive experience in preparing contract documents in a rail operating environment focused on constructability*
- *Complete understanding of the NJ Transit standards, specifications, and procedures for large projects*

EDUCATION

- *BS, Civil Engineering, Rutgers University, 1983*

CERTIFICATIONS

- *Registered Professional Engineer: NJ, PA*

WORK HISTORY

- *Jacobs Engineering Group, 1983-Present*

YEARS OF EXPERIENCE

- *With Current Firm: 32*
- *With Other Firms: 0*
- *Total Years Experience: 32*

Resumes

tracks with service speeds of 60 MPH, with a new set of structures capable of accommodating four tracks with service speeds of 90–100 MPH.

- **NJ TRANSIT, Portal Bridge Capacity Enhancement Project, NJ**
  Jacobs Project Manager and Portal Partners Tri-Venture Overall Deputy Project Manager responsible for design integration / interface between rail systems and civil / structural components and coordination of contract packaging, construction staging, and scheduling. The project extends from the NJ Turnpike in Kearny to the Frank R. Lautenberg Station at Secaucus Junction in Secaucus, and is approximately 2.5 miles in length. Jacobs is part of the Tri-Venture Team "Portal Partners" providing professional railway, structural, civil, and geotechnical services for the replacement of Portal Bridge over the Hackensack River on the NEC in Kearny and Secaucus, NJ. Final engineering design was completed and provides a two-track, fixed bridge to the north to replace the aging existing bridge and has an estimated construction value of $950 million.

- **NJ TRANSIT, Frank R. Lautenberg Rail Station at Secaucus Junction, Secaucus, NJ**
  Project Manager responsible for final design and construction support services for this major transportation project. Rich was also responsible for development and evaluation of track support alternatives, particularly comparing the investigation of track alignment alternatives including various configurations for high-speed operations, maneuvering and station access embankments and elevated structures, while addressing cost, ROW, environmental, and embankment/ground stabilization alternatives. The NEC was expanded from two to four tracks for approximately two miles between Bergen and Portal Interlockings with the two outside mainline tracks utilized for 100 mph through service and the two interior tracks designed to accommodate a new center and two new side platforms for commuter service. Due to the project's proximity to one of the most highly traversed railroad corridors in the nation, close coordination with all involved railroad agencies was required to develop design documents to expedite construction while maintaining operation. Bid package preparation, bid phase assistance, and construction support services were provided for ten construction contracts and three turnout procurement contracts.

- **NJSEA, Meadowlands Rail & Roadway Preliminary & Final Engineering, East Rutherford, NJ**
  Rail Engineering Manager responsible for overseeing all railroad aspects of project including track, signals / communications, railroad electrical, rail operations, construction staging, constructability, and VE coordination. Rich was also responsible for coordinating all Force Account and tie-in issues with NJ TRANSIT's Pascack Valley Line. The project included preliminary and final engineering and preparation of an EIS for the rail service located within the Hackensack Meadowlands Area, only eight miles from Manhattan. The service will operate over a new 2.3-mile railroad alignment connecting with NJ TRANSIT's Pascack Valley Line. Included in the project was a new rail station servicing passengers to Met Life Stadium, the Meadowlands Racetrack, the IZOD Center, and the Meadowlands Xanadu Project (on hold), a mixed-use attraction with diverse components of sport and family entertainment, retail, restaurants, hotels, and office space. The design for this $150 million rail project included new track, structures, viaducts, roadwork, sitework, signals, communications, and a new station.

- **NJ TRANSIT, Newark Drawbridge Rehabilitation, Harrison and Newark, NJ**
  Rail Engineering Manager responsible for design services for the rehabilitation of Newark Draw and five of the approach bridges. Newark Draw supports the NJ TRANSIT's Morristown Line over the Passaic River in Newark. The bridge is a through truss swing span with two flanking deck truss spans. The flanking spans are unique in having an open deck with one end of the bridge ties resting on the top chord of the trusses. The five approach bridges include a total of 17 open deck steel spans, 5 ballasted deck steel spans, and 12 concrete arch spans.

Resumes

Michael Walton, PE, DGCP

Assistant Power Leader

Mike has worked closely with NJ TRANSIT in support of the NJ TRANSITGrid Feasibility Study with Sandia and a Value Engineering study on the 30% Design of Mason Substation. He has a unique blend of more than a decade of experience working with traction power systems, commercial medium voltage power systems, control and protection systems, power systems software and technology, and microgrid implementation. He will capitalize on this experience with NJ TRANSIT and other microgrid projects to help the team deliver on NJ TRANSIT's ambitious NJ TRANSITGrid project.

Representative Projects

- **NJ TRANSIT, Micro-Grid Alternatives Analysis, NJ**
  Project Manager responsible for the validation and refinement of a microgrid concept being developed for NJ TRANSIT. The assessment analyzed the feasibility and constructability of the overall microgrid strategy, identify potential issues or limitations with the current strategy, and identify constructability issues and/or potential cost saving measures. Mike was responsible to oversee the review of the transmission, distribution and substation elements of the microgrid concept. The project is focusing specifically on 130 MW central plant capital and operating cost, prime mover configuration, operating strategies to meet highly variable traction power loads and distributed generation to support non-traction power loads at outlying passenger facilities.

- **Philadelphia Industrial Development Corporation, Philadelphia Navy Yard, Advanced Microgrid Implementation, Philadelphia, PA**
  Project Manager for a turnkey project to transform the Navy Yard's unregulated electric grid into a "state of the art" advanced smart microgrid. The new grid incorporates smart metering and substation technology, mesh network communications, distributed generation, electric storage, energy efficiency, and bi-directional building-to-grid control strategies. Now in the implementation phase, the project includes the design, procurement and deployment of advanced metering infrastructure, communication systems, utility software applications, and a Network Operations Center to manage and control the microgrid. The project also utilizes clean energy supply alternatives including natural gas engines, fuel cells, solar PV, and battery storage technologies to help enable capacity growth from today's 30 MW demand to an anticipated peak electric load of more than 60 MW by 2022. The total project cost is estimated to be $100 million, with roughly $50 million provided by third-parties using innovative asset-ownership business models.

PRIMARY QUALIFICATIONS

- *Extensive technical expertise in the evolving microgrid technology field through recent work on projects for NJ Transit, SEPTA and the Philadelphia Navy Yard*
- *Key part of the team that led the feasibility and constructability analysis for the NJ Transit microgrid*
- *Experience designing and implementing the high-profile, state-of-the-art smart microgrid at the Philadelphia Navy Yard*

EDUCATION

- *BS, Electrical Engineering, Drexel University, 2003*

CERTIFICATIONS

- *Registered Professional Engineer: PA*
- *Distributed Generation Certified Professional (DGCP)*

PROFESSIONAL ASSOCIATIONS

- *Institute of Electrical and Electronic Engineers (IEEE)*
- *Association of Energy Engineers (AEE)*

WORK HISTORY

- *Burns Engineering, Inc., 2003-Present*

YEARS OF EXPERIENCE

- *With Current Firm: 12*
- *With Other Firms: 0*
- *Total Years Experience: 12*

Resumes

- **NJ TRANSIT, Mason Substation Value Engineering, NJ**
  Electrical Engineer to provide value engineering support to NJ TRANSIT to review the 30% design of the replacement of Mason Substation at the Meadows Maintenance Complex. The substation, which provides traction power to the M&E line, was severely damaged in Superstorm Sandy and needs replaced. The new design called for a 230kV indoor GIS substation and a physically separated new traction power substation. Our team provided potential cost saving options for NJ TRANSIT to evaluate before moving the project forward. Burns was part of Jacobs' team for this project.

- **Temple University Microgrid, Philadelphia, PA**
  Project Manager responsible for the engineering, design and construction support for the modernization of the electrical infrastructure at Temple University's main campus in Philadelphia, PA. This campus-wide, three year and $15 million program extended to every corner of the 105 acre urban campus. Burns design provided Temple with a modern, efficient and resilient electrical infrastructure that included the installation of over 14 miles of underground power cable and two major substations with minimal disruption to campus operations. Temple's new modern and fully functional microgrid is a localized electric grid that can disconnect from or "island" from the traditional utility electric grid by utilizing its own 16 MW on-site distributed generation. This provides the campus with increased reliability, resilience and safety by enabling the campus to continue functioning when the main grid is down. It also provides Temple with ample capacity for future expansion and the opportunity to effectively manage peak loads, and reduce their cost of electrical power.

- **Philadelphia Industrial Development Corporation (PIDC), Navy Yard East Substation, Philadelphia, PA**
  Project Manager responsible for technical and managerial oversight of the design of a substation intended to address power capacity needs of Southport at the east end of the Navy Yard. Project scope includes: siting and layout of the substation building; configuration and layout of the electrical equipment in the building for all phases; evaluation of existing ductbanks and capacity for new feeders; new ductbank layout for connection to PECO ductbanks/ manholes at the Navy Yard property boundary; new ductbank layout for connection to existing Navy Yard manholes/ductbanks; refinement of cost estimates; and coordination with the local utility on new service needs.

- **SEPTA, Wayne Junction 8.6MW CHP, Wayne Junction, PA**
  Project Manager responsible for overseeing preliminary analysis of a 8.6MW CHP plant that will provide power to their regional rail system and heating to the adjacent train maintenance facilities. Burns worked with SEPTA to review locations, sizes, and developed lifetime cost analysis. SEPTA will be pursing the project through a guaranteed energy savings contractor for which Burns assisted in the development of the RFP documents.

- **Washington Dulles International Airport, Medium Voltage and DC Traction Power Design, Dulles, VA**
  Electrical Engineer supporting the design/fit-out of the Washington-Dulles International Airport Automated People Mover (APM) power distribution system. The network comprises dual and single tunnels, five terminals, a five-track vehicle yard, and the APM maintenance facility. Mike was involved in the development of the APM power distribution system, comprised of Medium Voltage Distribution, DC Traction Power System, and an Auxiliary Power System. Other aspects of the design included SCADA, power loads analysis, short circuit analysis, circuit protection coordination, grounding, and cathodic protection analyses. Burns was part of the Sumitomo Corporation design/build team for the project.

Resumes

Frank DiPalma

Regulatory & Stakeholder Coordination Leader

Frank is an operations oriented engagement / project manager who leads teams of consultants to resolve complex business problems in energy utilities. Frank is skilled at directing, planning and implementing approach and objectives for client's project. He is experienced in engineering and operations management, process improvement, project management, construction, business development, marketing, customer service, strategic alliances, labor relations, strategic planning, change management, organization assessments, and regulatory compliance. His duties include operations reviews, merger due diligence, safety and reliability reviews, emergency response, integrity management, and benchmarking.

Frank's diverse background and extensive experience helps him to resolve complex business problems involving energy utilities, state commissions and independent transmission operators. He has successfully completed several assignments involving PSE&G, the NJBPU, and PJM including: a gas infrastructure filing, a management audit, and an operational due diligence in connection with the contemplated Exelon-PSE&G merger.

Representative Projects

- **PSE&G Company, Gas Infrastructure Filing**
  Regulatory Lead and Stakeholder Coordinator responsible for the PSE&G gas infrastructure filing to replace approximately 4,000 miles of cast iron and bare steel, while recovering all associated costs in a timely manner. To address filing requirements, we analyze and developed: a safety case, a business case and a program execution plan with a roadmap for executing the infrastructure replacement program. The analysis resulted in direct testimony that was filed with the NJ Board of Public Utilities on February 27, 2015.

- **NYS Public Service Commission, Electric Reliability Reporting Metrics of the NYS Electric Utilities**
  Regulatory Lead and Stakeholder Coordinator responsible for verifying that the data provided by the six major New York State electric utilities to the NYSPSC is sound and accurate, and reflects the appropriate levels of reliability.

- **MD Public Service Commission and DE Public Service Commission Operational Due Diligence Consulting in Connection with the Exelon - Pepco Holdings Inc. Merger**
  Regulatory Lead and Stakeholder Coordinator responsible for analyzing and testifying as to the potential impacts on Pepco Holdings' two operating utilities in

PRIMARY QUALIFICATIONS

- *Routinely resolves complex business problems involving energy utilities, state commissions and independent transmission operators*
- *Experience with PSE&G, the NJBPU and PJM*
- *History of successfully coordinating regulatory, utility and key stakeholder issues that emerge from complex projects*
- *Recognized and well-known to both PSE&G and the NJBPU*

EDUCATION

- *MBA, Management/Finance, Fairleigh Dickinson University, 1970*
- *BS, Mechanical Engineering, New Jersey Institute of Technology, 1967*

WORK HISTORY

- *Jacobs Engineering Group, 2002–Present*
- *Stone & Webster Consultants, 2000–2002*
- *Mountaineer Gas Company, 1996–2000*
- *Public Service Electric & Gas Co., 1968–1996*

YEARS OF EXPERIENCE

- *With Current Firm: 13*
- *With Other Firms: 27*
- *Total Years Experience: 40*

Resumes

Maryland and Delaware. Jacobs' role was to assist the MDPSC and DEPSC in determining if the transaction was in the public interest by assessing how it could affect the reliability (including PJM), adequacy and safety of electric and gas service. Support activities included: analysis of pre-filed materials, participate in discovery, provide expert analysis, provide expert testimony, develop cross examination, assist in brief preparation, and support settlement discussions.

- **The NH Public Utilities Commission, Public Service NH Clean Air Project at Merrimack Station**
  Regulatory Lead and Stakeholder Coordinator responsible for supporting due diligence on completed portions of the project, monitoring of the ongoing portion of the project, quarterly reports to track the progress and summarization of project completion. PSNH was installing a wet scrubber at Merrimack Power Generating Station, originally the project was estimated to cost $250M, at the time we were assigned the cost estimate had increased to $457M. Our due diligence was summarized in testimony and presented at a NH Commission cost of service hearing.

- **Elliott Management Corp., Conduct Technical Due Diligence Power Generation Assets**
  Regulatory Lead and Stakeholder Coordinator responsible for supporting a technical, organizational, environmental, and power market assessment. In addition we provided assumptions for Elliott's cash flow spreadsheet and develop a Dispatch/Market Analysis Model for the acquisition power generation assets located in Latin America.

- **Central Alberta Rural Electric, Transmission and Growth Strategy Assignments**
  Regulatory Lead and Stakeholder Coordinator responsible for supporting the Operational Capabilities Report to support right to serve all new customers within its territory; Transmission Report to support having costs allocated directly for existing transmission lines; Load Settlement Report to determine the feasibility of taking over the existing lines; Independent Operating Agreement with Fortis; and Fortis-AB Rate Case Phase 2 Assistance for CAREA as it merged with North Parkland.

- **CT Public Utilities Regulatory Authority, Responding to the Requirements of Public Act No. 12-148, An Act Enhancing Emergency Preparedness and Response**
  Regulatory Lead and Stakeholder Coordinator responsible for supporting an interactive process with five utilities, Rate Council and Commission Staff. This supported Connecticut's need to enhance emergency preparedness and response and establish electric and gas company performance standards for emergency preparation and service restoration in the aftermath of Tropical Storm Irene and the October 2011 Snow Storm.

- **NJBPU, Management Audit of Public Service Electric and Gas Company**
  Regulatory Lead and Stakeholder Coordinator responsible for supporting the independent management audit of PSE&G mandated by The State of New Jersey's Board of Public Utilities (BPU). Serving as Jacobs' project manager, the technical and management practices of PSE&G were assessed in the areas of electric transmission and distribution, gas transmission and distribution, gas procurement and supply and contractor performance.

- **Spectra Energy, Assessment Study of Project Execution of Major Gas Pipeline Project**
  Regulatory Lead and Stakeholder Coordinator responsible for supporting a Critical Assessment Study of project execution for the New Jersey-New York Pipeline Expansion Project. Coordinated a review the risk mitigation areas, which could impede permitting and construction of the $1 billion project.

Resumes

Seth Parker

Economics and Financial Analysis Leader

Seth, a VP and Principal of Levitan & Associates, has a long history of tackling economic, financial, contract, and regulatory issues for cogeneration and microgrid projects. One of his most recent assignments was New York University's microgrid project that operated successfully during Superstorm Sandy while lower Manhattan was blacked out. He evaluated the economics of multiple technology and configuration options under various fuel and power scenarios and prepared the final pro forma and valuation documents for NYU Finance Committee and Board approval of the 13.4 MW project (two gas turbine generators plus a steam turbine extraction generator). NYU's project "kept the lights on" during Superstorm Sandy, saves NYU $5-$8 million/year, and reduces NOx, SO2, and CO emissions in NYC.

Seth has worked on many conventional and renewable power projects in the Northeastern U.S., including New Jersey's Long-Term Capacity Agreement Pilot Program. Levitan was the LCAPP Agent for the New Jersey Board of Public Utilities and tasked with the cost-effective development of 2,000 MW of new gas-fired in-state capacity. Seth's responsibilities included evaluating bidder financial strength / development expertise, drafting the long- term PPA agreement between the project developers and electric utilities consistent with PJM wholesale market rules, and implementing financial security provisions.

Representative Projects

- **Maryland Public Service Commission**
  Prepared procurement regulations and now implementing an offshore (Delmarva Peninsula) wind application, evaluation, and selection process for the Maryland Public Service Commission; managing three subcontractors for technical, permitting, and regulatory reviews and project selection, expected to be 300-400 MW, in the PJM market.

- **New York Power Authority**
  Advised NYPA on inter-market transactions, including power economics, interconnection requirements, grid upgrades, reliability impacts, permit issues, and regulatory considerations. Worked with NYPA VP of Finance to structure tax-exempt debt terms and repayment schedule for proposed inter-market cable project.

- **New Jersey Board of Public Utilities**
  Levitan was the LCAPP (Long-Term Capacity Agreement Pilot Program) Agent for the BPU to develop 2,000 MW of new in-state capacity. Seth was responsible for

PRIMARY QUALIFICATIONS

- *Commercial expert in the economic, finance, and regulatory issues of generation and microgrid projects*
- *Experience preparing financial evaluations for power and cogeneration projects*
- *Experience with over a dozen technical and commercial due diligence reviews of power and infrastructure projects*

EDUCATION

- *Course in Basic Gas Turbine Technology, International Gas Turbine Institute, 1996*
- *Courses in International Political Economy and Geopolitics of Oil, Harvard University, 1982 and 1993*
- *MBA, Finance / Operation Research, University of Pennsylvania, 1978*
- *BS, Applied Mathematics / Economics, Brown University, 1976*

PROFESSIONAL ASSOCIATIONS

- *Board of Directors, Northeast Energy and Commerce Association, 2007-2011*

WORK HISTORY

- *Levitan & Associates, Inc., 1998-Present*
- *Stone & Webster Management Consultants, 1988-1998*
- *Ocean State Power, 1984-1988*
- *ThermoElectron Energy Systems, 1981-1983*
- *Pacific Gas and Electric Co., 1978-1981*

YEARS OF EXPERIENCE

- *With Current Firm: 17*
- *With Other Firms: 20*
- *Total Years Experience: 37*

Resumes

evaluating bidder financial strength / development expertise, drafting a PPA contract that balanced the needs of developers, utilities, and ratepayers, and implemented financial security (letter of credit and escrow) provisions.

- **PJM Generator Group**
  Advised generator group on PJM's proposed Reliability Pricing Model capacity valuation mechanism, including gas turbine capital & operating costs, net revenues, financing charges, etc.; represented group's interests at FERC Technical Conference.

- **New England Clean Power Link**
  Forecasted power market, emission, and rate impacts of New England Clean Power Link, a proposed 1,000 MW u/w and u/g HVDC cable to import renewable hydroelectric and wind energy from Quebec for TDI-NE's Certificate of Public Good application; submitted testimony to the Vermont Public Service Board.

- **Entergy Transmission Divestiture**
  Evaluated proposed spin-off of Entergy transmission assets and merger with ITC Holdings for the Mississippi Public Utilities Staff including financial effects, business risk, transmission planning / operations, MISO regulation, and rate impacts; submitted written testimony.

- **Deepwater Block Island Wind Project**
  Provided an Expert Report on the Deepwater Block Island offshore wind farm contract price and electric impacts and an Advisory Opinion on regional economic impacts for the Rhode Island Economic Development Corporation; testified before the Rhode Island Public Utility Commission.

Relevant Projects with Other Firms

- **Vice President, Stone & Webster Management Consultants (US and UK)**
  Managed due diligence review, construction monitoring, and acceptance testing of cogeneration, combined cycle, fluidized bed, and industrial projects for commercial lenders, investment banks, and government, bilateral & multilateral agencies:

  - Brooklyn Navy Yard, 220 MW cogeneration plant, New York
  - Derwent Cogeneration Project, 210 MW cogeneration plant, England
  - East Java Power, 500 MW combined cycle plant, Indonesia
  - EES Coke Battery, 900,000 ton per year coke facility, Michigan
  - Guna Power Project, 347 MW naphtha / gas combined cycle plant, India
  - Hadley Falls, 43 MW hydroelectric plant, Massachusetts
  - Hub Power, 1,200 MW, $1.8 billion, World Bank-supported plant, Pakistan
  - Indiana Harbor Coke Battery, 1.3 million ton per year facility, Indiana
  - Kot Addu, 1,600 MW oil / gas combined cycle plant, Pakistan
  - Midland Cogeneration Venture, 1,370 MW $2.3 billion cogeneration plant, Michigan
  - Niagara Falls Resource Recovery, 800,000 ton per year plant, New York
  - Panther Creek, 80 MW fluidized bed power plant, Pennsylvania
  - Warrior Run, 180 MW fluidized bed power plant, Maryland

Resumes

Bruno Fiorentino, PE

Quality Control Leader

Bruno has served as the principal and technical lead on a number of MicroGrid and Distributed Generation projects employing the latest advanced technologies in electrical power generation, distribution, monitoring and control. He has over 30 years of specialized experience in engineering design and project management and has served in a management, Quality Assurance and/or lead technical role for over 50 energy/utility and transit infrastructure projects for agencies including NJ Transit, Amtrak, SEPTA, PATCO, PATH, and Metro-North. Bruno has a proven track record of project management and technical quality on projects requiring implementation of innovative and advanced technologies.

His experience also includes electrical demand management, energy monitoring and control systems, thermal storage, cogeneration, computer modeling of energy usage, life cycle cost analysis. Experience also includes design of mechanical/electrical system controls and automation systems.

Representative Projects

- **NJ TRANSIT, Microgrid Alternatives Analysis, NJ**
  Principal in Charge for the Burns team to provide engineering and financial analysis for the validation and refinement of a microgrid concept being developed for the transit agency. Focus on 130 MW central plant capital and operating cost, prime mover configuration, operating strategies to meet highly variable traction power loads and distributed generation to support non-traction power loads at outlying passenger facilities.

- **Philadelphia Navy Yard, Advanced Microgrid Implementation, Philadelphia, PA**
  Principal in Charge for the Burns team to lead a turnkey project to transform the Navy Yard's unregulated electric grid into a state-of-the-art smart microgrid. The new grid incorporates smart metering and substation technology, mesh network communications, distributed generation, electric storage, energy efficiency, and bi-directional building-to-grid control strategies. Now in the implementation phase, the project includes the design, procurement, and deployment of advanced metering infrastructure, meter data management and a Network Operations Center. The project utilizes clean energy supply alternatives including natural gas engines, fuel cells, solar PV, and battery storage technologies to help enable capacity growth from today's 30 MW demand to an anticipated peak electric load of more than 60 MW by 2022. Total project cost is estimated at $100 million, with roughly $50 million provided by third parties using innovative asset-ownership business models.

PRIMARY QUALIFICATIONS

- *Served as technical lead or principal on numerous microgrid and distributed generation projects*
- *Extensive experience working on public transit agency projects, including over 50 energy/utility and transit infrastructure projects for agencies including NJ Transit, Amtrak, PATH, PATCO, SEPTA and Metro-North*
- *Key part of the team that led the feasibility and constructability analysis for the NJ Transit microgrid*
- *Experience designing and implementing the high-profile, state-of-the-art smart microgrid at the Philadelphia Navy Yard*

EDUCATION

- *MBA, Business Administration, Villanova University, 1995*
- *BS, Mechanical Engineering, Penn State University, 1980*

CERTIFICATIONS

- *Registered Professional Engineer: NJ, DC, PA*

PROFESSIONAL ASSOCIATIONS

- *Association of Energy Engineers*

WORK HISTORY

- *Burns Engineering, Inc., 1996–Present*
- *Weston Solutions, 1985-1996*
- *Honeywell, 1982–1985*

YEARS OF EXPERIENCE

- *With Current Firm: 19*
- *With Other Firms: 14*
- *Total Years Experience: 33*

Resumes

- **Temple University MicroGrid, Philadelphia, PA**
  Principal in Charge for the Burns team to provide engineering, design and construction support for the modernization of the electrical infrastructure at Temple University's main campus in Philadelphia, PA. This campus-wide, three year and $15 million program extended to every corner of the 105 acre urban campus. Burns design provided Temple with a modern, efficient and resilient electrical infrastructure that included the installation of over 14 miles of underground power cable and two major substations with minimal disruption to campus operations. Temple's new modern and fully functional microgrid is a localized electric grid that can disconnect from or "island" from the traditional utility electric grid by utilizing its own 16 MW on-site distributed generation. This provides the campus with increased reliability, resilience and safety by enabling the campus to continue functioning when the main grid is down. It also provides Temple with ample capacity for future expansion and the opportunity to effectively manage peak loads, and reduce their cost of electrical power.

- **New York Power Authority (NYPA), Distributed Generation and Microgrid, New York, NY**
  Principal in Charge for the Burns team to complete a feasibility assessment for combined heat and power (CHP) at the Kings County Hospital Center in Brooklyn. Project included the development of a Level 1 Assessment of with the following three (3) scenarios evaluated for possible CHP implementation: 1) CHP sized for avoidance of local utility standby demand charges, 2) providing maximum facility thermal efficiency and 3) maximum electrical resiliency in the event of a utility outage. An evaluation of project costs, annual savings/simple payback, and CHP efficiency was conducted. A recommendations report was prepared and presented to the NYPA addressing the pros and cons of each scenario.

- **Southeastern Pennsylvania Transportation Authority (SEPTA), Distributed Generation, Philadelphia, PA**
  Principal in Charge for the Burns team to assist SEPTA in analyzing the technical and economic feasibility for the installation of a Distributed Generation system to supplement the electrical power needs of its Regional Rail system. Options included an 8.6MW CHP plant to provide power to their regional rail system and waste heat used to supply heating to the adjacent train maintenance facilities. Burns worked with SEPTA to review locations, sizes, and developed lifetime cost analysis. Project also included working with the City's Air Management authorities and the local gas and electric utilities for interconnection requirements.

- **Philadelphia Gas Works, Natural Gas Microturbine Project, PGW Headquarters, Philadelphia, PA**
  Principal in Charge for the Burns team to lead the engineering effort for the design of an energy-efficient 200 kW microturbine system for Philadelphia Gas Works (PGW), the largest municipally-owned gas utility in the country. A microturbine powered by natural gas as well as a 40-ton absorption chiller was installed at PGW's corporate headquarters. The microturbine is a new, energy-efficient technology that uses a small gas turbine to generate both electricity and hot water. In addition to providing PGW with energy savings, the microturbine system will help educate customers on the financial and environmental benefits of using a Combined Heat and Power (CHP) system. The system supplies around 40 percent of the building's peak electrical needs, along with 20 percent of the peak hot water needs.

- **SEPTA, General Engineering Contract, Philadelphia, PA**
  Task Manager / Project Manager for four SEPTA General Engineering Contracts over the last 15 years (1995, 1999, 2005 and 2010). He has been responsible for the supervision and execution of all design and planning on over 50 important task orders. He has managed simultaneous tasks to successful completion.

Michael Pytlik

Project Controls Leader

Michael was chosen for this role on this project due to his extensive experience in Project Controls with rail, power, and manufacturing projects. Michael's core competencies include preparation and maintenance of master and progress schedules, look-ahead schedules, commissioning phase schedules, and daily progress measurement reporting. His abilities in leading Interactive Planning Sessions, delay analysis, and project risk control led to several hundred thousand dollars in change management-related savings.

Representative Projects

- **Colgate-Palmolive Project, Hodges, SC**
  Project Controls Manager as Agent of the client on a $268M+ takeover project. Managed a staff of project controls professionals and supported their daily tasks. Duties included the daily interaction with clients and consultants as well as contractors. Attended regular meetings and provide detailed cost and schedule reports on a weekly basis. Managed design changes and schedule slippages impact. Developed ETC cost estimate. Developed and maintained standards to exhibit schedule and plan hierarchy and inform client and company management. Recommended and customized project control systems to satisfy project requirements. Identified significant irregularities, trends and variances and suggest corrective action. Gathered inputs from project team and update management reports on a weekly and monthly basis. Supported project execution and project controls efforts by the home office project controls staff. Coordinate with cross functional team.

- **Amtrak, Nationwide Program Management for Accessible Stations Development Program (ASDP), Nationwide, USA**
  Project Controls Manager responsible for the Weekly Master Design Schedule for the Amtrak ASDP Program using Primavera P6 scheduling software. Services included the preparation the weekly input sheets, coordination with the geotech, survey, and design teams; the development, management, and updating of the schedule; the review and verification of the schedule information, and the generation of reports for Amtrak, internal schedule and earned value reports. Assisted in the development of the ASDP Contractor's Database using P6 Version 8. Assisted in the preparation, updating, and review of ASDP Contractor's Progress Schedules. Facilitated Interactive Planning Sessions. Provide progress schedule reviews and schedule development using Primavera P6 software on a Web-based Enterprise Network for the Amtrak ARRA Construction Program.

PRIMARY QUALIFICATIONS

- *Impressive record on high value construction projects as a scheduler and project controls manager*
- *13+ years of professional project controls related experience*
- *Ability to lead a staff under aggressive deadlines*

EDUCATION

- *BS, Construction Management, University of Nebraska, 2001*

PROFESSIONAL ASSOCIATIONS

- *Philadelphia Surety Claims Association, Former Officer on the Board of Directors and also a Founding Member*
- *Associate Constructor (AC# 4178), American Institute of Constructors, November 2001*
- *Instructor Certificate of Training, National Highway Institute, July 2007*
- *Construction Awards of Excellence Judge, Associated Builders and Contractors, Inc – Southeast Pennsylvania Chapter, 2007 to 2011*
- *New Jersey Society of Asphalt Technologists, Member*
- *Project Management Institute, Member*
- *Delaware Valley Chapter Project Management Institute, Member*

WORK HISTORY

- *Jacobs Engineering Group, 2012-Present*
- *Trauner Consulting Services, Inc., 2005-2011*
- *CME Associates, 2002-2005*

YEARS OF EXPERIENCE

- *With Current Firm: 3*
- *With Other Firms: 11*
- *Total Years Experience: 14*

Resumes

- **City of Philadelphia, National Recreational Trail System, East Coast Greenway Projects Boardwalk, Philadelphia, PA**
  Project Controls Manager responsible for scheduling on the CM/CI TIGER funded high profile project in the heart of Center City Philadelphia. The boardwalk is expected to be completed 2014.

- **Delaware River Port Authority-PATCO, Program Management Services for Capital Improvement Program –Development of PMP for the DRPA-PATCO Transit Car Overhaul Project, Camden, NJ**
  Project Controls Manager responsible for providing scheduling and delay review services for DRPA-PATCO's undertaking of a $200 million transit car overhaul program for their entire fleet of cars serving the PATCO line. As a partially FTA-funded program, and due to the size of the project, FTA requires that the DRPA have a Project Management Plan (PMP) on file for the program. Jacobs coordinated with the design engineering consultant, program oversight consultant and DRPA-PATCO staff and prepared a PMP to meet the needs of the program and FTA requirements.

- **DSM Nutritional Products, Inc., Belvidere, NJ**
  Project Controls Manager responsible for supporting the safe construction of a 9.5 megawatt Direct Combustion Turbine Generator, Steam Turbine Generator, and Heat Recovery Steam Generator. Services included the preparation and maintenance of master and progress schedules, look-ahead schedules, commissioning phase schedules, and daily progress measurements; managed and reported on procurement, engineering, and subcontractor costs using Jacobs Project Control System. Managed and updated the Total Installed Cost (TIC) Reports, including contingency and client costs for review by the Home Office and Client. Reviewed and submitted subcontractor invoices, prepared and maintained engineering and field change order logs, prepared field change orders, and prepared subcontractor status reports.

Relevant Projects with Other Firms

- **Trauner Consulting Services, Inc., Philadelphia, PA**
  Consultant and Director responsible for managing project schedules for large $100-million dollar+ construction projects using Primavera P3, Primavera P6, and Microsoft Project scheduling software. Services included the preparation of pre-bid schedules, the development, management, and updates of the construction schedules; and the reviews of subcontractor schedules. Managed overall budget and costs for clients using Earned Value in Primavera P6. Used project schedules and contract documents to analyze delay, acceleration, and inefficiency claims; and presented the results to Stakeholders, Owners, and Project Engineers. Used project schedules to perform critical path analysis, construction delay analysis and claims avoidance.

- **CME Associates, Howell, NJ**
  Construction Engineer responsible for the Project Management and Contract Management of State-aided capital improvement contracts, including the preparation of contract documents and specifications. Revised approved cost estimates of construction costs showing actual costs for activities in progress and estimates for uncompleted tasks. Tracked contractor and developer progress using performance bond estimates, payment applications, and CPM Schedules; and reported the progress to City and Township officials. Supervised field personnel related to construction observation services for capital improvement and large private development projects.

Resumes

F. William Lipfert, Jr.

Rail Power Analysis / Operations Modeling

Bill was chosen for the role on this project due to his extensive experience in simulating NJ TRANSIT commuter rail and light rail operations, including work on the NEC, NJCL, ACRL, M&E, RVL and HBLRT.

Bill has devoted his entire professional career to operations planning, capacity analysis and related software development in the rail industry. After spending the first part of his career at the Long Island Rail Road's Computer Systems Department working on network simulation models, he has served as an industry consultant on a variety of projects, ranging from conceptual feasibility studies to detailed design efforts and construction contracts. Bill participates in both the technical and managerial aspects of projects.

Bill was formerly responsible for creating and managing the development of the RAILSIM® Simulation Software Suite, including its Train Performance Calculator, Network Simulator and Electrical Load Flow Analyzer applications. He now manages the development of the LTK TrainOps® Simulation Software. He has performed simulation software training across the U.S. and internationally.

Representative Projects

- **Massachusetts Department of Transportation, Northern New England Intercity Rail Initiative**
  Operations Planning Task Manager responsible for managing the development of intercity rail operations & maintenance costing models and for condition assessment/capital needs determination of the lines' communications and signals equipment. In cooperation with Connecticut and Vermont, this project is investigating improved intercity passenger rail service between Boston-Montreal and Boston-New Haven-New York via the "Inland Route".

- **Massachusetts Department of Transportation, Green Line Positive Train Control Project**
  Operations Planning Task Manager responsible for benchmarking existing operations and evaluating future operations under various PTC and CBTC architectures. Managed the computer simulation modeling of the entire Green Line system, including a "Day in the Life of the Green Line" data collection effort to quantify trip times, throughput and service regularity.

- **Massachusetts Department of Transportation, Green Line Operations Capacity Study**
  Project Manager responsible for a study of a comprehensive network simulation model of the entire Green Line Central Subway, street running and Highland Branch

PRIMARY QUALIFICATIONS

- *More than 30 years of experience modeling NJT rail operations and traction power networks*
- *Extensive experience with optimizing energy recovery through regenerative braking and enhanced traction power network receptivity*
- *Managed multiple major energy studies in which NJT participated*
- *Knowledgeable in future rolling stock procurement strategies that will minimize energy consumption and maximize energy recovery*

EDUCATION

- *BA, Engineering Science, Dartmouth College, 1982*
- *Graduate Courses in Transportation, Thayer School of Engineering, 1981-1982*

CERTIFICATIONS

- *Certified Professional Public Buyer (CPPB)*

WORK HISTORY

- *LTK Engineering Services, 2009-Present*
- *Systra Consulting, 2001-2009*
- *LS Transit Systems, 1986-2001*
- *Long Island Rail Road, 1984-1986*
- *Gibbs & Hill, Inc. (On-Site at LIRR), 1982-1984*

YEARS OF EXPERIENCE

- *With Current Firm: 6*
- *With Other Firms: 27*
- *Total Years Experience: 33*

Resumes

operations. The study evaluated the capacity benefits of alternative terminal pairings, turnback operations, operation of three-car trains and "dynamic" (computer-assigned) double-berthing stations stops within the Central Subway.

- **Massachusetts Department of Transportation, Blue Line Resignaling Project**
  Task Manager working with MBTA Signals to identify changes required to support six-car train operation. The work included signal design safe braking analysis and optimization of Grade Time (GT) settings, as well as network simulation to confirm the operational feasibility of all changes.

- **Massachusetts Department of Transportation, Green Line Automatic Vehicle Identification System**
  Project Manager responsible for system installation, OCC software development, documentation, training and warranty support. Developed customized training programs for MBTA Subway Operations (both OCC and field), Signals and Light Rail Vehicle Engineering.

- **Illinois Department of Transportation, Chicago-St. Louis Tier 2 Environmental Impact Statement, Granite City, IL – St. Louis MO**
  Task Leader supporting the EIS effort in this corridor analysis between Illinois and Missouri with rail operations simulation, along with support for air quality, noise, vibration and grade crossing gate down time analysis of multiple alternatives. These alternatives focus on the important Mississippi River crossings, including those that upgrade the 1917 MacArthur Bridge, upgrade the 1889 Merchants Bridge or construct a new bridge.

- **Washington Metropolitan Area Transit Authority, Rail Operations Construction Work Windows "Playbook"**
  Task Manager for the development of an operations "playbook" that optimizes the time and geographic range of track outages to support construction and maintenance activities. The "Playbook" scenarios, based on TrainOps® network simulation results, are designed to maximize operational reliability and minimize inconvenience to WMATA's passengers during construction and maintenance activities while maximizing construction efficiency. Developing a Rail Controller Playbook for appropriate response to unplanned outages on the Red Line to provide the optimal balance of passenger safety (minimizing passenger crowding on the platform), minimizing overall Red Line customer travel time and maximizing system on-time performance.

- **Washington Metropolitan Area Transit Authority, Core Capacity Study**
  Operations Simulation Lead for the capacity analysis of the existing system, as well as the travel time modeler for three proposed new lines in Washington.

- **Federal Railroad Administration, Tier 1 Programmatic EIS for Northeast Corridor**
  Operations Planner for the "NEC Future" Environmental Impact Statement, spanning the Washington-New York-Boston NEC, as well as branches to Richmond, Harrisburg, Albany and Springfield. Developed a simplified capacity analysis methodology that determines future volume/capacity ratios for specific NEC segments based on maximum speed, stopping patterns, traffic mixes and dispatching considerations.

- **Caltrain/Samtrans Peninsula Corridor Joint Powers Board, Caltrain/California High Speed Rail (HSR) Blended Operations Analysis**
  Task Leader for detailed computer simulation analysis of potential future operating scenarios where California HSR utilizes existing Caltrain trackage between San Jose and San Francisco. Work included development of multiple future scenarios, varying proposed infrastructure, HSR service levels and maximum operating speeds, as well as coordination with Caltrain Planning, Operations and Engineering to optimize each solution with respect to community impacts, operability and capital cost.

Daren Petroski, PE

Senior Traction Power Leader

Daren is a Vice President of Burns Engineering and leads the firm's railroad and transit design and construction services practice. He has over 25 years' experience in the design, estimating and construction management of railroad and transit systems and facilities including overhead contact systems (OCS), traction power substations and signals and communication systems. Having worked as a contractor for the first eight years of his career, Daren's field experience gives him a critical insight into the form, fit and function required for the projects he is involved with.

Representative Projects

- **Amtrak, Zoo to Paoli Transmission Line Design, Philadelphia to Paoli, PA**
  Project Manager for the design of transmission lines between the existing Zoo and Paoli substations. Specific design tasks include replacement of all catenary structures with new structures that will support both the catenary and transmission systems, design of the new 138kV to 12kV traction power substation, design of a redundant 100Hz signal power distribution system and relocation of ancillary facilities including a 34kV PECO distribution line, independent fiber optic network and cellular phone antenna for the 20-mile alignment.

- **NJ TRANSIT, Power Generation System to Increase System Resiliency and Reliability**
  Traction Power Specialist to support work with Sandia National Labs as a subconsultant to Jacobs. Burns undertook a comprehensive assessment of the economic, technical and operational feasibility of "TransitGrid." Daren led the conceptual engineering and feasibility analysis of both the physical plant requirements for the railroad transmission and distribution facilities as well as the railroad substations. A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations and innovative operating strategies.

- **NJ TRANSIT, THE Tunnel Project, Secaucus, NJ to New York, NY**
  Lead Traction Power Engineer for the preliminary design required for electric traction facilities that would support NJ TRANSIT's two-track addition to the existing Northeast Corridor into New York City from Secaucus, NJ. Work included power system analysis, load flow calculations and substation and Electric Traction facility designs.

PRIMARY QUALIFICATIONS

- *Led railroad power transmission and distribution components of preliminary assessment for NJ Transit TransitGrid project*
- *Leads Burns Engineering's Rail and Transit Systems practice with technical focus on traction power substations and railroad power distribution*
- *Extensive experience on rail and transit electrification projects throughout the Northeast Corridor*

EDUCATION

- *BS, Electrical Engineering, Drexel University, 1990*

CERTIFICATIONS

- *Registered Professional Engineer: NJ, CO, MD, PA*

WORK HISTORY

- *Burns Engineering, Inc., 2008-Present*
- *Systra Consulting, 1996-2008*
- *Vanalt, 1988-1996*

YEARS OF EXPERIENCE

- *With Current Firm: 7*
- *With Other Firms: 20*
- *Total Years Experience: 27*

Resumes

- **Amtrak, Relocation of Catenary Sectionalizing Switches at PS18 in Pennsylvania Station, New York, NY**
  Principal-in-Charge for the development of conceptual level options for the relocation of 38 Amtrak sectionalizing / disconnect switches from catenary structure PS-18. To relocate the switches, expanding the Seventh Avenue substation and relocating the traction power circuit breaker was necessary. Provided technical consultation with Amtrak to develop design criteria and equipment location options.

- **Amtrak, IQTO Task Order Contract, Philadelphia, PA**
  Project Manager and Lead Instructor for the electric line department training. Work included development of training material including safety and maintenance, instructing field personnel, and developing and monitoring assessments.

- **NJ TRANSIT, Hudson Interlocking Pocket Track, Newark, NJ**
  Lead Electric Traction Engineer responsible for the engineering and design of modifications to Amtrak's Hudson interlocking. The work included catenary structure replacement, catenary design, sectionalizing and controls, switch heater unit substations, and interlocking lighting.

- **PANY&NJ, PATH Washington Street Powerhouse Substation Relocation, Jersey City, NJ**
  Project Manager for the assessment of potential locations for the relocation of the existing Washington Street traction power substation which is currently in a developing urban area. This study was the first step in the process of relocating the substation to allow for redevelopment of the existing Powerhouse building site. Work included evaluating three candidate locations and scoping out mechanical, electrical plumbing and fire protection work required. Elements included 26.4kV utility service and customer 26.4kV distribution (replacing outdoor substation with exposed bus and oil circuit breakers with indoor 38kV class switchgear), 13.8kV and 480/277V distribution systems. In addition, a standby generator, 650VDC traction power rectifiers and 25Hz signal power systems were included.

- **PANYNJ, PATH Downtown Service Restoration Program, New York, NY and Jersey City, NJ**
  Lead Electrical Engineer responsible for the traction power and facilities electrical design, including medium voltage 15 kV and 27 kV distribution systems, low voltage tunnel lighting, wayside equipment control, and indication cabling for Exchange Place Station and Tunnels E & F.

- **Amtrak Floodgates Reactivation, North River Tunnels, New York, NY**
  Project Manager/Lead Electric Traction Engineer responsible for the engineering and design of moveable conductor bridges for the automatic opening and closing of the catenary for the North River Tunnels in Penn Station, New York for the reactivation of the existing floodgates. The work included four catenary moveable sections with integration of controls and indications between the signal system, floodgate controllers and power control systems.

Resumes

Robert Rosa, PE

SCADA Coordination

Robert was chosen for the role of SCADA Coordination due to his extensive experience in industrial control systems. Robert has 26 years experience in the industrial automation field specializing in design and implementation of Supervisory Control and Data Acquisition (SCADA) and industrial control systems. He currently works as a project manager and designer.

Representative Projects

- **Campus Power SCADA Upgrade, Secure Government Facility, VA**
  Project Manager leading the team responsible for staged upgrade of a PLC based system controlling critical power to a large campus. PLC control includes automatic operation of the main/tie/main breakers. Also include interface to a Load Management Control System to allow load shedding during peak electrical usage or under generator power after a utility power failure.

- **Amtrak, NEC Frequency Converter Controls Upgrade, Several NEC Locations**
  Project Manager leading the team responsible for design of new PLC controls for the NEC Frequency Converters. Amtrak trains utilize 25 hertz power on the NEC Line. The frequency Converters step down street power for 60 hertz to 25 hertz. Responsibilities included design of new PLC controls for three frequency converters, design of retrofit of existing hardware, programming, integration and start-up of new controls. Design also included interface to existing railroad control system.

- **PANY&NJ, New York City, Replacement of SCADA Programmable Logic Controllers (PLC) Hardware and Interface for Eleven Port Authority Trans-Hudson Corporation (PATH) Stations, NY**
  Lead SCADA Engineer designing the replacement of a legacy PLC control system. This design also includes the network and software interface to the Hoban Control Center. The PATH operates several commuter train lines that connect New York and New Jersey. PATH stations, yards and electrical substations along the train lines have ventilation and traction power equipment. These critical systems are monitored and controlled by the power director remotely from Hoban Center in Jersey City, NJ through a SCADA system.

- **PANY&NJ PATH Christopher Street Substation Modernization, NY**
  Lead SCADA Engineer responsible for the successful design of the new, state-of-the-art, programmable logic controllers-based monitoring and control system for the Christopher Street Substation. This design included the network and software interface to the Hoban Control Center. Project electrical and traction power system

PRIMARY QUALIFICATIONS

- *Licensed control systems engineer with industrial control system experience*
- *Extensive knowledge in the control and automation of both AC and DC traction power plants*
- *Relationship with the project's stakeholder, Amtrak*
- *Extensive integration and commissioning experience in diverse SCADA systems*

EDUCATION

- *BT, Electrical Engineering, Rochester Institute of Technology, 1989*

CERTIFICATIONS

- *Registered Professional Engineer: NJ, VA, CA*

PROFESSIONAL ASSOCIATIONS

- *International Society of Automation (ISA) – NJ Section Board Vice President and two-term past President*

WORK HISTORY

- *Jacobs Engineering Group, 2005-Present*
- *Engineered Energy Systems, 1989-2005*

YEARS OF EXPERIENCE

- *With Current Firm: 10*
- *With Other Firms: 16*
- *Total Years Experience: 26*

Resumes

elements include installation of new cable vaults and duct banks, traction power cables, replacement of medium voltage switchgear, four existing 1.5 MW transformer / rectifiers with three MW transformer / rectifier lineups, replacement of existing 650 V DC switchgear, new lighting systems, replacement of uninterruptible power supply, design of an super capacitor energy storage system, new fire alarms and SCADA equipment.

- **Washington Department of Transportation, I-90 Tunnels and Management Operation Center, Seattle, WA**
  Lead SCADA Engineer responsible for designing the new tunnel SCADA for the I-90 project. This design includes a PLC based ventilation control system, interface to the tunnel variable message signs, a PLC based control for the tunnel power and lighting systems and an interface to the fire detection and suppression systems. As part of this system, a control scheme was developed to reduce energy usage by staging ventilation fans based on real time air quality readings.

- **MTA Bridges and Tunnels, Brooklyn-Battery Tunnel Switchgear Replacement, BB-45, New York, NY**
  Project Manager responsible for construction support services for the $2.6 million design of replacement low-voltage switchgear for entire tunnel. Electrical system is divided among three buildings, each with multiple sets of double-ended 2000A or 4000A switchgear sets with automatic transfer capabilities. In addition, design includes all replacement conduit and wiring to loads fed from switchgear including 4160V feeders to remove ventilation building. Also responsible for UPS design to handle uninterruptible power source to all tunnel lighting and critical loads. Responsible for all short-circuit analysis, load studies, and other electrical system reliability analysis for electrical equipment to form basis of design.

- **MTA Metro-North Railroad, Control of the Harlem River Lift Bridge, New York, NY**
  Project Manager managing the PLC control of the Harlem River Lift Bridge, a railroad bridge connecting Manhattan and the Bronx. His responsibilities included design of a new PLC control, sequences for normal and emergency operation, HMI screen design, design of a high-speed fiber optic backbone for the control system, and construction support services. The design included interface to existing signal control system. The Jacobs team successfully completed this project due to our proven experience in connecting controls of various subsystems to one overall SCADA system.

Relevant Projects with Other Firms

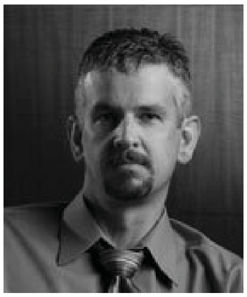
- **International Crossroads Cogeneration Plant, Mahwah, NJ**
  SCADA Engineer for the design and implementation of an automation system for a cogeneration plant at a campus facility in Mahwah, NJ. The system used waste heat created by two large turbine generators. This heat was used by a series of chillers to provide cooling for the campus. Any residual power generated by the facility was sold back to the utility.

- **New York Life Insurance Company, Chilled Water Plant Automation, Clinton, NJ**
  Lead Control Systems Engineer designing and implementing a programmable chiller optimization system. This PLC based control system controlled four refrigeration machines used to cool a data center. The design included the use of plate and frame heat exchangers to allow for free cooling in the winter months. In free cooling mode, the cooling tower was used to make chilled water allowing for the refrigeration machines to be shut down allowing for significant energy savings. The control system would calculate the coldest available condenser water and would automatically switch between mechanical and free cooling. This automation allowed for maximum energy savings.

Resumes

C. Kent McAnally, PE

Lead Power Process Engineer



Kent will serve as the Mechanical System Modeler on this project. He was chosen for this role based on his experience leading right-sizing analysis and system modeling, as well as expertise in combined cycle evaluations.

Kent is a senior mechanical engineer in the Jacobs Energy & Power Group. To that role, he brings extensive experience in the design and analysis of power generating facilities, as well as other heavy industrial facilities and mechanical energy systems. His technical skills encompass all facets of engineering including feasibility analysis, utility infrastructure master planning, budgeting, conceptual design, process design, detailed design, drawing development, engineering calculations, equipment sizing, specification development, procurement, project tracking, field engineering, construction administration, commissioning support, and project close-out. Kent emphasizes technical accuracy and quality of design while meeting the client's scheduling and budgetary objectives.

Representative Projects

- **Thermal Energy Corporation at Texas Medical Center, Owner's Engineer - Microgrid Utility Upgrades, Houston, TX**
  Senior Mechanical Engineer supporting the new Combined Heat & Power (CHP) and chiller plant facilities including gas turbine, heat recovery steam generator, and steam turbine-generator equipment at TECO's existing thermal energy plant. Jacobs served as Owner's Engineer on the project. Additional scope items include electrical infrastructure and substation upgrade, thermal storage, and 85,000 ton chilled water plant addition. **Like TransitGrid, this large capital program was needed to provide resilient utility services to the Texas Medical Center for hurricane hardening.** Project value $340M.

- **Texas A&M University, Campus Microgrid Renovation, College Station, TX**
  Lead Mechanical Engineer providing inter-discipline coordination for all phases of this 45 MW combined heat & power addition to the existing central utility plant. The addition included a new 34 MW gas turbine generator, 210,000 lb/hr heat recovery steam generator, and 11 MW backpressure steam turbine generator. Work included planning, equipment optimization and selection, equipment pre-purchase, as-builting of existing facilities, preliminary design, detailed design, construction administration, startup / commissioning support, and as-builting of newly-constructed facilities. Project value $71M.

PRIMARY QUALIFICATIONS

- *Expertise in combined cycle evaluation*
- *Experience leading right sizing analyses and system modeling*

EDUCATION

- *BS, Mechanical Engineering, Texas Tech University, 1991*

CERTIFICATIONS

- *Registered Professional Engineer: TX, MN*
- *NCEES, File #20181*

WORK HISTORY

- *Jacobs Engineering Group, 2004-Present*
- *Lauren Engineers and Constructors, Inc., 2001-2004*
- *Gauss Integrated Engineering, 1999-2001*
- *Tippett & Gee Engineers-Architects, 1994-1999*
- *Marathon Pipe Line Company, 1991-1994*

YEARS OF EXPERIENCE

- *With Current Firm: 11*
- *With Other Firms: 13*
- *Total Years Experience: 24*

Resumes

- **University of Minnesota, Microgrid Design, Minneapolis, MN**
  Senior Mechanical Engineer responsible for planning and design of new combined heat and power generation as a component in the microgrid. This new 20.6MW system was right sized for the application to provide highly reliable thermal and electrical supply to this intensive research based institution. Through our rigorous right sized engineering, this project is projected to save over $40M in life cycle costs over baseline. Project value ~$105M (included extensive remediation and renovation of a historical building).

- **North Carolina State University, Microgrid Cogeneration Plant, Raleigh, NC**
  Senior Mechanical Engineer supporting the development the plant sequence of operations, assisted with mechanical and instrumentation & control design, and conducted an internal quality control on this 11MW combined heat and power addition project. Project was awarded the 2014 Honors Award for Engineering Excellence, North Carolina CEC. Total Project Value ~$70M.

- **Texas Women's University, Steam Tunnel and Distribution Study, Denton, TX**
  Project Manager responsible for overseeing the detailed engineering evaluation and condition assessment of existing steam tunnel and distribution system, approximately 8,000 linear-feet of tunnel serving 1.8MM square-feet of conditioned space. Recommended upgrades to mechanical, structural, electrical and ventilation systems. Conducted asbestos testing and NDE analysis of existing systems.

- **University of Oklahoma, Utility Plant 4, Norman, OK**
  Senior Mechanical Engineer responsible for pre-purchased equipment bid evaluation and overall quality control for the mechanical design of a new 15MW combined heat and power facility. Equipment includes two 7.5MW gas turbine-generators, two 60,000 lb/hr duct fired heat recovery steam generators, and one gas-fired packaged boiler. Total size of the project was15 MW power generation and 120,000 lb/hr steam generation.

- **Rice University, Central Plant Boiler and Chiller Addition Project Development Study, Houston, TX**
  Senior Mechanical Engineer responsible for supporting a project development study to evaluate various equipment and layout options for adding 2,000 tons of chiller capacity and 40,000 lb/hr of boiler steam capacity to existing central plant. The study addressed recommended equipment types, layout, auxiliary equipment requirements, estimated construction and life cycle operating costs, architectural impacts, environmental permitting ramifications, and phasing.

Resumes

Darrell Widner, PE

Lead Electrical Engineer

Darrell was chosen for the transportation and interconnection team due to his expertise in power system design and nationwide interconnection experience.

Darrell is a senior electrical engineer with 18 years of experience on major facility projects for energy, utility, industrial, healthcare, and higher education projects. His prior experience includes campus substation and distribution system projects as well as many years working for Centerpoint Energy. His experience in working in the campus setting with the myriad of project stakeholders provides the senior leadership and guidance that will make this NJ TRANSIT project a success. It is vitally important that the microgrid engineer for a project that will disturb such a vast amount of the impact operations have the experience to work hand in hand with the numerous parties to garner consensus and coordinate interaction.

Representative Projects

- **University of Texas at Austin, Pickle Research Campus Electrical System Upgrades, Austin, TX**
  Senior Electrical Engineer responsible for designing and coordinating substation upgrades due to increased load requirements and age of the existing substation. Darrell managed a multi-discipline team and conducted senior engineering oversight and input for system modeling, analysis, detailed design, and specification of switchgear, relaying, controls, monitoring and medium voltage distribution for the 100 MVA 138 kV:12.47 kV substation serving the campus.

- **University of Minnesota, Combined Heat and Power Plant and Electrical Interconnection, Minneapolis, MN**
  Senior Electrical Engineer for QA/QC responsible for quality reviewing the planning, design, analysis and equipment optimization, equipment prepurchase, as-built of existing facilities, construction administration, and commissioning support services for decommissioning and combined heat and power addition to the University of Minnesota. Darrell served as the quality control professional for the electrical systems design including medium and low voltage substation and distribution, controls and protection systems, grounding, and other electrical systems within the plant.

- **North Carolina State University, Sullivan Substation, Raleigh, NC**
  Senior Electrical Engineer for QA/QC for this multiphase project that replaces the main interconnection substation for NC State in preparation for the Cates CHP Upgrade. Project includes the addition of two (2)-30/40/50 MVA power transformers, 115kV bus-work, breakers, and medium voltage switchgear.

PRIMARY QUALIFICATIONS

- *Expertise in power system design*
- *Nationwide interconnection design experience*

EDUCATION

- *BS, Electrical Engineering, Texas A&M University, 1997*

CERTIFICATIONS

- *Registered Professional Engineer: TX*

WORK HISTORY

- *Jacobs Engineering Group, 2011-Present*
- *PageSoutherlandPage, 2006-2011*
- *Stanley Consultants, 2000-2006*
- *Reliant Energy HL&P, 1997-2000*

YEARS OF EXPERIENCE

- *With Current Firm: 4*
- *With Other Firms: 14*
- *Total Years Experience: 18*

Resumes

Schweitzer relaying additions for the generator interconnection were also included. The substation was built into a hillside that required close coordination with existing and new site civil aspects while maintaining proper easements, electrical clearances, and electrical service to the campus.

- **North Carolina State University, Centennial Biomedical Campus Substation Electrical Upgrade, Raleigh, NC**
  Project Manager responsible for overseeing campus upgrades include replacing many of the campus' pad mounted switching stations with automated switches with SEL hardware configured for self-healing capabilities. This provides minimal downtime for a given outage event by identifying and isolating a faulted circuit, and restoring the rest of the system.

- **Orange County, Central Utility Facility Strategic Renovation Plan and Plant Upgrade, Santa Ana, CA**
  Senior Electrical Engineer supporting the full study and design phase services to create and implement a Central Utility Facility Strategic Development Plan to improve the efficiency, safety and reliability of the Civic Center Campus electrical and thermal production and distribution systems. Darrell served as the senior electrical engineer directing the electrical design components for the new plant infrastructure and developing the overall phased demolition and replacement of electrical components in order to maintain full operability of the plant during construction.

Relevant Projects with Other Firms

- **University of Texas at Austin, Harris Substation Upgrade and Weaver Power Plant Switchgear Replacement, Austin, TX**
  Lead Electrical Engineer responsible for designing, specifying, and generating drawings for the replacement and upgrade of six 12kV, 1000 MVA, 3000-Amp switchgear lineups and one 5 kV, 250 MVA, 3000-Amp switchgear lineup. Services included design, specification, and generation of drawings for the installation of four 30/40/50 MVA, 138/69 kV: 12 kV transformers, a new 8 breaker ring bus gas insulated substation arrangement, and all infrastructure involved. Provided detailed construction phasing sequence to maintain the campus' high level of reliability. Owner's on-site representative and project liaison during construction.

- **University of Texas at San Antonio, Electrical System Upgrade, San Antonio, TX**
  Electrical Engineer responsible for project coordination and medium voltage substation design for an electrical distribution upgrade at the University of Texas at San Antonio. Provided overall coordination of project with outside subcontractors, surveyors, and client interface in addition to internal project management. Design included 2,800 linear feet of duct bank, 12 manholes, two new 30/40/50 MVA transformers, and $1 million in new medium voltage switchgear. Provided interface with the local utility for the interconnection agreement.

- **University of Illinois, Cogeneration Facility Expansion, Chicago, IL**
  Electrical Engineer responsible for supporting the detailed design drawings and specifications for a 45 MW cogeneration facility that included 3 reciprocating engines with heat recovery and three steam turbines. Provided calculations and coordination for all motor control centers, medium voltage (5kV and 15kV) switchgear, unit substations, bus ducts, duct banks, cable and conduits. During commissioning, developed relay coordination curves, and provided settings for all protective relays.

- **University of Texas at Austin, Black Start Generation Study, Austin, TX**
  Electrical Engineer responsible for field data collection and analysis necessary to determine the most effective way of provide black start capability to the electrical system at the University of Texas at Austin. Provided overall coordination of project as well as technical guidance for system evaluation.

Resumes

Kalaivanan Uthirapathy, B.Eng, C.Eng, MIET

Substation Engineer

Kalai was chosen for the role of lead substation design engineer based on his extensive substation design experience. Kalai has a diverse background with all types and configurations of high voltage substations include air and gas insulated. He is a recognized expert in high voltage applications and has recent experience in developing EPC documents for substation construction. Additionally, as a seasoned protection and control engineer, Kalai will be responsible for integrating the overall protection and control concepts in the design of the 230kV substation, the connection to Mason, PSE&G, the 138kV frequency converters and connection to Amtrak Kearny No. 41 and 42, and the line interaction to the HBLR systems.

Representative Projects

- **Confidential Data Client, Substation Development, Various Locations, Worldwide**
  Substation Design Engineer supporting a confidential client in Master Planning and design EHV /MV / HV Utility and Distribution Substations for their large capacity facilities at multiple locations across North America and Europe.

- **UK National Grid, Supergrid Transformer and Shunt Reactor Emergency Replacement, Various UK Locations**
  Principal Electrical Engineer responsible for overseeing the 400/132/13 KV, 240 MVA supergrid transformer and 13 kV 60 MVAR shunt reactor emergency replacement project for the UK national grid.

- **UK National Grid, Z-Route Circuit Transfer, Various UK Locations**
  Principal Electrical Engineer supporting the design of the front end engineering design package in line with the National Grid's TP500 network development process for their transmission networks.

- **Western Power, Distribution Design Protection Systems, Various UK Locations**
  Principal Electrical Engineer supporting the design protection systems for various reinforcement projects at the Keswick, Newent, Ledbury and Bromyard 66/11 kV substations and Shrewsbury 132 kV / 33 kV GSP for Western Power Distribution.

PRIMARY QUALIFICATIONS

- *Key front-end planning experience for complex substations*
- *Experience developing protection and control philosophies as part of substation planning*
- *Experience with turnkey bridging documents for substation implementation*

EDUCATION

- *BE, Electrical & Electronics, Bharathiar University, 1996*

CERTIFICATIONS

- *Professional Registration with Engineering Council as Chartered Engineer (CEng.)*
- *Association for Project Management (APM), APMP Qualification (IPMA Level D Certification)*
- *National Grid – UK TP141 Protection & Control Contractor Design Approval Engineer*
- *Basic Electricity Safety Competence (BESC) Assessment*

WORK HISTORY

- *Jacobs Engineering Group, 2013-Present*
- *Alston Grid UK Ltd., 2007-2013*
- *WS Atkins & Partners Oversees, 2006-2007*
- *Tata Consultancy Services, 2003-2006*
- *Asea Brown Boveri Limited, 2000-2003*
- *Avasarala Power Projects, 1997-2000*

YEARS OF EXPERIENCE

- *With Current Firm: 2*
- *With Other Firms: 16*
- *Total Years Experience: 18*

Relevant Projects with Other Firms

- **UK National Grid, GIS Substation, Various UK Locations**
  Lead Design Engineer responsible for secondary systems to support the design of the Leiston 132 kV GIS substation 500 MW windfarm connection for the National Grid end user.

- **Greater Gabbard Offshore Winds Limited, Windfarm Module GIS Bays, Various UK Locations**
  Lead Design Engineer responsible for secondary systems to support the design of the 3-off 132 kV windfarm module GIS bays at Leiston for Greater Gabbard Offshort Winds Limited.

- **UK National Grid, Substation, Various UK Locations**
  Lead Design Engineer responsible for secondary systems to support the design of the Sellindge 400 kV GIS 4-switch mesh substation for the National Grid end user.

- **UK National Grid, Light Current Frame Work Agreement, Various UK Locations**
  Tendering Engineer for the National Grid light current frame work agreement for operational tripping and auto close scheme.

Resumes

Eric Persson, CompTIA Network+, CISSP, CACE

Cybersecurity Engineer

Eric has over 20 years of experience as a hands-on IT Manager for multi-national companies, and over 10 years' experience in the field of process control cybersecurity and Industrial Networks. At exida LLC he is the lead Senior Cybersecurity Engineer with primary responsibilities including performing Cybersecurity Vulnerability and Risk assessments, developing and reviewing network architectures, cybersecurity and Industrial networking course development and training, and assisting with the commissioning of network segmentation solutions. Prior to that Eric was with the MTL Division of Eaton / Cooper Crouse-Hinds where he was the IT/IS Manager for the Americas, Industrial Networks Product Line Manager and Technical Support and Applications Manager for the Americas, and also spent a number of years at Gould-Modicon as a Technical Support Engineer supporting a number of products that are now Schneider PLC systems.

Representative Projects

- **Confidential Client, Confidential Project, TX**
  Senior Cybersecurity Engineer responsible for providing assistance with evaluation of network design, and implementation of Cybersecurity solution. Training provided on Tofino solution.

- **Confidential Energy Client, Confidential Project, TX**
  Senior Cybersecurity Engineer responsible for evaluating current network situation and follow-up implementation of cybersecurity solution. Training provided on networking and Tofino solution.

- **Confidential Refinery Client, Confidential Project, CA**
  Senior Cybersecurity Engineer responsible for evaluating the current network situation and follow-up implementation of cybersecurity solution. Training provided on networking and Tofino solution.

- **Confidential Water Systems Client, Confidential Project, NJ**
  Senior Cybersecurity Engineer responsible for evaluating the current network situation and follow-up implementation of cybersecurity solution. Training provided on networking and Tofino solution.

- **Confidential Client, Confidential Project, NJ**
  Senior Cybersecurity Engineer responsible for evaluating the current network situation and follow-up implementation of cybersecurity solution. Training provided on networking and Tofino solution.

PRIMARY QUALIFICATIONS

- *Previous experience in networking, cybersecurity, training, and devices*
- *Experience with ISA-62443 (ISA-99) and NERC CIP*

EDUCATION

- *MBA, Franklin Pierce University, 2005*
- *Masters of IT Management, Franklin Pierce University, 2004*
- *BS, CIS, Southern New Hampshire University, 2002*

CERTIFICATIONS

- *CompTIA Network+*
- *CISSP*
- *CACE*
- *ISA IC-32 Certified Instructor*
- *GICSP Certification (pending)*

WORK HISTORY

- *Exida, LLC, 2013-Present*
- *Eaton / Cooper Crouse-Hinds, 2005-2013*
- *Gould-Modicon, 1984-1989*

YEARS OF EXPERIENCE

- *With Current Firm: 2*
- *With Other Firms: 25*
- *Total Years Experience: 27*

Resumes

- **Confidential Water Systems Client, Confidential Project, KY**
  Senior Cybersecurity Engineer responsible for evaluating the current network situation and follow-up implementation of cybersecurity solution. Training provided on networking and Tofino solution.

- **Confidential Seaway Client, Confidential Project, Canada**
  Senior Cybersecurity Engineer responsible for assisting with evaluation of current lock and drawbridge network situation and follow-up implementation of cybersecurity solution. Training on Tofino solution.

- **Confidential Client, Confidential Project, Ft McMurray, Alberta, Canada**
  Senior Cybersecurity Engineer responsible for the assessment and evaluation of Delta-V network operations and system performance issues.

- **Confidential Water Resources Client, Confidential Project, VA**
  Senior Cybersecurity Engineer responsible for train and commission Tofino infrastructure.

- **Confidential Water Department Client, Confidential Project, WI**
  Senior Cybersecurity Engineer responsible for full cybersecurity assessment and gap/solution report.

- **Confidential Client, Confidential Project, Dubai, UAE**
  Facilitator of Risk Assessment Activities responsible for philosophy development for Greenfield oil well field and refinery.

- **Confidential Client, Confidential Project, CA**
  Senior Cybersecurity Engineer responsible for firewall rule set document and review for appropriateness.

Resumes

Asif Bhangor, CPEng., RPEQ

Transmission Engineer

Asif was chosen for this role on this project due to his extensive experience working with major utilities and overhead lines for some of the world's most complex, congested applications. Given the complexity of interfacing all of the new line work in the transit right of ways, it will be vital to have this industry leading experience in transmission line design to avoid unintended system interactions between the high voltage components and the OCS systems, and medium voltage traction power circuits.

With over 17 years of professional experience, Asif started his Overhead line design career working in a design, manufacture and build environment.

Asif specializes in the structural / civil design for steel towers, foundations, substation gantries, steel poles and other support structures involved in transmission network engineering.

Asif has worked on numerous LV and HV projects ranging from 22kV to 500kV designs. He has prepared capital cost estimations for the design and construction related to feasibility studies on new connections/ upgrade work Utilities. Asif has also managed the design of two projects involving the 66/132/220kV UG Cable Designs with Horizon Power and Western Power.

Representative Projects

- **Altina Energy, Owners Engineer for 120kms 220kV Single Circuit Transmission Line from Newman Power Station to Roy Hill Mine**
  Transmission Engineer responsible for the preparation of technical requirements and specifications on the lattice steel material, conductors, insulators and other hardware material for the transmission line construction. In addition, carried out design reviews for the transmission line and witnessed Tower Testing in China for the Tower Designs.

- **Horizon Power, Owners Engineer / Designer for 6kms of 220kV Double Circuit 220kV Transmission Line Design**
  Transmission Engineer responsible for supporting the detailed design of a 220kV double circuit line. Works included preparation of technical requirements and specifications on the lattice steel material, conductors, insulators and other hardware material for the transmission line construction. In addition, carried out the detailed tower design and conducted load testing for two towers in China for suspension and terminal tower.

PRIMARY QUALIFICATIONS

- *Experienced overhead line designer and senior engineer*
- *International experience working with utilities and private clients (mining)*
- *Due diligence experience for asset acquisition*

EDUCATION

- *MBA, University of Western Australia*
- *BS, Civil Engineering, Middle East Technical University*

CERTIFICATIONS

- *Australian National Registered Professional Engineer NPER*
- *Chartered Engineer CPEng, RPEQ*
- *Member Australian Panel for Transmission Lines CIGRE AP B2*

WORK HISTORY

- *Jacobs Engineering Group, 2006-Present*
- *Future Pipe Dubai, 2002–2006*
- *Mitas Metal Turkey, 2001–2002*
- *Galkon Turkey, 2000–2001*
- *Mitas Metal Turkey, 1997-2000*

YEARS OF EXPERIENCE

- *With Current Firm: 8*
- *With Other Firms: 9*
- *Total Years Experience: 17*

Resumes

- **Rio Tinto, 220 kV/ 132 kV Transmission Line Design Project**
  Transmission Engineer responsible for the detailed design of 220 kV & 132 kV transmission lines, including line design in PLS CADD, structural and foundation designs for a total of four (4) 220 kV transmission towers and three (3) 132 kV steel pole types. Full Scale load testing of the design towers in the Chinese Test Facility, Beijing. The 220 kV line length was 50 km from 7-Mile Power Station to Cape Lambert Bulk Supply Station. Designed wind speeds were 90 m/s (region D wind as per AS1170.2). Activities included site technical assistance during the foundation pours, tower procurement, tower installation and line commissioning. Received an Australian Safety Award for the Best Safety Solution in Tower Installation for this project.

- **Western Power, 330 kV Transmission Line Design from Northern Terminal to Neerabup Terminal Switchyards**
  Transmission Engineer responsible for the detailed design of a 330 kV transmission line (quad conductor configuration), including tower design in PLS Tower, fabrication and assembly drawings, prototyping and load testing for three (3) tower types in China, and foundation design using steel H piles for loose soil conditions. Site technical assistance in the installation of reinforcement steel on an existing tower including foundation installation.

- **Wind Prospects Pty Ltd, Boco Rock Wind Farm**
  Transmission Engineer Reviewer responsible for review and technical support during construction of 20kms of 132kV transmission lines for the Wind Farm connection, including line design review in PLS CADD, structural and foundation design reviews for 132kV steel pole types and augered/ bored foundations.

- **China Machinery CMEC, Purchase of Turkish Distribution Assets in Turkey**
  Technical Due Diligence for a distribution utility in Turkey. Review of the appropriateness of organisational structure, staff experience and resources. Check the regulatory performance and future targets/objectives. Reviews of the asset management philosophy, policy and practices, asset performance and operation and maintenance practices and procedures. Carried out a site visit in Turkey to assess the asset age profiles, condition, and replacement/refurbishment requirements. Obtain data on the system security and planning criteria. Network capacities and reinforcement needs. Reviewed historic CAPEX and OPEX. Forward forecasts of Capital and Operating and Maintenance Expenditures. Review of safety programmes and performance. Environmental systems, policies and issues.

Resumes

Gabriel Serna, PE

Structural Engineer

Gabe was chosen for this role on this project due to his experience with various types of structural systems and his recent and extensive experience with vibration analysis and design of high-speed rotary machinery foundations.

With 12 years of experience, Gabe has broad and comprehensive experience in design and analysis of building structures. Experience includes the design and construction of low to midrise building structures, parking garages, electrical substation support structures, and water infrastructure support structures in various regions nationally and internationally. Structural systems include structural steel, cold-formed steel, reinforced concrete, post-tensioned concrete, wood, and masonry. Industries include federal, higher education, healthcare, commercial, energy and power, and water and wastewater. Type of work provided includes development of drawings, calculations, specifications, quality control reviews, as well as construction administration services. Projects involve ground-up structures as well as renovations of existing structures. Specialized areas of expertise include experience with structures in high seismic regions and dynamic design of structures to support high-speed vibrating machinery used for power generation.

Representative Projects

- **Confidential Client, Macrogrid PJM Black Start Addition, OH**
  Structural Engineer responsible for the design of two new electrical substations and vibration analysis and design of foundations for two new combustion turbine generators. Foundation design for new LM2500 combustion turbines required rigid block foundations with massive rebar to meet the strict vibration criteria established by GE. Foundation design included requirements soil removal and replacement with controlled low-strength materials due to the poor soil conditions at the site and the required dynamic shear modulus of the soil to produce a desired response to machine excitation. Design also included provisions for construction of the mass concrete foundations to control the heat of hydration and avoid cracking during curing periods. Final dimensions of the foundations were approximately 55 ft long x 12 ft wide at the surface x 10 ft thick, with base widths extending up to 26 ft. The proportions of the foundation were determined by using a 3D model in STAAD.Pro v8i to perform a modal analysis and a time-history analysis. The modal analysis ensured the natural frequency of the foundation was sufficiently separated from the 3600 RPM operating frequency of the turbine to avoid excessive resonant amplification of the foundation response. The time-history analysis was used to determine the velocity response of the foundation at all points in contact with the turbine base to ensure conformance with the operational foundation response

PRIMARY QUALIFICATIONS

- *Recent experience with dynamic foundation design using modern software analysis packages and current methods for determining soil-structure interaction values*
- *Experience with various types of structural systems supporting vibrating machinery (mass block foundations, mat foundation, pier foundations, mass combined elevated platform and foundation)*
- *Comprehensive structural engineering experience with several building types allowing for an understanding of their behavior and interaction with foundations for vibrating machinery*

EDUCATION

- *ME, Civil Engineering with Structural Emphasis, University of Texas at Arlington, 2010*
- *BS, Civil Engineering, University of Texas at El Paso, 2003*

CERTIFICATIONS

- *Registered Professional Engineer: TX, CA, OK, OH*

WORK HISTORY

- *Jacobs Engineering Group, 2006-Present*
- *John Morrison Engineering, 2003-2005*

YEARS OF EXPERIENCE

- *With Current Firm: 9*
- *With Other Firms: 3*
- *Total Years Experience: 12*

Resumes

velocity limit of 0.07 inches per second established by General Electric. The 3D model was created using an array of 8-noded solid elements to model the concrete foundation mass. Dynamic spring values and damping ratios used in the models were established using dynamic soil shear modulus and material damping values determined during the geotechnical investigations along with the methods provided in ACI 351.3. The foundation was proportioned by performing several analyses to capture the wide range of possible soil values applicable at the site.

- **University of Minnesota, Microgrid Generation Design, MN**
  Lead Structural Engineer responsible for a vibration analysis and design of foundation and elevated platform for a new LM2500 combustion turbine generator. Design of elevated platform included a modal analysis to ensure mass and natural frequencies of the platform were sufficient for the effective use of vibration isolators below the turbine. The modal analysis was performed using STAAD.Pro v8i software and verified using RISA software to ensure satisfactory performance of the platform. Construction challenges included use of a non-symmetrical platform arrangement to avoid interference with existing building columns. The non-symmetrical arrangement required several analysis iterations to adequately capture all modes of vibration of the platform.

- **Denbury Resource Partners, Delhi Methane Gas Power Generation, LA**
  Lead Structural Engineer responsible for a vibration analysis and design of foundations for new combustion turbine generator and 20,000 horsepower centrifugal compressor.

- **University of California, Cogeneration Facility, Santa Cruz, CA**
  Engineer of Record for a $30 million; 4,000 sq ft steel-framed building housing cogeneration process equipment including a combustion turbine generator. Performed a seismic response spectrum analysis on building structure and provided special detailing of the building lateral system due to the high seismicity in the region Design also included investigation of the effects of the combustion turbine generator on the first floor that shared the same mat foundation on which the building structure was supported.

- **Texas A&M University, Campus Microgrid Renovation, College Station, TX**
  Technical Reviewer for design of foundation for new turbine generator. Foundation design included a vibration analysis of a rigid foundation block supported on belled piers. The foundation consisted of a 10 ft thick rigid block supported on 2 ft diameter piers with 4 ft diameter bells. Pier lengths were approximately 18 ft. A modal and time-history analysis was performed using SAP2000 software to verify conformance with the operational foundation response velocity limit of 0.07 inches per second established by General Electric. Construction challenges included interference of pier locations with existing utilities which dictated several iterations of the model be performed to capture all possible modes of vibration of the foundation block.

- **Orange County, Central Utility Facility Strategic Renovation Plan and Plant Upgrade, Santa Ana, CA**
  Engineer of Record for the design of an independent elevated structural system within an existing building to support new steam and domestic water systems within existing central utility facility building. Design of the new structural system included strategic placement of new supports within the existing facility to utilize the strength of the existing foundation but avoid dynamic interaction with the existing structure during an earthquake.

Resumes

Edward Tsikirayi

PJM Regulations & Interconnection

Edward is an Executive Consultant of Levitan & Associates who has advised numerous clients on transmission and wholesale power market issues. He served as the Project Manager in providing Long Island Power Authority with Power Markets Support Services associated with LIPA's participation on various NYISO, PJM and ISO-NE member committees, including advising LIPA on relevant policy issues, conducting power flow studies, and validating PJM transmission cost allocations for transmission upgrades allocated to the Neptune HVDC line. Edward has also provided transmission planning and bulk power market support to the New York Power Authority in their participation in the PJM Interconnection Marketplace as part of their involvement in the development of the 660 MW HVDC Hudson Transmission Project.

Edward has provided transmission planning and bulk power market analysis services to a group of NYC Generating Companies in their participation in the NYISO stakeholder process to reset NYISO's Demand Curve parameters. Services included analysis of generator and transmission interconnection and deliverability issues affecting System Deliverability Upgrades, System Upgrade Facilities and Attachment Facilities and developing the rationale for the inclusion of the related costs in the Cost of New Entry. He submitted expert testimony on behalf of a group of generators before FERC to justify including Upgrade costs in setting capacity market prices; FERC ruled in his favor.

Representative Projects

- **Long Island Power Authority**
  Project Manager responsible for providing LIPA with Power Markets Support Services associated with LIPA's participation in NYISO, PJM and ISO-NE, including (i) attending committee meetings on behalf of LIPA, identifying significant issues, recommending policy positions, and advocating on LIPA's behalf at any of the committees and working groups covered, (ii) administering LIPA's ISO working group conference calls, chairing the meetings, uploading meeting materials and other information to the LIPA PMP SharePoint system, and tracking related action items, (iii) providing LIPA with qualitative and spreadsheet analysis of relevant and current market issues, including estimates of their value for prioritization purposes, (iv) conducting power flow studies and validating PJM transmission cost allocations, (v) participating in LIPA internal policy development meetings and assisting in developing policy positions and market response to market structure issues, and (vi) supporting LIPA's identification and integration of public policy requirements into its Local and Regional Transmission Planning Process.

PRIMARY QUALIFICATIONS

- *Expertise in bulk power planning and operations, ISO/RTO markets and rules, transmission reliability assessment, load flow and optimal power flow analysis*
- *Familiar*

EDUCATION

- *MS, Electrical Engineering, Moscow Power Engineering Institute*
- *BS, Electrical Engineering, Moscow Power Engineering Institute*

WORK HISTORY

- *Levitan & Associates, Inc., 2003-Present*
- *ISO-NE, 1999 - 2003*
- *Zimbabwe Electricity Supply Authority, 1990-1999*

YEARS OF EXPERIENCE

- *With Current Firm: 12*
- *With Other Firms: 13*
- *Total Years Experience: 25*

Resumes

- **Maryland Public Service Commission**
  Project Manager responsible for providing transmission planning and bulk power market analysis services for the Maryland Public Service Commission in several studies to determine future energy options for the state of Maryland. Services included developing backbone and related transmission infrastructure assumptions for use in the production simulation analyses, providing analysis of factors affecting new generation entry in the state, providing analysis on the definition and estimation of the Capacity Gap in Maryland and providing an analysis of the SWMAAC Resource Balance based on the Locational Deliverability Area's Capacity Emergency Transfer Objective and Capacity Emergency Transfer Limit.

- **New York Power Authority**
  Project Manager responsible for providing transmission planning and bulk power market support to NYPA in their participation in the PJM market as part of their involvement in the development of the 660 MW HVDC Hudson Transmission Project. Support included representing NYPA in the PJM Interconnection Marketplace by advising NYPA on the PJM Market Rules and Dynamics, which included but was not limited to the Large Generator and Merchant Transmission Interconnection Process, the PJM DFAX methodology for transmission cost allocation, Capacity Export Charges and Credits and Incremental Capacity Transfer Rights.

- **Virginia State Corporation Commission**
  Project Manager responsible for providing transmission planning support to the staff of the Virginia State Corporation Commission regarding the application of PATH-VA for a Certificate of Public Convenience and Need for the 765 kV PATH backbone transmission project. Support included reviewing the PATH application and pre-filed testimony, assessing reasonableness of the assumptions and data inputs, replicating the application load flow study base case, conducting an independent transmission alternative solution analysis, assessing the reasonableness of the PJM RTEP process regarding transmission and generation deliverability, and submitting testimony.

- **NYC Generating Companies**
  Project Manager responsible for providing transmission planning and bulk power market analysis services, to a group of NYC Generating Companies in their participation in the NYISO stakeholder process to reset NYISO's Demand Curve parameters. Services included analysis of generator and transmission interconnection and deliverability issues.

Relevant Projects with Other Firms

- **Power Supply and Reliability Planning, ISO New England**
  Lead Engineer responsible for performing reliability assessments, participating in ISO-NE's Regional Transmission Expansion Planning Process, and representing ISO-NE on the Northeast Power Coordinating Council CP-8 working group.

Dale Legg, PE

Constructability Leader

Dale was chosen for this role on this project due to his extensive construction background, design-build experience, and diverse design background.

Dale has 42 years of management, design, and construction experience. He has extensive experience in the design of rail facilities, bridges, bridge inspection, buildings, highway/roadway systems, sanitary systems, water distribution systems, parks, and recreation areas. He also has a diverse background in environmental assessments, regulatory codes, regulations, and permit applications. Additionally, Dale has participated on numerous Value Engineering studies throughout the country. This broad spectrum of experience, along with his recent work as Chief Engineer and Design Coordinator on major projects, makes him an ideal Chief Engineer. His diligence regarding detail and his ability to coordinate and communicate across multiple disciplines gives him a unique ability to review and produce accurate, detailed documents.

In his current capacity as Chief Engineer for the NAI Mid-Atlantic Region, Dale gathers facts about the project, allocates and coordinates employee resources, and reviews the following project aspects: design elements (including mathematical equations), cost estimates, statistics, and reports. Dale's focus is on the public welfare when it comes to all engineering projects. He confirms that documents are produced consistently and with the highest quality.

Representative Projects

- **NJ TRANSIT, Task #8, MMC Building Perimeter Pumps Generators, Superstorm Sandy Recovery Program, Kearny, NJ**
  Project Manager responsible for the design of Flood Protecting systems and devices to prevent or reduce flooding from entering many of the Meadows Maintenance Facility (MMC) Buildings. Dry Flood protecting at openings within the various building envelopes, including openings for rolling stock. Because all flood protecting will have some amounts of leakage, pumps are installed in many locations including outdoors where required and all conduits and other piping such as storm sewers were required to be closed to prevent the infiltration of flood and stormwater. Also, it involves the design and construction of providing high-volume pumps and associated stand-by and flood emergency generators to operate with the loss of commercial power. Subconsultants under this assignment included GTS Consultant, Sowinski Sullivan Architects, and Matrix New World.

PRIMARY QUALIFICATIONS

- *Currently the PM on a NJ TRANSIT Task Order involving Superstorm Sandy improvements*
- *Extensive experience with design-build projects for transit clients including MTA*

EDUCATION

- *BS, Civil Engineering, University of Kentucky, 1971*

CERTIFICATIONS

- *Registered Professional Engineer: IN, MD, NY, FL*
- *NCEES – Examiners for Engineering and Surveying, US*

PROFESSIONAL ASSOCIATIONS

- *American Society of Civil Engineers (ASCE)*
- *Structural Stability Research Council (SSRC)*

WORK HISTORY

- *Jacobs Engineering Group, 1993-Present*
- *AECON, Inc., 1975-1993*
- *Associated Engineers Consulting, Inc., 1973-1975*
- *Kentucky DOT, Bureau of Highways, 1971-1973*

YEARS OF EXPERIENCE

- *With Current Firm: 22*
- *With Other Firms: 20*
- *Total Years Experience: 42*

Resumes

- **NJ TRANSIT, Portal Bridge Capacity Enhancement Project, NJ**
  Constructability Analysis Leader for multiple elements of the project throughout the final design phase including analyses of construction tasks relative to work windows available to determine the most cost-effective solutions. Also led the development and review of the Cost Estimating Task for the Program. The project extends from the NJ Turnpike in Kearny to the Frank R. Lautenberg Station at Secaucus Junction in Secaucus, and is approximately 2.5 miles in length. Jacobs is part of the Tri-Venture Team "Portal Partners" providing professional railway, structural, civil, and geotechnical services for the replacement of Portal Bridge over the Hackensack River on the NEC in Kearny and Secaucus, NJ. Final Design was advanced to provide a two-track, fixed bridge to the north to replace the aging bridge and has an estimated construction value of $950 million.

- **MTA MNR, Design and Construction Services for the Harmon Shop Replacement Program, Harmon Yards Rail Facility, Phase III, Croton on the Hudson, NY**
  Architectural / Structural / Geotechnical / Site Coordinator responsible for the design coordination for the two new maintenance buildings constructed at the Harmon Yards Facility in Croton on the Hudson, NY. This facility is now used to repair Coach Cars and Locomotives for the Hudson Line of Metro North Railroad. The buildings total over 220,000 square feet in area and were completed in April 2010. Our firm was a member of a Joint Venture Design-Build Team that was also responsible for building the facility.

- **MTA MNR, Engineering & Design for Addition of Mid-Harlem Third Mainline Track & Associated Interlocking Improvements, Mt. Vernon to Crestwood, NY**
  Project Manager responsible for the final designs for the $49-million addition of a third track on Metro-North's Mid-Harlem Line between Mt. Vernon and Crestwood Stations. Engineered improvements included 3.6-miles of track and high-speed interlocking design; new and rehabilitated bridges including and retaining structures; substation modifications and traction power improvements; communications and signals improvements; and historic structure evaluation. Additional responsibilities include project scheduling and control, oversight of all structural designs and coordination with all specialty subconsultants. Traction power modifications include a new third rail system with associated positive and negative feeder cables, control cable, duct line and conduit system, as well as modifications to substations.

- **MTA LIRR, Design-Build Arch Street Yard/Shop Joint Venture, New York, NY**
  Lead Structural Engineer and Coordinator of Structural, Architectural and Geotechnical portions of this project as well as responsible for oversight of the entire $75M design/build maintenance facility and rail yard. This project involves the design-build of a train service yard and heavy maintenance facility, as well as a traction power substation, Extensive Interior Cleaning (EIC) Platform, EIC Storage Building, track-work, utilities, and a new 3rd rail power substation and duct banks. In particular, this facility contains a five-track, four hundred foot long maintenance shop, a two-track 900-foot-long cleaning platform, and two 250-foot-long maintenance tracks. The yard is accessed by a four-track, quarter-mile-long lead-in track, with access to an adjacent tenant and a 1,900-foot run-around track. In addition the site contains a, Con-Ed block house and third rail traction power, utilities, storage buildings, communications, lighting, and a three-story administration area.

- **MTA MNR, Highbridge Yard-Design-Build, Bronx, NY**
  Project Manager responsible for $76 million electrified storage and cleaning yard along the Harlem River including a 900 ft long clean, build, substation, two platforms, bridge, and diesel fueling facilities. This project was a key component of the MTA/LIRR East Side Access Program with a fast-track, 18-month schedule for design and construction.

Resumes

Michael Albergo, PE, PMP, LEED® AP BD+C

Risk Management Facilitator / Leader

Michael was chosen for this role on this project due to his expertise and passion for risk evaluation, his engineering background, and his analytical and communications skills. He brings 30 years of experience in the planning, development, and engineering analysis of public works projects. His experience includes project development from concept through construction, analysis of the supporting logistics, and risk management. He has worked with both public and private organizations to address their concerns during planning, design, and construction. He recently completed a risk assessment for NYC Transit's $500M+ Canarsie Tube Reconstruction and is currently serving as Lead Facilitator for a new bus rapid transit system proposed for Richmond, VA.

Representative Projects

- **Richmond Bus Rapid Transit System, Risk Assessment**
  Lead Facilitator responsible for a qualitative risk assessment of a new $50M bus rapid transit system currently in design for Richmond, Virginia. Key tasks are risk identification, qualitative analysis, mitigation development, and update of the existing risk register, with an optional quantitative analysis to develop schedule and budget contingencies.

- **NYC Transit, Canarsie Tube Reconstruction, Risk Assessment**
  Facilitator responsible for the qualitative risk assessment for this major tunnel reconstruction project. More than 60 risks were identified, and their impacts were assessed and ranked. Michael authored the risk assessment report for NYCT and outlined the approach to perform follow-on Monte Carlo analysis and ongoing management of risks during construction.

- **Port Authority of NY & NJ, WTC Program Assessment, New York, NY**
  Facilitator for the Port Authority's WTC Business team in identifying the status of and risks to the WTC scope, schedule, and budget. This was an intense 4-week effort. The effort was documented in WTC Team Assessment Report, which identified the key challenges confronting the project and then risked the program schedule and budget. The report was provided to the Executive Director of the Port Authority and was the basis of a report provided to Governor Patterson in July 2008.

PRIMARY QUALIFICATIONS

- *Expertise in risk identification, evaluation, and management*
- *Broad engineering experience*
- *Strong communication, facilitation, presentation skills*

EDUCATION

- *BS, Humanities and Engineering (Nuclear Engineering, Writing, American Literature), Massachusetts Institute of Technology, 1983*

CERTIFICATIONS

- *Registered Professional Engineer: NY*
- *Project Management Professional (PMP)*
- *LEED Accredited Professional, Building Design & Construction (BD+C)*
- *Nassau County / FEMA, Tree and Debris Removal Training*

WORK HISTORY

- *Jacobs Engineering Group, 2013-Present*
- *LiRo Engineers, Inc., 2006-2013*
- *Weidlinger Associates, 2002-2006*
- *LiRo Engineers, Inc., 1995-2002*
- *Michael Baker Jr., Inc., 1992-1995*

YEARS OF EXPERIENCE

- *With Current Firm: 2*
- *With Other Firms: 21*
- *Total Years Experience: 23*

Resumes

- **Value Planning Risk-Based Analysis of WTC Site, Lower Manhattan Construction Command Center**
  Program Coordinator for a full risk assessment and quantitative analysis for the WTC site, supported by subject matter experts from around the world. Michael organized the workshop and provided logistics analysis for proposed scenarios. Working with the facilitator and subject matter experts, he identified risks and mitigations for several construction scenarios, and provided the final report for the risk analysis.

- **NYC School Construction Authority, Hurricane Sandy Emergency Repair Program**
  Emergency Response Team Consultant under contract to the NYC School Construction Authority, responsible for providing emergency repairs to 23 schools in Rockaway and Howard Beach damaged by Hurricane Sandy. The goal of the program was to quickly assess and "triage" schools to get them operational as quickly as possible. Michael developed a work breakdown structure including more than 500 elements and was responsible for tracking NYCSCA-directed repairs in accordance with FEMA requirements and coordinating the response team. Nineteen of the 23 damaged schools were repaired and reopened in 60 days, and Michael's documentation for the construction was accepted by FEMA for reimbursement.

- **NYC Department of Design and Development/NYC Mayor's Office, MED 598, West 30th Street and Tenth Avenue Area Construction Coordination, New York, NY**
  Program Coordinator on behalf of NYCDDC and the Mayor's Office providing program coordination services in connection with the installation of new sewer and water mains on 10th Avenue and West 30th Street in Manhattan. The construction of these utilities was coordinated with numerous ongoing construction projects and public programs. These included Tower C, a 1,000-ft tall commercial tower being constructed by the Related Companies as part of the Hudson Yards; the High Line (Phase 3), being constructed adjacent to and beneath Tower C; a new 24-story residential tower across 30th Street; and a DEP shaft for the Third Water Tunnel. Michael maintained a coordination schedule (Primavera P6), supported monthly street logistics meetings, and provided ongoing coordination with all stakeholders.

- **NYC Department of Design and Development/NYC Mayor's Office, MED 609, Lincoln Center Area Construction Coordination, New York, NY**
  Program Coordinator on behalf of NYCDDC and the Mayor's Office providing program coordination services in connection with the installation of a new 48-inch NYCDEP water main on West 62nd Street at Lincoln Center. The construction of this new main was coordinated with numerous ongoing construction projects and public programs. These included Lincoln Center performances and operations; Fashion Week; the Big Apple Circus; Fordham University's construction of a new 25-story law school and dormitory; and Glenwood Property's construction of a new residential tower. Michael maintained a coordination schedule (Primavera P6), led monthly street logistics meetings, and provided ongoing coordination with all stakeholders.

- **Lower Manhattan Construction Command Center, New York, NY**
  Project Manager overseeing the planning, analysis, and coordination in connection with the permanent opening of the 9/11 Memorial scheduled. In this capacity, he examined issues and evaluated options for access and emergency egress, pedestrian queuing areas, queue lengths, sidewalk capacities, and operational impacts. He worked with NYCDOT to develop a bus dispatch system for tour buses and with the Alliance for Downtown NY, NYC Dept. of Buildings, and the NYC Building Congress to facilitate public art installations, mitigate street and sidewalk reconstruction impacts, and improve signage, way-finding, and beautification. He developed the NYC Building Congress's Livable City scoring program.

Richard LaRuffa, PE, CVS

Value Engineering Leader

Rich was chosen for this role on this project due to his extensive local and international transit value engineering experience, experience with power generation and distribution facilities for transit properties, and extensive project management background on large, complex projects.

Rich has served as Project Director or Project Manager, overseeing project teams with up to 40 staff members. Assignments included P/CM, construction claims analysis and prudency audits, value engineering, constructability reviews, peer reviews, CPM scheduling, and cost estimating on projects ranging from $0.5 million to $6 billion. A Life-Certified Value Specialist, Rich has been actively involved in value engineering for more than 35 years. He has participated in over 250 value engineering workshops, as team member or team leader.

Rich has presented seminars on project management and value engineering to agencies including New York City Transit, SEPTA, and NJ TRANSIT. He has also taught the SAVE certified MOD I curriculum, and has published and presented more than 10 papers on value engineering in conjunction with SAVE International and AASHTO VE Conferences.

Representative Projects

- **Florida Department of Transportation, Miami Intermodal Center, Value Engineering and Risk Management Study**
  Team Leader for a value engineering/risk management study for the new intermodal station proposed for Miami International Airport to connect local, regional, and long distance rail and bus services to a new airport people mover, and car rental facility. The multi-modal facility will serve Amtrak & Regional commuter rail, light rail, airport monorail, and city bus operations.

- **Crossrails, Ltd, London, UK**
  Peer Reviewer for a the week-long international panel to evaluate methods and procedures developed for the design stages of the multi-billion program to construct a new rail line connecting Paddington Station with rail lines on the east end of London including seven new stations / connection points.

- **MTA New York City Transit, Value Engineering Consultant Services**
  Project Manager and primary CVS Team Leader on five successive on-call contracts. Since 1997, more than 165 studies have been conducted on more than 140 station upgrades and new stations, power, signal and communications systems, bus depots, bus command centers, and TA facilities. Projects included

PRIMARY QUALIFICATIONS

- *Conducted multiple project value engineering studies for NJ Transit since 1992*
- *Conducted numerous value engineering studies on transit power substations, traction and catenary transmission facilities, and operations for heavy and light transit properties nationwide*
- *Active involvement in value engineering since 1978*

EDUCATION

- *MS, Northwestern University, 1968*
- *BS, SUNY Stony Brook, 1966*

CERTIFICATIONS

- *Registered Professional Engineer: NJ, NY*
- *Life Certified Value Specialist*
- *AAA, Arbitration and Mediation Training*

WORK HISTORY

- *Jacobs Engineering Group, 1995-Present*
- *LaRuffa Management Associates, Inc., 1992-1995*
- *High Point Schaer, Construction Claims Consultant, 1990-1992*
- *LaRuffa Management Associates, 1988-1990*
- *O'Brien-Kreitzberg & Associates, Inc., 1974-1988*
- *Meridian Engineering Co., 1971-1974*
- *Esso Research & Engineering Co., 1967-1971*

YEARS OF EXPERIENCE

- *With Current Firm: 20*
- *With Other Firms: 27*
- *Total Years Experience: 47*

Resumes

new traction power substations, as well as modernization of existing substations, frequency change operations, back-up power generation, and involved 3rd rail and catenary line, yard and shop distribution systems. Projects totaled more than $4 billion in construction.

- **NYS, Metropolitan Transit Authority, Capital Construction Company**
  Value Engineer for the MTACC new routes programs for the New York City rail systems. Rich conducted a Market Capacity Analysis for Systems & Equipment packages for East Side Access, as well as VE studies on tunnel boring and station systems for the new Second Avenue Subway, East Side Access, and No. 7 Line Extension projects.

- **Metropolitan Transit Authority, Metro-North Railroad Value Engineering Consultant Services**
  Project Manager and CVS Facilitator responsible for performing value engineering studies to upgrade ventilation systems at Grand Central Station, upgrades to the Park Avenue Viaduct from the portal to the reconstructed 125th Street Station (including ADA upgrades), replacement of the Annsville Creek Bridge in Poughkeepsie, NY, as well as mechanical / electrical upgrades to the movable Walk and Saga bridges (CDOT-Rail) that also serves Amtrak in Connecticut.

- **Metropolitan Transit Authority, Long Island Rail Road, Jamaica Station**
  Value Engineer responsible for conducting a best value analysis (BVA) workshop for a new station platform to expand capacity and facilitate train movements into East Side Access program. Per the LIRR BVA process, components of the preliminary design were reviewed for capital and life cycle costs.

- **NJ TRANSIT, Value Engineering Consultant Services**
  Project Manager and CVS Facilitator responsible for four value engineering studies for the new Frank J. Lautenberg Rail Station and value engineering/ risk workshops for replacement of the $1.5 billion Portal Bridge along Amtrak's Northeast Corridor, a new rail station in Union, and rehabilitation (including ADA upgrades) to the Perth Amboy Rail Station, the Trenton Rail Station.

- **Amtrak ARRA and Accessible Stations Development**
  Value Engineer responsible for leading construction preparation QA/QC programs and conducting field QA/QC audits for the Amtrak nationwide facilities improvement programs started with ARRA funding, and continuing with ASDP. Rich oversaw staff conducting constructability reviews for design on ASDP projects. As part of the program, a value engineering study was conducted on the A&S Transmission Line Replacement in Western Pennsylvania.

- **Port Authority of NY & NJ**
  Project Manager and Value Engineer Team Leader responsible for conducting value engineering workshops on concepts for confidential Homeland Security upgrades at all PA airport facilities and rail tunnels, a new 800-passenger Ferry Terminal at Battery Park City.

- **Baltimore Red Line, Baltimore, MD**
  Value Engineer to facilitate a cost evaluation workshop on the concept alternatives for a new light-rail corridor that includes elevated, at-grade, and tunnel sections from the Centers for Medicare and Medicaid to Bayview Campus. Subsequently conducted a value engineering workshop on the preliminary engineering design for preferred alternative.

- **Massachusetts Bay Transportation Authority, Boston, MA**
  Value Engineer responsible for facilitating a workshop for upgrades to the Fitchburg Line that included an extended section of third track, new signals, and station upgrades.

Resumes

Russell Ferretti, PE, CMQ/OE, CQA

Quality Manager

Russell was chosen for this role on this project due to his extensive experience as a quality assurance manager at MTA – MNR, where he created coordinated QA policies throughout the MTA.

Russ has 48 years of increasingly responsible positions in Project & Construction Management, Engineering and Quality Assurance in the Transportation, Power and Buildings industries in both public and private sectors.

Representative Professional Record

- **STV Incorporated, Buildings & Facilities Division, 2010-2013**
  Division Quality Manager responsible for the implementation and monitoring of Corporate and Division Quality Program requirements for design projects in company offices nationwide, including project support, training and auditing. Supported Project Managers with project implementation plan development including quality requirements, provided design quality support on multiple projects, audited Division projects for satisfaction of requirements and needed process improvements, provided quality system training for Division offices and personnel nationwide. Reported directly to the Division Executive Vice President and coordinated with the Corporate Quality Director on quality program performance results and improvement needs. Performed project quality audits including customer surveys to identify weaknesses, trends and quality program elements needing improvement. Initiated project corrective actions as needed. Reviewed and approved sub-consultant quality plans and monitored implementation. Trained and coached new employees and project team members on quality program requirements.

  Performed Quality Engineering Manager functions on various projects including: modernization of the 240,000-sf West Point Military Academy Science Center buildings, involving renovation and upgrade of plumbing, lighting, HVAC, telecommunications, and life safety building systems; design of upgrades for West Point Eisenhower Hall Fire Alarm and Public Address systems; fast track design/build of Central Utilities Building for the NY State Office of General Services South Beach Psychiatric Center.

- **MTA Metro-North Railroad, 1989-2010**
  Assistant Director of Quality Assurance responsible for development and implementation of Metro-North Capital Project Management System and Quality Assurance activities for all capital projects to ensure safe, effective and high quality

PRIMARY QUALIFICATIONS

- *Extensive experience in quality assurance in the transportation, power, and building industries*
- *Developed and implemented a railroad QA/QC program*
- *Developed and managed the capital program policy and procedure for a major transportation agency*

EDUCATION

- *MBA, Rutgers University*
- *BS, Civil Engineering, University of Rhode Island*
- *Project Management Courses, American Management Association & National Transit Institute*

CERTIFICATIONS

- *Registered Professional Engineer: NJ, NY*
- *Certified Quality Systems Manager and Auditor*

PROFESSIONAL ASSOCIATIONS

- *American Society for Quality, Past Chair of NY/NJ Metropolitan Section*
- *National Transportation Quality Consortium, Past Chair*
- *Institute for Supply Management, Rail Industry Quality Committee, Past Chair*
- *Association of American Railroads, Quality Assurance Committee, Past Chair*

WORK HISTORY

- *Jacobs Engineering Group, 2013-Present*
- *STV Incorporated, Buildings & Facilities Division, 2010-2013*
- *MTA Metro-North Railroad, 1986-2010*

YEARS OF EXPERIENCE

- *With Current Firm: 2*
- *With Other Firms: 27*
- *Total Years Experience: 29*

Resumes

management of capital project design, construction, procurement and operations work. Coordinated with Federal Transit Administration and MTA Independent Engineering personnel.

Directed Metro-North Quality Assurance staff and supported Project Management and Force Account Departments with planning and implementation of design, procurement, construction, manufacturing and quality assurance activities on Metro-North capital improvement projects. Led project quality engineering activities with review and approval of Metro-North, contractor & consultant QA programs. Responsible for development and implementation of company Capital Project Management System training program.

Recommended policies and directed the development and implementation of Metro-North's Vendor Quality Program to ensure that procured products and services satisfy specified requirements.

Coordinated Metro-North's QA Program with other MTA agencies (NYC Transit, Long Island Railroad, MTA Bridges & Tunnels) and transportation authorities in the USA to promote consistent QA policies within the transit and vendor community. Administered Metro-North All Agency Contractor & Consultant Evaluation program with MTA Headquarters and Agencies. Represented Metro-North on the Association of American Railroads QA Committee to establish consistent QA policy and sharing of vendor information among all North American railroads. Represented Metro-North on American Public Transportation Association Quality Service Task Force developing a quality program for the transit industry.

Directly performed quality management & engineering functions during design & construction of the $400 million Hannon Shop & Yard Replacement program, a 6-year facility upgrade in Croton-on-Hudson, NY. Project role included QA/QC program development and management during this three-phased Design/Build and Design/Bid/Build project over more than 8 years working directly with Railroad Project Management, design consultants and construction contractors for all design & construction quality assurance, quality engineering and control matters. Directly supported other Metro-North capital projects involving bridge and tunnel rehabilitation, station improvements, infrastructure improvements, rolling stock procurement/rehabilitation and information technology improvements.

- **Metro-North Railroad, Capital Programs Division**
  Project Manager responsible for the development and management of capital projects including Park Avenue Tunnel Improvements and Park Avenue and Yonkers Viaduct Rehabilitation. Included management of professional staff and design consultants on various Metro-North bridge and tunnel improvement projects and coordination with other Metro-North support departments.

Resumes

Gerard Ruggiero, CSP

Safety / Security Leader

Gerard was chosen for this role on this project due to his unique understanding of the safety and security challenges facing transit agencies.

Gerry's professional career has encompassed all aspects of transit system safety, including heavy rail, light rail, commuter rail, bus and Para-transit. Since joining Jacobs, he took the leadership role in the company's work with Amtrak – ARRA project as the lead HSE Manager for the rail program. Gerry has developed health and safety action plans (HASAPs) for several rail and airport projects including All Aboard Florida, East Side Access, Wachusett Station and P& W Railroad GEC contract, Barnstable Airport, Beverly Airport, Nantucket Airport, and Burlington Airport.

Prior to joining Jacobs, Gerry held numerous upper management and mid-level positions with the Massachusetts Bay Transportation Authority (MBTA) during his 24 year career, including Deputy Director of Safety, Assistant Director of Engineering and Construction Safety, System Safety Engineer and Engineering Representative for the Railroad Operations Division. He has a complete understanding of the safety and security requirements necessary to perform construction work on an operating rail system.

Earlier in his career, Gerry worked at Guilford Transportation Industries, for 5 years as a Project Engineer where he prioritized work schedules, assisted with track surveys and delegated assignments for field staff. As Deputy Director for MBTA, he interfaced with CSX the Old Colony Railroad Rehabilitation Project.

Representative Projects

- **Massachusetts Bay Transportation Authority, Commuter Rail System Procurement Assistance, Boston, MA**
  HSE Manager supporting the project management, regulatory compliance, engineering, and technical support services to the MBTA in order to assist in the transition to a new third party operations and maintenance services provider for the Commuter Rail System in Massachusetts and Rhode Island. Work comprised ODRL review for safety submittals regarding safety and security plans, accident incident reporting, workplace safety programs, emergency preparedness planning, proficiency testing, and quality plan review.

- **Amtrak, Accessible Stations Development Program, Nationwide US**
  National Rail Safety Program Manager for the ADA construction renovations to approximately 400 stations. Develop plans, organize and manage the HSE program

PRIMARY QUALIFICATIONS

- *Known in the rail safety industry serving on several FRA, APTA and AREMA safety committees*
- *Unique understanding of the safety and security challenges facing transit agencies*
- *Construction and operations safety / security background*

EDUCATION

- *MA, Management, Emmanuel College, 2007*
- *BS, Civil Engineering, University of Lowell, 1987*

CERTIFICATIONS

- *Certified Safety Specialist (Rail Transit), World Safety Organization*

PROFESSIONAL ASSOCIATIONS

- *Member, APTA, AREMA TRB*
- *Railroad Safety Advisory Committee Member, Federal Railroad Administration*
- *1997 Recipient of the Safety Recognition Award from Millar Elevator Company*

WORK HISTORY

- *Jacobs Engineering Group, 2010-Present*
- *Massachusetts Bay Transportation Authority, 1987-2010*
- *Guilford Transportation Industries, 1983-1986*

YEARS OF EXPERIENCE

- *With Current Firm: 5*
- *With Other Firms: 27*
- *Total Years Experience: 32*

Resumes

for assigned projects. Interface with project and operations management, including subcontractors and other representatives.

- **Amtrak, ARRA Program Management, Nationwide US**
  HSE Manager responsible for assisting Amtrak in implementing safely and effectively over 100 projects at more than 500 different locations in 46 states over a 24 month period. Administer, coordinate and implement the project health, safety, security and environmental management systems. Lead HSE professional at the Boston office.

- **Maryland Transit Administration, Baltimore, MD**
  HSE Manager for 16-mile light rail project extending from Bethesda to New Carrollton which will provide a direct link to Amtrak, MARC and WMATA. Review preliminary design drawings from a safety perspective, review safety submittals related to MTA operating procedures. Member of the Fire Life Safety Security committee and the Safety Certification Team.

- **Maryland Transit Administration, System along the Brunswick and Camden Lines, MD**
  HSE Manager supporting the project management, regulatory compliance, engineering, and technical support services to the Maryland Transit Administration (MTA) in order to assist in the transition to a new third party operations and maintenance services provider for the Maryland Area Regional Commuter (MARC) system along the Brunswick and Camden Lines. Work comprised CDRL review for safety submittals regarding safety and security plans, accident incident reporting, proficiency testing, and quality plan review.

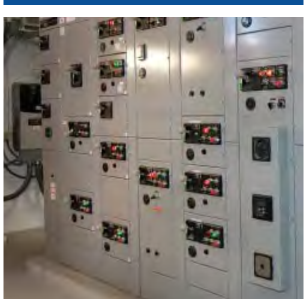
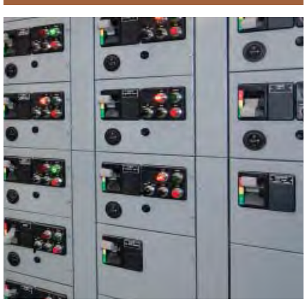
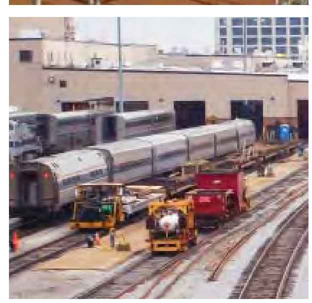
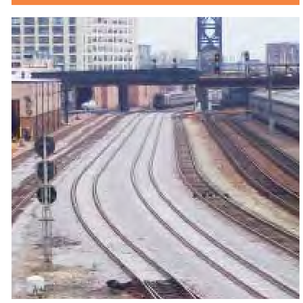
Relevant Projects with Other Firms

- **Massachusetts Bay Transportation Authority, Boston, MA**
  Deputy Director of Safety responsible for managing, planning, directing, and monitoring system safety for all operational transportation modes and construction projects for the fifth largest public transportation system in the United States. Supervised the day-to-day operations of the MBTA Safety Department staff of 24 safety professionals. Administered the FTA state oversight Safety Performance Program, including development and implementation of the MBTA System Safety Program Plan and Security and Emergency Preparedness Plan. Develop the MBTA System Safety/Security Certification Program, which insures that safety and security measures are integrated into the life cycle of revenue service extensions, new vehicles and facilities. Recent examples include; Greenbush Commuter Rail Extension, Ansaldobreda Light Rail Vehicles, Airport Station construction and Silverline BRT Project. MBTA primary liaison to the Department of Public Utilities, Federal Transit Administration, Federal Railroad Administration, National Transportation Safety Board, and American Public Transportation Association in matters concerning safety and security and/or the investigation of serious accidents/incidents. Oversee the annual operating and capital safety budget to ensure that adequate funding is being appropriated for safety and security initiatives.

- **Massachusetts Bay Transportation Authority, Boston, MA**
  Assistant Director of Safety for Engineering and Construction responsible for managing day-to-day activities of the Construction and Engineering Safety Staff. Was responsible for the safety of over 45 construction contracts working on MBTA property. Chairman of the Ansaldobreda Green Line Vehicle Derailment Team which allowed for the safe operation of the fleet of 95 LRV's. Provided safety oversight for Bus Operations and Construction Department regarding new Compressed National Gas (CNG) facilities and vehicles. Identified problems, diagnosed causes and determined corrective actions for several construction projects. Assisted subordinates and supervisors in identifying and resolving safety hazards Coordinated National Elevator/Escalator Safety Week at the MBTA since 1995 demonstrated effective communication and negotiation skills.

4 References



Section 4 | References

A. Three Client References

JACOBS ENGINEERING GROUP INC. (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
University of Texas at Austin PO Box 7580 Austin, TX 78713 [redacted], [redacted] Utilities and Energy Management [redacted]	University of Texas at Austin, Utility Master Plan and CHP Implementation and Energy Master Plan and Implementation	2005 – Ongoing	Roger Copeland; Kent McAnally; Joe Saltarelli; Mike Lewis; Darrell Widner; Morgan Sutton; Gabe Serna; Kevin Fox; Rodney Carpenter
Short Description: Design of new generation and interconnect to complete a microgrid; plant and campus district energy system design; life cycle costing; financial analysis; full-service design engineering; construction estimates; and construction support services.			
University of Minnesota 319 15th Avenue SE Minneapolis, MN 55455 [redacted]	University of Minnesota, Combined Heat and Power Plant	2012 – Ongoing (Currently in Construction)	Roger Copeland; Herb Tull, Kent McAnally; Joe Saltarelli; Mike Lewis; Morgan Sutton; John Beaudry; Darrell Widner; Gabe Serna; Kevin Fox; Rodney Carpenter
Short Description: Design of new generation and interconnect to complete a microgrid; plant and campus district energy system design; life cycle costing; financial analysis; full-service design engineering; construction estimates; and construction administration.			
Confidential Client Confidential Midwest Address [redacted]	Confidential Client, Blackstart Turbine Generator and Substation Addition	2013 – 2014	Roger Copeland; Herb Tull; Darrell Widner; Morgan Sutton; Gabe Serna; Kevin Fox; Rodney Carpenter
Short Description: Jacobs provided planning; detailed full-service design engineering; construction management; startup phase services.			
PANYNJ Two Gateway Center Newark, NJ 07102 [redacted] Additional Contact: [redacted]	PANYNJ, PATH – Replacement of Substation No. 9, Harrison, NJ	2014-2018	Diaa Elmaddah; Thomas Decker
Short Description: Jacobs provided architectural and engineering services for the design of a new PATH Substation no. 9. The existing substation had been submerged under a few feet of water and rendered completely unusable after Super Storm Sandy flood waters receded. Repairs were made to the substation but, due to the extensive nature of the repairs and patchwork, the reliability and maintainability of equipment was compromised and now poses a risk to continuous operation and a satisfactory level of customer service. As such, the replacement of Substation No. 9 is critical to PATH operations.			

Section 4

BURNS ENGINEERING, INC. (BURNS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Power Generation System to Increase System Resiliency and Reliability	11/2013 – 02/2014	Bruno Fiorentino; Michael Walton; Daren Petroski
Short Description: Hired to work with Sandia National Labs as a subconsultant to Jacobs, Burns undertook a comprehensive assessment of the economic, technical and operational feasibility of "TransitGrid." A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations and innovative operating strategies. Burns evaluated distributed energy resources that would support non-traction power loads at outlying passenger facilities including cogeneration, solar PV, fuel cells, battery storage and demand response.			
Philadelphia Industrial Development Corporation The Navy Yard, Building 101 4747 South Broad Street Philadelphia, PA 19112 [redacted]	Philadelphia Navy Yard, Smart Micro-Grid Energy Master Plan, Philadelphia, PA	2012 – Ongoing	Bruno Fiorentino; Michael Walton
Short Description: PIDC hired Burns to: study and plan a Smart Microgrid for the Philadelphia Navy Yard campus with a seven-firm team; act as client and stakeholder liaison for over 60 organizations; and provide planning, energy consulting, and engineering.			
Amtrak 30th Street Station, 3rd Floor South Philadelphia, PA 19104 [redacted]	Amtrak, Zoo to Paoli Transmission Line, Philadelphia, PA to Paoli, PA	2011 – Ongoing	Daren Petroski; Randy Winks
Short Description: Burns is the lead design firm responsible for the design of two, 138 kV transmission lines between the existing Paoli and Zoo substations with the addition of a new 138kV to 12kV traction power substation at Bryn Mawr and upgrade of traction power substations at Zoo and Paoli.			

Section 4

LEVITAN & ASSOCIATES, INC. (LEVITAN) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
New York University 10 Astor Place, 6th Floor New York, NY 10003 [redacted]	NYU Cogeneration Microgrid Project	2002 – 2005	Seth Parker; Phil Curlett
Short Description: LAI prepared an initial economic screening analysis of microgrid cogeneration alternatives (diesel and gas turbine options) for NYU and provided ongoing economic, contractual, operational, and financing advice to NYU and its engineer, Vanderweil. We also completed a detailed lifecycle financial analysis for the $100+ million, 13.4 MW gas turbine/steam turbine cogeneration project that was approved by the NYU Board. The plant operated successfully in the aftermath of Superstorm Sandy while the rest of southern Manhattan was blacked out and reduces NYU's electricity costs and air emissions.			
Cornell University [redacted]	Cornell University Microgrid Energy Master Plan	Analysis: 2004-2006 Construction: 2006-2009	Phil Curlett; John Bitler; Matt DeCourcey
Short Description: LAI developed a comprehensive technical/financial model of the campus energy system to calculate the life-cycle costs for alternative CHP expansion concepts under a range of load growth and market conditions. Our model used a probabilistic module to capture load and fuel price volatility in the short run and different scenarios in the longer run. Based on our economic screening analysis and advance probabilistic evaluations, two 15 MW Solar Titan gas turbines with heat recovery steam generators were added to the existing CHP, along with a 3.2 mile dedicated gas lateral, a new 115 kV substation, and a dump condenser in the $82.3 million project.			
New York Power Authority 123 Main Street White Plains, NY 10601-3170 [redacted]	Hudson Transmission Project PJM Interconnection for New York Power Authority	Analysis: 2007-2009	Edward Tsikirayi; Seth Parker
Short Description: LAI shepherded the 660 MW HVDC Hudson Transmission Project through the PJM interconnection process for NYPA, the primary beneficiary, in which we identified ways to reduce system costs and improve project economics. We represented NYPA at various meetings with PJM and the local transmission owner, PSEG. We also advised NYPA on PJM market rules and dynamics, the DFAX methodology for transmission cost allocation, Capacity Export Charges and Credits, and Incremental Capacity Transfer Rights in the PJM market.			

Section 4

LTK ENGINEERING SERVICES (LTK) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Atlantic City Rail Line Operations Study	2010-2012	Bill Lipfert; Nick Willey; Ben Spears
Short Description: LTK performed physical feasibility assessment, conceptual design, review of alternative promising rail technologies (light rail, DMU, etc.), capital and O&M cost estimates, and supplemental environmental screening. Capacity and reliability assessments were performed using LTK's TrainOps® network simulation tool.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Multi-Level Commuter Rail Car Procurement	2003-2014	David Diaz; Pat Sheeran; Pallavi Lai
Short Description: LTK led the effort to assist NJ TRANSIT's program to procure 329 multi-level cars for service throughout the NJ commuter rail system, including the NEC. The project began in 2000 with LTK staff members analyzing the feasibility of multi-level commuter car operation on the corridor. The firm conducted an industry review and prepared conceptual specifications and sketches for the vehicles.			
[redacted] NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Raritan Valley Line Third Track Feasibility Study	2011-2012	Bill Lipfert; Nick Willey; Ben Spears
Short Description: LTK developed a long-term Raritan Valley Line (RVL) infrastructure master plan that provides for pragmatic solutions to accommodate growing ridership while not precluding shorter term capital improvements. Such a plan logically focuses on the possibility of a third main track for a portion of the RVL between Raritan and Cranford stations to support zone express overtakes of local trains in the peak direction.			

Section 4

INFRAMAP CORP. (INFRAMAP) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
New York State DOT Design Quality Assurance Bureau, 50 Wolf. Rd., POD 23 Albany, NY 12232 [redacted]	Professional Subsurface Utility Engineering Services, Region 1-11, Statewide for New York State Department of Transportation, (Three Year Agreements 2002-2014)	2002 - 2014	Kenneth Kerr; Jason Ebert; Christopher DeAngelis
<u>Short Description</u>: Project included supervision of client coordination, permits, traffic control, field locating, CAD, QA./QC and final deliverables for over 70 S.U.E. projects for the NYSDOT ranging in size and complexity from $7,000 to $200,000. Currently, a total of 600,000 LF of utility designating (QLB) and over 1,600 test holes (QLA) have been completed under the last two term contracts for a total cost of $3.8 million.			
ENG/CMD - Central Survey Group, Port Authority Technical Center 41 Erie Street, Room 236, 2nd Floor Jersey City, NJ 07310 [redacted]	Professional Subsurface Utility Surveying Services for Port Authority of New York and New Jersey, (Three Year Term Agreements since 2002)	2002 - current	Kenneth Kerr; Jason Ebert; Christopher DeAngelis
<u>Short Description</u>: Project included supervision of S.U.E. services at airports including Newark Liberty, John F. Kennedy, LaGuardia, and Stewart; at river crossings including Bayonne Bridge, Goethals Bridge, George Washington Bridge, Holland Tunnel, Lincoln Tunnel, and Outerbridge Crossing; as well as Port Terminals including Port Newark and Howland Hook. Currently, over 200,000 LF of utility designating (QLB) and over 100 test holes (QLA) have been completed on 90 S.U.E. projects under the last two term contracts for a total cost of $1.8 million.			
Parsons Brinckerhoff 2000 Lenox Drive, 3rd Floor Lawrenceville, NJ 08648-2314 [redacted]	NJ Route 72 Bridge over Manahawkin Bay, Stafford, NJ (2009 – present)	2009-current	Kenneth Kerr; Jason Ebert; Christopher DeAngelis
<u>Short Description</u>: The project included the utility designating of hundreds of thousands of feet of utilities, both subsurface and submarine for this project. Underwater Utility Designating included the engineering, design and building of a custom geophysical floating platform, including low frequency electromagnetic sensors. Project included over 130,000 LF utility designating (QLB) and over 120 test holes (QLA) for the project. Responsibilities include records research, supervision of targeting (QLB), field crew scheduling and coordination, in-field utility locating troubleshooting, weekly client budget and project status updates and coordination, facility coordination and QA/QC of all final deliverables.			

Section 4

EXIDA CONSULTING, LLC (EXIDA)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
[redacted] Chirico Scientiific LLC	Industrial Cyber Security	February 2015	Eric Persson
Short Description: Performed complete cyber security gap assessment. Created phenomenal defense in-depth plant floor security network layout and design, based on assessment. Continuation of cyber security training and consultation.			
Phoenix Contact [redacted]	Shared Cyber Services Audits	7/14-Present	Eric Persson
Short Description: This project involved Eric Persson/Exida to augment Phoenix Contact staff to perform Cyber Security Audits on Industrial Control Systems in various industries. Eric is responsible for completing these audits within the agreed upon schedule and within budget.			
Tennessee Valley Authority (TVA)	Company Wide Security Upgrade for FERC Standards	2/1/2011 – Ongoing	Eric Persson
Short Description: TVA needed to perform a complete security assessment of their facilities and determine the best way to protect themselves and meet the FERC requirements. The solutions included using a variety of different technologies such as firewalls, VPN connections, Deep Packet Inspection, etc. to secure the various plants. No more detail about the design can be given as this information is held in confidence.			

Section 4

GTS CONSULTANTS, INC. (GTS)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Subconsultant to: Jacobs Engineering 299 Madison Avenue Morristown, NJ 07962 [redacted]	Lackawanna Cut-Off Passenger Rail Service Restoration, Netcong, Byram, and Andover, NJ	2008-2014	Fredrick L. Voss; Thurman Golightly; Mikhail Zavyazkin
Short Description: GTS Survey Support: Established survey control for aerial mapping, established ground survey baseline and benchmarks for 8-mile segment, provided track bed cross-sections, recovered and established existing railroad right-of-way, detailed topographic survey for bridge overpasses, grade crossings, and new passenger station area, detailed topographic survey for off-site culvert improvements, survey for eroded washout area, located wetlands as delineated by others, stream cross-sections for hydraulic modeling			
Subconsultant to: Jacobs Engineering 299 Madison Avenue Morristown, NJ 07962 [redacted]	County Yard Improvements, New Brunswick and North Brunswick, NJ	2014-2018	Fredrick L. Voss; Joseph Messina; Kenneth Moscetti; Mikhail Zavyazkin
Short Description: GTS Survey Support: Established survey control for aerial mapping, established ground survey baseline and benchmarks for 5-mile segment, provided track bed cross-sections, recovered and established existing railroad right-of-way, detailed topographic survey for bridge overpasses, grade crossings, and new passenger station area,, located wetlands as delineated by others, stream cross-sections for hydraulic modeling, 3-D Laser Scanning for limited segments of NEC tracks and catenary wires, extensive surface and sub-surface utility survey, preparation of right-of-way acquisition documents			
Subconsultant to: Jacobs Engineering 299 Madison Avenue Morristown, NJ 07962 [redacted]	Meadowlands Maintenance Complex Kearny, NJ	2013-2017	Fredrick L. Voss; Joseph Messina; Mikhail Zavyazkin
Short Description: GTS Survey Support: Established survey control for aerial mapping, developed topographic survey and key elevations to evaluate flooding risk/potential at critical electrical and building components, performed detail topographic survey for Rail Operations Center (ROC) Building, established system of vertical control (benchmarks) throughout the complex to facilitate elevation measurements to electrical system components, provided detailed edit of aerial mapping to incorporate ground features and utility structures			
Subconsultant to: Jacobs Engineering 299 Madison Avenue Morristown, NJ 07962 [redacted]	West Summit Interlocking, Summit, NJ	2013-2014	Fredrick L. Voss; Joseph Messina; Mikhail Zavyazkin
Short Description: GTS Survey Support: Established survey control for aerial mapping, developed topographic survey and utility locations along the entire project limits, performed nigh time 3-D Laser Scanning of electrical and communications cables attached to walls in cut section to minimize track outages and interference with rail operations, established existing rail right-of-way throughout 2.5 mile corridor			

Section 4

JERSEY BORING AND DRILLING (JERSEY BORING)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Portal Bridge Capacity Enhancement Project (Tri-Venture) (E6X67800)	2008 to ongoing Design Est. 2013 Constr. Est. 2019	Shelley Lach; Dennis Spearnock; Frank Carrozza
Short Description: Drilling Reconstruction for a 99-year old swing bridge and track upgrades for NJ TRANSIT and Amtrak. Jersey Boring was in charge of coordinating test boring and instrumentation operations. The project scope of work included hundreds of test borings including soil boring, rock coring, and instrumentation and monitoring well installation on land and over water. Truck, track, ATV, and skid mounted drill rigs as well as rigs mounted on a barrel float or barge for drilling over water.			
NJ TRANSIT/THE Partnership 2 Gateway Center, 17th Floor, Newark, NJ 07102 [redacted]	Access to the Region's Core/Trans-Hudson Express Tunnel Project, Hudson County, NJ and New York, NY	2009-2010	Shelley Lach; Dennis Spearnock; Frank Carrozza
Short Description: Jersey Boring was in charge of coordinating all field drilling operations including test borings, New York City and New Jersey Department of Transportation permits and traffic regulations. The project scope of work included hundreds of test borings including soil boring, rock coring, packer testing, and instrumentation installation. Responsibilities included scheduling and coordination of drilling crews, obtaining permits, and field supervision.			
STV, Inc. 225 Park Avenue South, 5th Floor New York, NY 10003 [redacted]	Metropolitan Transportation Authority/Long Island Rail Road, East Side Access Project, New Jersey/New York	2003 - Present	Shelley Lach; Dennis Spearnock; Frank Carrozza
Short Description: Jersey Boring is in charge of coordinating all field drilling operations including test borings and New York City Department of Transportation permits. The project scope of work included hundreds of test borings including soil boring, rock coring, packer testing, and instrumentation installation. Responsibilities included scheduling and coordination of drilling crews, directing subcontractors, obtaining permits, and field supervision.			

Section 4

LKG-CMC, INC. (LKG) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Metropolitan Atlanta Transit Consultants (MATC) 2400 Piedmont Road NE PO Box 13087 Atlanta, GA 30324 [redacted]	General Engineering Consultant Services for Track and Systems	July 2007 –June 2016	Veronica Hollis; Robin Miller; David Gaillard
Short Description: LKG performed the following services: Document Control; Configuration Management; Contract Administration; Cost Analysis; Construction Administration; RFI Processing and Tracking; Submittal Processing and Tracking; Change Control; Contract/Accounting Services; Office Engineering; Policies and Procedures; Administrative Support.			
General Engineering Consultant 469 7th Avenue 16th Flr. New York, NY 01118 [redacted]	MTA/LIRR Eastside Access GEC	October 1999 – December 2015	Alla Kudravitsky; Ethel Harris; Kia Frasier; Dawn McLeod; Kathy Tsirkas
Short Description: LKG performed the following services: Scheduling; Project Controls; Fire Protection Engineering; Electrical Engineering; Architectural Services; Specification Development Support; DBE Plan Development; Safety Certification Tracking; Configuration Management; Document Control; Database Development; CADD; Administrative Support; Submittal Processing and Tracking; RFI Processing and Tracking.			
Parsons Brinckerhoff One Penn Plaza Suite 200 New York, NY 10119 [redacted]	Second Avenue Subway	July 2007 – December 2017	Juan Viruet
Short Description: LKG performed the following services: Document Control; RFI Processing and Tracking; Submittal Processing and Tracking.			

Section 4

MATRIX NEW WORLD ENGINEERING, INC. (MATRIX) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
STV, Inc. 225 Park Avenue South, 5th Floor New York, NY 10003 [redacted]	Metropolitan Transportation Authority/Long Island Rail Road, East Side Access Project, New Jersey/New York	2000 - 2014	Clare Sullivan; Matthew Duffy; Jody Mack
Short Description: Matrix is the MTA/LIRR East Side Access Task Manager for the Environmental Site Investigation (ESI), construction specifications, Construction Contaminant Management Plans (CCMP), environmental-related cost estimates and Remedial Action Workplan (RAWP) for several design packages including Grand Central Terminal, Arch Street, 63rd Street Yard A and Harold Interlocking. The Arch Street Yard and Maintenance Facility and Grand Central Terminal (Madison Yard and East Yard) required the preparation of site-specific Sampling and Analysis Plans (SAPs) for the collection of environmental data for the eventual management of contaminated materials (soil, ballast, timber ties, asbestos, lead-based paints, sediments, surface water and groundwater). All of the design packages required the preparation of construction specifications, CCMPs and RAWPs. Matrix has also assisted in the preparation of various environmental-related permits for the off-site management of contaminated materials prior to construction activities.			
AECOM 20 Exchange Place New York, NY 10005 [redacted]	Metropolitan Transportation Authority/NYC Transit Environmental Services, 2nd Avenue Subway	2001 - 2014	Clare Sullivan; Donald Wendt; Gavin Gilmore
Short Description: Matrix is providing environmental services, including field investigation work, data management, permitting assistance, geotechnical-environmental-related design, report preparation and construction management services during the preliminary engineering, final engineering and construction phases of the project. The Second Avenue Subway Project is estimated to be a $17 billion construction project. It will eventually extend new subway service beneath Second Avenue from 129th Street down to lower Manhattan. The initial phase of the project covers the northern half of the line from 129th Street to 57th Street. The new line will be used by approximately 384,000 riders per day. Field services provided by Matrix included hazardous materials investigations to evaluate the presence of soil and groundwater contamination during the advancement of geotechnical and environmental borings being conducted over the length of the project area (approximately 8.5 miles) including work in the New York City Parks that would be impacted by the work on the alignment. Matrix also prepared the Construction Environmental Protection Program (CEPP) for the project, which assigns specific responsibilities for environmental compliance and communication, addresses monitoring procedures, and provides an overview of the types of mitigation measures and coordination necessary to limit potential impacts to the environment, protected resources, and communities within and abutting the project alignment. This CEPP has become a model for New York City Transit (NYCT) projects.			
City of New York Department of Design and Construction 30-30 Thomson Avenue Long Island City, NY 11101-3045 [redacted]	New York City Department of Design and Construction (NYCDDC), Geotechnical Inspection Services for Various Projects, New York, NY	2005 - 2011	Donald Heck; Charles Bassett; Brian Stabile
Short Description: Matrix provided a variety of geotechnical engineering services under a multi-year indefinite quantity contract with the Bureau of Environmental & Geotechnical Services of the New York City Department of Design and Construction (NYCDDC). The tasks performed to date primarily include the field oversight of land and water geotechnical borings, the preparation and coordination of laboratory testing of selected samples of soil and rock, and the preparation of records of the borings which include boring location plans, logs of the borings, and the results of the laboratory testing. Geotechnical reports were also prepared on select tasks. Pavement cores, groundwater monitoring wells and test pits have also been completed as part of many geotechnical investigations.			

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<table>
<tr><th colspan="4">RICHARD GRUBB & ASSOCIATES, INC. (RGA)
Three (Minimum) Client References</th></tr>
<tr><th>Client Name
Reference Contact Information</th><th>Project Title</th><th>Start & End Date</th><th>Key Personnel Involved</th></tr>
<tr><td>New Jersey Department of Transportation (NJDOT)
1035 Parkway Avenue
Trenton, NJ 08625
[redacted]</td><td>NJDOT Term Agreements, Cultural Resources Services, Various locations throughout New Jersey</td><td>2010-Ongoing</td><td>Paul McEachen; Glenn Modica; Damon Tvaryanas; Ilene Grossman-Bailey; Michael Gall; Megan Springate; Robert Lore; Jennifer Leynes; Philip Hayden; Michael Tomkins; Virginia Brounce Overberger</td></tr>
<tr><td colspan="4"><u>Short Description</u>: Provided various cultural resources consulting services on behalf of the NJDOT, including cultural resources screenings, Phase I-III archaeological surveys, reconnaissance and intensive-level architectural surveys, and fulfilling mitigation measures, such as Historic American Buildings Survey/Historic American Engineering Record documentation and National Register nominations. Projects include Phase I/II cultural resource surveys and mitigation measures for two NJ Route 27 bridge replacement projects in the borough of Metuchen. Phase III archaeological data recovery investigations at the Cooper-Mann House Site (28-Sx-399) and the Stites Farmstead and Prehistoric Site (28-Un-36); National Register of Historic Places Nomination for the Sussex Borough Historic District.</td></tr>
<tr><td>Delaware Department of Transportation (DelDOT)
P.O. Box 778
800 Bay Road
Dover, DE 19903
[redacted]</td><td>DelDOT Parent Agreements 1417 and 1537, Cultural Resources Services, Various locations throughout Delaware</td><td>2010-Ongoing</td><td>Paul McEachen; Glenn Modica; Damon Tvaryanas; Ilene Grossman-Bailey; Michael Gall; Sharon White; Jennifer Leynes; Philip Hayden; Michael Tomkins; Virginia Brounce Overberger</td></tr>
<tr><td colspan="4"><u>Short Description</u>: Provided various cultural resources consulting services on behalf of the DelDOT, including Phase I, II, and III archaeological surveys. Projects include Phase I and II archaeological surveys for the Howell School Road improvement project, and Phase II and III archaeological surveys for the U.S. Route 301 (Levels Road Mitigation Site and Section 3 Mainline) Road improvement project.</td></tr>
<tr><td>U.S. Fish and Wildlife Service (USFWS), Region 5
300 Westgate Center Drive
Hadley, MA 01035
[redacted]</td><td>USFWS, Region 5 Indefinite Delivery/Indefinite Quantity (IDIQ) Contract, Cultural Resources Services, Southern Zone, States of DE, MD, and NJ</td><td>2006-Ongoing</td><td>Paul McEachen; Glenn Modica; Damon Tvaryanas; Jesse Walker; Megan Springate; Ilene Grossman-Bailey; Philip Hayden; Michael Tomkins</td></tr>
<tr><td colspan="4"><u>Short Description</u>: Provided various archaeological surveys on behalf of the USFWS, Region 5 within the Southern Zone states of Delaware, Maryland, and New Jersey, including several involving geomorphological investigations. Archaeological surveys and archaeological overview and assessment reports were performed at the Bombay Hook National Wildlife Refuge, Delaware; Blackwater National Wildlife Refuge and Patuxent Research Refuge, Maryland; Edwin B. Forsythe National Wildlife Refuge, New Jersey; and Target Rock National Wildlife Refuge, New York. Several of the projects involved the identification of archaeological sites that necessitated Phase II site evaluation work.</td></tr>
</table>

SJH ENGINEERING, P.C. (SJH) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105	Portal Bridge Capacity Enhancement Project	08/2008 – 06/ 2013 Est. Const. Compl. 2019 (Ongoing) Construction Not Started	Venket Tiruchirappalli
Short Description: Under this $1.7 billion design project, the existing swing bridge river crossing is being replaced and a new parallel crossing is being added. The design features 3-span tied-arch structures with adequate clearance for navigational traffic below. SJH provided cost estimating and design services, and prepared construction documents for the installation of Construction Access Platforms, estimated at $49 million.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105	Hurricane Sandy Repairs for Electrical Substation and Related Equipment at Hoboken, MMC and Bay Head	05/2013 - Ongoing	Venket Tiruchirappalli
Short Description: SJH is providing structural, civil and geotechnical engineering services. Project responsibilities include assessments, evaluation, analysis, alternatives, design, and construction assistance services for the repair, reconstruction and replacement of electrical substations and equipment. The first $200M task involves elevating buildings above grade, strengthening floors, demolishing buildings, and modeling HVAC/MEP components of buildings in REVIT.			
USDOT, USMMA 300 Steamboat Road Kings Point, New York 11024	UDOT USMMA Buildings Evaluation Report	07/2012 – 01/2013	Venket Tiruchirappalli
Short Description: Cost Estimating and comprehensive asset condition assessments for short-term operational continuity and long term capital improvements/ utilization for 48 campus assets. Conducted inspections and estimated recommended repairs for electrical, mechanical, environmental, structural, civil, and architectural deficiencies on the 82 acre waterside campus. Infrastructure improvements included electrical distribution.			

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SOWINSKI SULLIVAN ARCHITECTS, P.C. (SSA) Three (Minimum) Client References			
Client Name Reference Contact Information	**Project Title**	**Start & End Date**	**Key Personnel Involved**
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	North Brunswick Station, North Brunswick, NJ Wesmont Station, Wood Ridge, NJ	2013–Ongoing (Design) 2009 – 2013 (Design/Construction	Richard Sullivan; Rob Witte; Anastassia Kowalski
<u>Short Description</u>: North Brunswick: Architect on a team for the new station at North Brunswick located along the “New Jersey Speedway” section of the Northeast Corridor (NEC). The station is part of the Mid Line loop project which will provide a direct route for west bound trains to cross the NEC tracks and return east. The station will provide access to new a high level inbound and outbound twelve car island platforms over the NEC tracks via a pedestrian bridge equipped with stairs and elevators. Wesmont Station: Architect on a team of consultants that designed a new station to anchor a transit village-style mixed use project. There is one center island high-level platform, an overpass, two elevators and stair towers. The station was designed to utilize natural ventilation and daylighting techniques by using wire mesh to enclose the overpass and stairs.			
Metro North Railroad 525 North Broadway White Plains, NY [redacted]	Harmon Yards Shops & Facilities: Master Plan & Phased Replacement, Croton on the Hudson, NY	2001 – Ongoing (Design/Construction)	Richard Sullivan; Suzanne Sowinski; Anthony Horler
<u>Short Description</u>: Architect for the rehabilitation of Croton Harmon Yard. The Harmon Complex is and has been a key location for maintenance activities related to the operation of Metro North Railroad (MNR). A and two predecessor railroads. A master plan was developed in 2001 for the reconstruction and expansion of the yard’s storage tracks, maintenance buildings and shop facilities. The projects under this plan included design service for yard improvements, new maintenance and shop facilities, a new yard tower and a 200’-span bridge connecting the existing station with a new maintenance building. Ph I focused on safety upgrades, historic restorations and infrastructure improvements. During Ph III, SSA was the architect for four new shops built to replace the existing maintenance building and house locomotive, coach, electric car, and wash facilities. In Ph IV, SSA designed new employee offices and facilities. Currently, SSA is working with Metro North Railroad of Ph V, which involves a complete replacement of the existing main shop and the construction of a new Consist and EMU shop, as well as new offices, welfare facilities and training spaces.			
SEPTA 1234 Market St. Philadelphia, PA [redacted]	SEPTA New Payment Technologies, 12 Stations, Various Locations, PA	2012 – 2014 (Design); Construct: 2014 – Ongoing	Richard Sullivan; Suzanne Sowinski; Kelly Freeman; Rob Witte
<u>Short Description</u>: Architect to assist SEPTA by developing viable and implementable solutions to achieve the transition to new fare control at ten subway/ elevated rail stations: 69th Street, 52nd Street, 30th Street, 8th Street, 2nd Street, Frankford Transportation Center, Olney, Cecil B. Moore, Walnut Locust and AT&T; as well as two light rail stations: 19th Street and 22nd Street as part of their New Payment Technologies initiative.			

SULLIVAN COVE CONSULTANTS, LLC (SULLIVAN COVE) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Maryland Public Service Commission [redacted]	Maryland Public Service Commission, Drafting of Regulations Implementing Maryland Offshore Wind Energy Act of 2013	01/2014 –11/2014	John Graham
Short Description: As MBE subcontractor to prime contractor Kaye Scholer, Sullivan Cove provided the full spectrum of legal services to the team preparing regulations to implement the Maryland Offshore Wind Energy Act of 2013. Services included Assessments, Meetings and Presentations, Coordination of processes with federal Bureau of Ocean Energy Management, Legal Drafting of Regulations and appearance before the Commission and Presentation of Draft Regulations to the Commission.			
[redacted] Office of National Labs DHS Science & Technology Directorate [redacted]	Department of Homeland Security – Legal Support Services for National Bio and Agro Defense Facility, Manhattan, KS	07/2007 –12/2013	John Graham
Short Description: Legal and Legal Support Services and representation of the real estate division of the Science and Technology Directorate of the Department of Homeland Security (DHS) in the site development and acquisition of the four NBAF parcels of land: Drafted, negotiated and recorded easements, subordinations and other agreements; Prepared the Certificate of Inspection and Possession; Prepared the title commitment and title opinion; Reviewed and renegotiated easements to satisfy requirements of Department of Justice; Monitored all documents necessary for closing; Documented all negotiations; Prepared detailed reports to DHS to provide updates and ongoing progress reporting; Coordinated with team members at DHS; Post-closing document delivery, monitoring and reporting on all funding matters.			
Federal Communications Commission Office of the Inspector General 445 12th Street, SW, Washington, DC 20554 [redacted]	Legal Support Services for the Office of Inspector General of the Federal Communications Commission	9/29/2009 – 12/31/2010	John Graham
Short Description: As prime contractor, we provided the full spectrum of legal support services for the OIG at the FCC. The project involved more than 20 FTEs performing tasks set forth in 26 separate task orders over a 16-month period.			

B. Project Manager and Deputy Project Manager References

ROGER COPELAND, PE | PROJECT MANAGER/POWER LEAD (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Confidential Midwest Utility Client, New Richmond, OH [redacted]	Macrogrid PJM Blackstart Addition, Ohio	October 2013 – October 2014	Darrell Widner; Kent McAnally; Herb Tull; Gabriel Serna; Morgan Sutton; Rodney Carpenter
Short Description: Project Executive/Technical Leader provided EPCm services for the installation of equipment required to restart two large power plants in the event of a grid wide outage to this 640MW and 1280MW power plant site utilizing a LM2500 Gas turbines as the starting source for the larger power blocks to allow for grid restoration in the state of Ohio in the event of an outage like the Northeast outage of 2003. Staged isochronous control of the microgrid, as well as soft starting of the electrical system were unique challenges for these projects. Project utilized a unique starting methodology for grid restoration currently being developed for technical article.			
The University of Texas 2115 East 24th Street Austin, TX 78712 [redacted]	UT Austin Microgrid, Austin, Texas	1999-2015	Kent McAnally; Darrell Widner; Morgan Sutton; Mike Lewis; Joseph Saltarelli; Rodney Carpenter
Short Description: Numerous projects over many years supporting the campus microgrid for UT Austin. Projects have included design and installation drawings and specifications for the first of its kind General Electric 34 MW LM2500+G4 combustion turbine generator coupled to a heat recovery steam generator, a 27MW extraction condensing steam turbine generator, a 200MVA, 138kV campus substation and campus switchgear replacement, and a new campus cooling tower.			
North Carolina State University 2411 Yarbrough Drive #311 Campus Box 7513 Raleigh, NC 27695 [redacted]	NC State Microgrid, Raleigh, North Carolina	2006-2015	Morgan Sutton; Kent McAnally; Mike Lewis
Short Description: Principal Electrical Engineer responsible for the design and start-up for the addition of two gas turbines with heat recovery steam generators along with upgrades/replacements of three substations (110kV and 230kV primary) and distribution systems on campus. This included utility interconnection to the PJM grid, blackstart systems, island control for the substations, and new SEL based protection systems.			

DIAA ELMADDAH, PE, LEED® AP | DEPUTY PROJECT MANAGER (JACOBS)

Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
MTA Metro-North Railroad 347 Madison Avenue New York, NY 10017 [redacted]	Harmon Shop Replacement Program Phase III	2006 – 2009	Diaa Elmaddah
<u>Short Description</u>: Design-build, Design management, Architectural design, Electrical engineering, Rail Systems Engineering; Trackwork; Civil Engineering; Utilities Design; Construction Phase Services			
MTA Metro-North Railroad 525 N. Broadway North White Plains, NY 10603 [redacted]	Harmon Shop Replacement Program Phase V	2015 – 2017 Est. (Ongoing)	Diaa Elmaddah
<u>Short Description</u>: Design-build, Design management, Architectural design, Electrical engineering, Rail Systems Engineering; Trackwork; Civil Engineering; Utilities Design; Construction Phase Services			

C. Key Staff References

RUSSELL FERRETTI, PE, CMQ/OE, CQA (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Metro-North Railroad, NY, NY [redacted]	Capital Quality Assurance Program	September 1989 – May 2010	Russell Ferretti
Short Description: Russell Ferretti was Assistant Director of the Capital Program Quality Assurance Dept., reporting directly to Mr. Treasure and other Senior Directors since the QA Program was initiated. Developed Capital Project Management Policies and Procedures, including Quality Assurance/Quality Control, applicable to all Metro-North capital projects budgeted at approximately $200 million/year. Projects included rolling stock procurement, stations, track structures, maintenance shops & yards, power, communications. Directed staff performing project QA/QC support. Directly supported projects during design, procurement, construction, and commissioning phases of various projects. Developed and implemented Project Management Procedure Training for Project, Construction, Procurement, and Force Account Managers and support personnel.			
Long Island Rail Road, Jamaica, Queens, NY [redacted]	Joint Agency Procurement Projects - Locomotives, Coaches & Multiple Unit trains, Ticket Selling Machines, Positive Train Control Systems	2000 – 2007	Russell Ferretti
Short Description: Russell Ferretti directed Metro-North QA Staff and coordinated with LIRR Staff for design, procurement, and commissioning of rolling stock, revenue collection and automated train control systems, including new and reconditioned locomotives, new and rehabilitated coaches, new multiple-unit trains, ticket selling machines, and automated positive train control systems. Joint Agency Procurements enabled MTA commuter railroad agencies to procure new railroad system equipment and services at reduced costs through economy of scale and enabled sharing of equipment to improve operations.			
American Society for Quality, Milwaukee, WI [redacted]	NY/NJ Metropolitan Section Professional Organization	February 1990 – August 2015	Russell Ferretti
Short Description: Russell Ferretti has participated as Chair of the NY/NJ Metropolitan Section, Program Committee Chair, Section Secretary, and held other positions in this professional, volunteer organization. Organized and collaborated with past and present Section leaders and members to provide training in Quality Assurance and Control methods and tools to improve personal and organizational performance to public and private organizations in the New York City, Eastern New Jersey, and Southern Connecticut area. Participation is ongoing.			
Lake Harmony Estates Homeowners Association, Lake Harmony, PA [redacted]	Lake Harmony Estates Board of Directors	January 2012 – October 2014	Russell Ferretti
Short Description: Russell Ferretti was President of the Board of Directors, which consisted of seven Board members and was supported by a Property Management Company for the 340 homeowners in the Association. Duties involved policies, procedures, budgeting, contract management, legal matters, and homeowner communication.			

GERRY RUGGIERO, CSP | SAFETY OFFICER (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Amtrak 30th Street Station, 4th Floor Philadelphia, PA	Amtrak ARRA Project	2010-2011 (Construction)	Stan Rosenblum; Stan Grill; Gerry Ruggiero
Short Description: National Rail Safety Program Manager for the ARRA construction renovations to approximately 100 stations across the country. Amtrak was challenged to ramp up to implement safely and effectively over 100 projects at more than 500 different locations in 46 states over a 24 month period. My role was to administer, coordinate and implement the project Health, Safety Security and Environmental management systems.			
Amtrak 30th Street Station, 4th Floor Philadelphia, PA	Amtrak ASDP Program	2011-2014 (Design & Construction)	Stan Rosenblum; Stan Grill; Gerry Ruggiero
Short Description: : National Rail Safety Program Manager for the ADA construction renovations to approximately 400 stations across the country. Responsible to develop safety and security plans, organize and manage the Safety program for assigned construction projects. Interface with project and operations management, including subcontractors and other representatives.			
MBTA 10 Park Plaza Boston, MA 02116	MBTA – Positive Train Control Program Manager	2015 – Present	Gerry Ruggiero
Short Description: Short Description: Manager of Safety & Security to provide assistance to the Railroad Operations Department to achieve the successful integration of the new Positive Train Control (PTC) system design, fabrication, build-out, final integration and system cutovers within the System Integrators (SI's) approved schedule.			

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RICHARD SIRABIAN, PE | RAIL ENGINEERING & COORDINATION LEADER (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105 Nicholas Marton, PE, Capital Planning & Programs [redacted]	Portal Bridge Capacity Enhancement Project	2008–06/ 2013 Est. Const. Compl. 2019 (Ongoing) Construction Not Started	Kenneth Bienkowski; Thomas Decker; Bill George; Richard LaRuffa; Dale Legg; Richard Sirabian; Ted Turanick
Short Description: Structural Engineering; Rail Systems Engineering (Communications, Signals, Electrical); Trackwork; Civil Engineering; Utilities Design; Drainage; MPT; Support for Environmental/Regulatory Approvals; Geotechnical; Value Engineering; Risk Analysis; Scheduling; Cost Estimating; Construction Staging; Rail Operations Analysis; and Contract Packaging			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Meadowlands Rail & Roadway Improvement Project, East Rutherford, NJ	2004-2007 (Design) Miscellaneous Support Services Continued Until 2010	Kenneth Bienkowski; Richard LaRuffa; Lewis Morgan; Richard Sirabian; Theodore Turanick
Short Description: Traffic and Transportation Planning; Rail Operations Analysis; Structural Engineering; Environmental Engineering; Rail Systems Design (Communications, Signals, Electrical); Civil Design; Utilities; MPT; Traffic Analysis; Environmental/Wetlands Analysis; Survey/Right-of-Way; Value Engineering; Geotechnical Engineering; Station Design; Pedestrian Flow; Scheduling; Cost Estimates; and Construction Support Services			
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105 [redacted]	Portal Bridge Early Action Contract	2009-2010	Kenneth Bienkowski; Bill George; Dale Legg; Richard Sirabian; Ted Turanick
Short Description: Prepared bid documents for two contracts for early construction in advance of major infrastructure: 1. Fiber optic and 138 KV Relocation; and 2. Access road construction and utility relocations. Worked with NJ TRANSIT CM and Procurement to support E-Bid Process.			
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105 [redacted]	Frank R. Lautenberg Rail Station at Secaucus Junction Secaucus, NJ	1996-2004	Christopher Ellis; Richard LaRuffa; Richard Sirabian; Ted Turanick
Conceptual Planning; Environmental Assessment; Railroad Operations Analysis; Preliminary and Final Design; Track Design; Civil Design; Hydrology; Utilities; Structural Design; Architecture; Station Design; Electrification Engineering; Construction Staging; Cost Estimating; Subsurface Investigations; Geotechnical Engineering; Wetlands Delineation; and Permitting			

Section 4

FRANK DIPALMA | REGULATORY AND STAKEHOLDER COORDINATION (JACOBS)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Public Service Electric and Gas Co. 80 Park Plaza Newark, NJ 071025 [redacted]	Gas Infrastructure Filing	2015 to present Third-Party Expert Witness Support Services	Frank DiPalma; Mike Rafferty; Bill Williams
Short Description: PSE&G wanted to initiate a gas infrastructure filing to replace approximately 4,000 miles of cast iron and bare steel, while recovering all associated costs in a timely manner. To address requirements for a comprehensive filing, Jacobs analyze and developed: • Safety case consisting of understanding the effectiveness and safety of the current infrastructure replacement program, and contrasting those understandings to what would occur if the system were made of modern materials. • Business case that would address both qualitative and quantitative issues plus a comprehensive cost-benefit analysis. • Program execution plan with a long-term detailed plan and roadmap for executing the infrastructure replacement program. • The analysis resulted in Jacobs preparing direct testimony that was filed with the NJ Board of Public Utilities on 02/27/2015.			
NJ Board of Public Utilities 44 S Clinton Ave Trenton, NJ 08625 Phone: (609) 777-3300 [redacted]	Management Audit of Public Service Electric and Gas Company	2010-2011 Operations Focused Management Audit	Frank DiPalma; Mike Rafferty, Bill Williams
Short Description: Study: Jacobs participated in an independent management audit of PSE&G mandated by The State of New Jersey's Board of Public Utilities (BPU). Serving as Jacobs' project manager, the technical and management practices of PSE&G were assessed in the areas of electric transmission and distribution, gas transmission and distribution, PJM, gas procurement and supply and contractor performance.			
Elliott Management Corp. 40 W 57th St New York, NY, 10019 United States [redacted]	Conduct Technical Due Diligence Power Generation Assets	2013 Operational Due Diligence	Frank DiPalma; Mike Rafferty; Bill Williams
Short Description: Elliott Management Corporation was interested in acquiring certain power generation assets located in Latin America and the Caribbean. In order to develop a fair value offer for the assets, Elliott needed to know asset condition, environmental liabilities and the market in which the asset operated. This included understanding the strength of the existing power purchase agreements, the historical and anticipated continuity of fuel supply to the asset, any issues related to the existing use of a "dirty" type of fuel supply, potential plant enhancements that would improve output, trends in individual generator asset output, where the generator fitted into the economic dispatch profile by country, the impact a large power generation assets coming online would have on the competitiveness of an acquired asset, any significant regulatory risks, and where the opportunity existed for a fuel supply conversion. Serving as responsible officer and project manager, Jacobs performed a technical, organizational, environmental, and power market assessment.			

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MICHAEL PYTLIK | PROJECT CONTROLS LEAD (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Amtrak [redacted]	Amtrak, Nationwide Program Management for Accessible Stations Development Program (ASDP), Nationwide, USA	2011-2015 (Design & Construction)	Michael Pytlik; Kenneth Bienkowski
Short Description: Earned Value, Scheduling, Cost Estimating, Delay and Claims Analysis			
[redacted]	DSM Nutritional Products, Inc., Belvidere, NJ	2011-2012 (Engineering, Procurement, Construction)	Michael Pytlik
Short Description: Study: Project Controls Manager, Scheduling, Cost Estimating, Value Engineering, Delay Analysis			
City of Philadelphia, Streets Dept. [redacted]	City of Philadelphia, National Recreational Trail System, East Coast Greenway Projects Boardwalk, Philadelphia, PA	2012-2014 (Construction)	Michael Pytlik
Short Description: Earned Value, Scheduling, Cost Estimating, Delay and Claims Analysis			

Section 4

ROBERT ROSA, PE | SCADA COORDINATION (JACOBS)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Amtrak 30th & Market Streets 4th Floor North RM 497 Philadelphia, PA 19104 [redacted]	Amtrak, NEC Frequency Converter Controls Upgrade – Richmond Substation	November 2010 thru August 2011	Robert Rosa
Short Description: Design of new PLC controls for three frequency converters, design of retrofit of existing hardware, programming, integration and startup of new controls. Design also included interface to existing railroad control system.			
PANYNJ Two Gateway Center Newark, NJ 07102 [redacted]	Replacement of SCADA Programmable Logic Controllers (PLC) Hardware and Interface for 11 PATH Stations	2012 Stage 1 – Design Report	Robert Rosa
Short Description: Replacement of a legacy PLC control system. This design also includes the network and software interface to the Hoban Control Center. The PATH operates several commuter train lines that connect NY and NJ. PATH stations, yards and electrical substations along the train lines have ventilation and traction power equipment. These critical systems are monitored and controlled by the power director remotely from Hoban Center in Jersey City, NJ through a SCADA system.			
WSDOT 6431 Corson Ave South Seattle WA, 98108-3445 [redacted]	Washington Dept. of Transportation, I-90 Tunnels and Management Operation Center, Seattle, WA	September 2011 thru June 2014	Robert Rosa
Short Description: Design of a new tunnel SCADA for the I-90 project. This design includes a PLC based ventilation control system, interface to the tunnel variable message signs, a PLC based control for the tunnel power and lighting systems and an interface to the fire detection and suppression systems. As part of this system, a control scheme was developed to reduce energy usage by staging ventilation fans based on real time air quality readings.			

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KENT MCANALLY, PE | LEAD POWER PROCESS ENGINEER (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
University of Texas at Austin PO Box 7580 Austin, TX 78713 [redacted]	Gas Turbine 10	2007 – 2010	Roger Copeland; Kent McAnally; Darrell Widner; Morgan Sutton; Mike Lewis; Joseph Saltarelli; Rodney Carpenter
Short Description: Design of new generation and interconnect to complete a microgrid; plant and campus district energy system design; life cycle costing; financial analysis; full-service design engineering; and construction administration.			
Texas A&M University 401 Joe Routt Blvd. College Station, TX 77843 [redacted]	Utility Master Plan and Combined Heat & Power Upgrade	2006-2012	Roger Copeland; Kent McAnally; Mike Lewis
Short Description: Design of new generation and interconnect to complete a microgrid; plant and campus district energy system design; life cycle costing; financial analysis; full-service design engineering; construction estimates; and construction administration.			
University of Minnesota 319 15th Avenue SE Minneapolis, MN 55455 [redacted]	Combined Heat and Power Plant	2012 – Ongoing (Currently in construction)	Roger Copeland; Kent McAnally
Short Description: Design of new generation and interconnect to complete a microgrid; plant and campus district energy system design; life cycle costing; financial analysis; full-service design engineering; construction estimates; and construction administration.			

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DARRELL WIDNER, PE | MICROGRID ENGINEER (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
University of Texas at Austin PO Box 7580 Austin, TX 78713 [redacted]	Balcones Substation	2012-Ongoing	Roger Copeland; Darrell Widner
Short Description: Concept design; construction documents; thermal analysis of all medium voltage raceway systems; protective relay coordination and settings development; load flow and fault current analysis; route survey and alignment for 12.47kv feeders; analysis of geotech surveys; civil, structural, and electrical design; and coordination with utility company.			
Confidential Client Confidential Address [redacted]	Macrogrid PJM Blackstart Addition	2013-2014	Roger Copeland; Herb Tull; Darrell Widner; Morgan Sutton; Gabe Serna; Kevin Fox; Rodney Carpenter
Short Description: Planning; detailed design; construction; and startup phase services.			
University of Texas at San Antonio [redacted]	Substation and Electrical Distribution Upgrade	2005 – 2006	Darrell Widner
Short Description: Phased replacement of the existing medium voltage substation and expanded the overall underground distribution system at the University of Texas at San Antonio to support the campus growth. Design included 2800 linear feet of duct bank, 12 manholes, two new 30/40/50 MVA transformers, and $1 million in new medium voltage switchgear.			

Section 4

KALAIVANAN UTHIRAPATHY, B.ENG, C.ENG, MIET | ELECTRICAL DESIGN (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Western Power Distribution (Subsidiary of PPL Corporation-USA) Toll End Road Tipton England DY4 0HH [redacted]	Western Power Distribution- Network Infrastructure Reinforcement Projects- various 132kV & 66kV Substations	March 2014- December 2014	Kalaivanan Uthirapathy
Short Description: : Protection System Design consultancy support for various distribution substations owned and operated by Western Power Distribution			
National Grid [redacted]	400/132/13kV 240MVA Supergrid Transformer & 13kV 60MVAR Shunt Reactor Emergency Replacement Project for National Grid –UK	Feb 2014- August 2014	Kalaivanan Uthirapathy
Short Description: Detail Design Engineering works for the protection and control system for the Supergrid Transformer circuit. As National Grid Authorized TP141 Contractor Design Approval Engineer, verified the design for adherence to relevant client standards and project specific requirements.			
National Grid Alliance House, Unit A, Ashville Park, Short Way, Thornbury, South Gloucestershire, England, BS35 3UU [redacted])	Front End Engineering Design- National Grid 400kV, 275kV & 132kV Substations – Multiple Sites	August 2013 - Present	Kalaivanan Uthirapathy
Short Description: Front End Engineering Design for protection and control system for various National Grid substation projects which includes installation of new 400kV, 275 Shunt Reactors & Quadrature boosters. As National Grid Authorized TP141 Contractor Design Approval Engineer, verifying the design for adherence to relevant client standards and project specific requirements.			

ASIF BHANGOR, CPENG, RPEQ | TRANSMISSION LINES/OVERHEAD LINE ENGINEER (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
[redacted]	South Hedland Power Station 220kV Transmission Line	2014-Present (Design)	Asif Bhangor
Short Description: Services performed include: Structural Engineering; Civil Design; Utilities; Electrical Engineering; Surveying; Geotechnical Engineering; Topographic Survey; Scheduling; and Cost Estimates, Lattice Tower Steel Design, Full Scale Load Testing in China, Underground Cable Design 220kV, Steel Pole Designs			
[redacted]	Wind Prospect (CWP Renewables Pty Ltd for End Client: Essential Energy)	5/2013-5/2014	Asif Bhangor
Short Description: Services performed includes: Structural Engineering; Civil Design; Utilities; Electrical Engineering; Surveying; Geotechnical Engineering; Steel Pole Design Reviews.			
[redacted]	Rio Tinto – North West Coastal Highway Crossing Steel Pole Detailed Design	2013	Asif Bhangor
Short Description: Services performed included: Structural Engineering; Civil Design; Electrical Engineering; Surveying; Geotechnical Engineering; Steel Pole Design, Site Commissioning Inspections.			

GABRIEL SERNA, PE | STRUCTURAL ENGINEER (JACOBS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Confidential Midwest Utility Client, New Richmond, OH [redacted]	Macrogrid PJM Blackstart Addition, Ohio	October 2013 – October 2014	Darrell Widner; Kent McAnally; Herb Tull; Gabriel Serna; Morgan Sutton; Rodney Carpenter
Short Description: Project Executive/Technical Leader provided EPCm services for the installation of equipment required to restart two large power plants in the event of a grid wide outage to this 640MW and 1280MW power plant site utilizing a LM2500 Gas turbines as the starting source for the larger power blocks to allow for grid restoration in the state of Ohio in the event of an outage like the Northeast outage of 2003. Staged isochronous control of the microgrid, as well as soft starting of the electrical system were unique challenges for these projects. Project utilized a unique starting methodology for grid restoration currently being developed for technical article.			
Confidential Midwest Utility Client New Richmond, OH [redacted]	Macrogrid PJM Blackstart Addition, Ohio	October 2013 – October 2014	Darrell Widner; Kent McAnally; Herb Tull; Gabriel Serna; Morgan Sutton; Rodney Carpenter
Short Description: Project Executive/Technical Leader provided EPCm services for the installation of equipment required to restart two large power plants in the event of a grid wide outage to this 640MW and 1280MW power plant site utilizing a LM2500 Gas turbines as the starting source for the larger power blocks to allow for grid restoration in the state of Ohio in the event of an outage like the Northeast outage of 2003. Staged isochronous control of the microgrid, as well as soft starting of the electrical system were unique challenges for these projects. Project utilized a unique starting methodology for grid restoration currently being developed for technical article.			
University of Minnesota 319 15th Avenue SE Minneapolis, MN 55455 [redacted]	University of Minnesota, Combined Heat and Power Plant	2012 – Ongoing (Currently in Construction)	Roger Copeland; Herb Tull; Kent McAnally; Joe Saltarelli; Mike Lewis; Morgan Sutton; John Beaudry; Darrell Widner; Gabe Serna; Kevin Fox; Rodney Carpenter
Short Description: Design of new generation and interconnect to complete a microgrid; plant and campus district energy system design; life cycle costing; financial analysis; full-service design engineering; construction estimates; and construction administration.			

DALE LEGG, PE | CONSTRUCTABILITY LEAD (JACOBS)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
MTA – Metro-North Railroad 420 Lexington Avenue New York, NY Client: Skanska/ECCO III Joint Venture [redacted]	Design and Construction of the Harmon Wheel Truing Facility – Design-Build, Croton on Hudson, NY	2006-2007	Richard LaRuffa; Dale Legg; Ted Turanick
Short Description: The project required us to design the entire site and the building in conjunction with the wheel truing machine manufacturer. The machine was purchased by MNR under a separate agreement and we were required to coordinate all aspects of the machine operations. The tandem wheel truing machine is only the second installation of a dual axle machine in the United States and the first of this particular kind. The machine can simply be described as a device capable of making four wheels of a train car round simultaneously, while meeting FRA safety and comfort criteria.			
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105 [redacted]	Portal Bridge Capacity Enhancement Project	2008 – 06/ 2013 Est. Const. Compl. 2019 (Ongoing)	Kenneth Bienkowski; Thomas Decker; Bill George; Richard LaRuffa; Dale Legg; Richard Sirabian; Ted Turanick
Short Description: Services performed included: Structural Engineering; Rail Systems Engineering; Trackwork; Civil Engineering; Utilities Design; Environmental/ Regulatory Approvals; Geotechnical; Value Engineering; Scheduling; Cost Estimating; Construction Staging; and Construction Phase Services.			
MTA – Metro-North Railroad 420 Lexington Avenue New York, NY [redacted]	Engineering and Design for Addition of Mid-Harlem Third Mainline Track and Associated Interlocking Improvements	1998-2007	Richard LaRuffa; Dale Legg; Ted Turanick
Short Description: Jacobs was responsible for the final designs for the $49-million addition of a third track on Metro-North's Mid-Harlem Line between Mt. Vernon and Crestwood Stations. Engineered improvements included 3.6-miles of track and high-speed interlocking design; new and rehabilitated bridges including and retaining structures; substation modifications and traction power improvements; communications and signals improvements; and historic structure evaluation.			

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MICHAEL ALBERGO, PE, PMP, LEED® AP | RISK MANAGER (JACOBS)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
MTA NYC Transit 2 Broadway, 2nd Floor New York, NY 10004 [redacted]	Canarsie Tube Constructability Review	2015 (Ongoing)	Michael Albergo
Short Description: Post-Sandy reconstruction of these two under-river transit tunnels connecting Manhattan and Brooklyn. Included reconstruction of 30,000 linear feet of duct bank, the replacement of damaged track, circuit breaker houses, signals, traction power, communications systems, lighting, fire standpipe, and pumps, as well as some structural repair. Services include constructability review (checklist development, outage planning, logistics) and risk management.			
Port Authority of NY & NJ 115 Broadway, 10th Floor New York, NY 10006 [redacted]	WTC Program Assessment	2008	Michael Albergo (individual experience)
Short Description: Facilitated the Port Authority's WTC Business team in identifying the status of and risks to the WTC scope, schedule, and budget. The effort was documented in WTC Team Assessment Report, which identified the key challenges confronting the project and then risked the program schedule and budget. The report was provided to the Executive Director of the Port Authority and was the basis of a report provided to Governor Patterson in July 2008.			
Lower Manhattan Construction Command Center One Liberty Plaza New York, NY 10006 [redacted]	Value Planning Risk-Based Analysis of WTC Site	2007 - 2008	Michael Albergo (individual experience)
Short Description: Description: Structural Engineering; Rail Systems Engineering; Trackwork; Civil Engineering; Utilities Design; Environmental/Regulatory Approvals; Geotechnical; Value Engineering; Scheduling; Cost Estimating; Construction Staging; and Construction Phase Services			

RICHARD LARUFFA, PE, CVS | VALUE ENGINEERING LEAD (JACOBS)
Three (Minimum) Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
MTA – New York City Transit 2 Broadway New York, NY	On-Call VE Services 150 Task Orders Under 5 Contracts. Awarded 6th contract in August 2014	1997-2018	Richard LaRuffa
Short Description: Value Engineering Services			
NYSDOT 50 Wolf Road Albany, NY	On-Call VE Services Since 2000, more than 50 Task Orders Under 4 Contracts	2000-2014	Richard LaRuffa
Short Description: Value Engineering Services			
NJ TRANSIT One Penn Plaza East Newark, NJ	Multiple VE Studies on Secaucus Junction and Portal Bridge	1993-1998, 2009	Richard LaRuffa
Short Description: Value Engineering Services			

MICHAEL WALTON, PE, DGCP | ASSISTANT POWER LEADER (BURNS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Philadelphia Industrial Development Corporation Building 101, 4747 South Broad Street Philadelphia, Pennsylvania 19112 [redacted]	Philadelphia Industrial Development Corporation, Navy Yard, Advanced Microgrid Implementation	2011 – 2015 (CPS Ongoing	Bruno Fiorentino; Michael Walton
Short Description: Mike is the project manager for a turnkey project to transform the Navy Yard's unregulated electric grid into a "state of the art" advanced smart microgrid. The new grid incorporates smart metering and substation technology, mesh network communications, distributed generation, electric storage, energy efficiency, and bi-directional building-to-grid control strategies.			
Temple University 1009 West Montgomery Avenue Philadelphia, Pennsylvania 19122 [redacted]	Temple University Microgrid	2010 – 2012	Michael Walton; Bruno Fiorentino
Short Description: Mike was the project manager and was responsible for the engineering, design and construction support for the modernization of the electrical infrastructure at Temple University's main campus in Philadelphia, PA. Burns design provided Temple with a modern, efficient and resilient electrical infrastructure that included the installation of over 14 miles of underground power cable and two major substations with minimal disruption to campus operations.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, TransitGrid Feasibility Study	11/2013 – 02/2014	Bruno Fiorentino; Michael Walton; Daren Petroski
Short Description: Hired to work with Sandia National Labs as a subconsultant to Jacobs, Burns undertook a comprehensive assessment of the economic, technical and operational feasibility of "TransitGrid." Burns provided conceptual engineering and feasibility analysis of both the physical plant requirements for the railroad transmission and distribution facilities as well as the railroad substations. A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations and innovative operating strategies. Burns also evaluated distributed energy resources that would support non-traction power loads at outlying passenger facilities including cogeneration, solar PV, fuel cells, battery storage and demand response.			

BRUNO FIORENTINO, PE | QUALITY CONTROL LEAD (BURNS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Philadelphia Industrial Development Corporation 4747 South Broad Street, Building 101 Philadelphia, Pennsylvania 19112 [redacted]	Philadelphia Industrial Development Corporation, Navy Yard, Advanced Microgrid Implementation	2011 – 2015 (CPS Ongoing)	Bruno Fiorentino; Michael Walton
<u>Short Description</u>: Bruno is the principal in charge for a turnkey project to transform the Navy Yard's unregulated electric grid into a "state of the art" advanced smart microgrid. The new grid incorporates smart metering and substation technology, mesh network communications, distributed generation, electric storage, energy efficiency, and bi-directional building-to-grid control strategies.			
Temple University 1009 West Montgomery Avenue Philadelphia, Pennsylvania 19122 [redacted]	Temple University Microgrid	2010 – 2012	Michael Walton; Bruno Fiorentino
<u>Short Description</u>: Bruno was principal in charge for the project and responsible for the engineering, design and construction support for the modernization of the electrical infrastructure at Temple University's main campus in Philadelphia, PA. Burns design provided Temple with a modern, efficient and resilient electrical infrastructure that included the installation of over 14 miles of underground power cable and two major substations with minimal disruption to campus operations.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, TransitGrid Feasibility Study	11/2013 – 02/2014	Bruno Fiorentino; Michael Walton; Daren Petroski
<u>Short Description</u>: Hired to work with Sandia National Labs as a subconsultant to Jacobs, Burns undertook a comprehensive assessment of the economic, technical and operational feasibility of "TransitGrid." Burns provided conceptual engineering and feasibility analysis of both the physical plant requirements for the railroad transmission and distribution facilities as well as the railroad substations. A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations and innovative operating strategies. Burns also evaluated distributed energy resources that would support non-traction power loads at outlying passenger facilities including cogeneration, solar PV, fuel cells, battery storage and demand response.			

DAREN PETROSKI, PE | SR. TRACTION POWER LEADER (BURNS) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
SEPTA 1234 Market Street, 12th Floor Philadelphia, PA 19107 [redacted]	Overhaul of Morton and Lenni Substations, Morton and Lenni, PA	2014 – 2015 (CPS Ongoing)	Daren Petroski
Short Description: Daren was the Principal-in-Charge for the development of design-build bridging documents for the rehabilitation and reconstruction of these substations. The design includes 4,500 KVA, 138 KV to 12 KV transformers; circuit breakers; control, metering and relay panels; bus section potential transformers; current transformers and lightning arrestors; 125 KVA distribution transformers; switches, switch controls and insulators.			
Amtrak 30th Street Station, 3rd Floor South Philadelphia, PA 19104 [redacted]	Amtrak, Zoo to Paoli Transmission Line, Philadelphia, PA to Paoli, PA	2011 – Ongoing	Daren Petroski; Randy Winks
Short Description: Daren is Project Manager for the design of transmission lines between the existing Zoo and Paoli substations. Specific design tasks include replacement of all catenary structures with new structures that will support both the catenary and transmission systems, design of the new 138kV to 12kV traction power substation, design of a redundant 100Hz signal power distribution system and relocation of ancillary facilities including a 34kV PECO distribution line, independent fiber optic network and cellular phone antenna for the 20-mile alignment.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	Power Generation System to Increase System Resiliency and Reliability	11/2013 – 02/2014	Bruno Fiorentino; Michael Walton; Daren Petroski
Short Description: Hired to work with Sandia National Labs as a subconsultant to Jacobs, Burns undertook a comprehensive assessment of the economic, technical and operational feasibility of "TransitGrid." Burns provided conceptual engineering and feasibility analysis of both the physical plant requirements for the railroad transmission and distribution facilities as well as the railroad substations. A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations and innovative operating strategies. Burns also evaluated distributed energy resources that would support non-traction power loads at outlying passenger facilities including cogeneration, solar PV, fuel cells, battery storage and demand response.			

SETH PARKER | ECONOMIC & FINANCIAL ANALYSIS (LEVITAN) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
New York University 10 Astor Place, 6th Floor New York, NY 10003 [redacted]	NYU Cogeneration Microgrid Project	2002 – 2005	Seth Parker; Phil Curlett
Short Description: LAI prepared an initial economic screening analysis of microgrid cogeneration alternatives (diesel and gas turbine options) for NYU and provided ongoing economic, contractual, operational, and financing advice to NYU and its engineer, Vanderweil. We completed a detailed lifecycle financial analysis for the $100+ million, 13.4 MW gas turbine/steam turbine cogeneration project that was approved by the NYU Board. The plant operated successfully in the aftermath of Superstorm Sandy while the rest of southern Manhattan was blacked out and reduces NYU's electricity costs and air emissions.			
William Donald Schaefer Tower 6 St. Paul Street Baltimore, MD 21202-680 [redacted]	TDI-NE New England Clean Power Link	2014-ongoing	Seth Parker; Alex Mattfolk; Matthew DeCourcey; Richard Carlson
Short Description: LAI developed regulations to implement the Maryland Offshore Wind Energy Act of 2013 and is now administering the procurement of offshore wind renewable energy for the Commission. LAI conducted detailed economic analyses, developed a secure website, prepared an electronic bid form, established quantitative and qualitative evaluation criteria, and will evaluate applications to support a recommendation to the Commission in 2016.			
[redacted]	TDI-NE New England Clean Power Link	2014-ongoing	Seth Parker; Alex Mattfolk; Matthew DeCourcey; Richard Carlson
Short Description: LAI utilized a chronological dispatch simulation model to analyze power market and air emission impacts for this 1,000 MW HVDC transmission project that will import renewable hydroelectric and wind energy into ISO-NE. Seth filed testimony before the Vermont Public Service Board on behalf of the project developer TDI-NE and is providing ongoing economic and market support. A Certificate for the project is anticipated by year-end 2015.			

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<table>
<tr><th colspan="4">EDWARD TSIKIRAYI | PJM INTERCONNECTION (LEVITAN)
Three (Minimum) Client References</th></tr>
<tr><th>Client Name
Reference Contact Information</th><th>Project Title</th><th>Start & End Date</th><th>Key Personnel Involved</th></tr>
<tr><td>New York Power Authority
123 Main Street
White Plains, NY 10601
[redacted]</td><td>Hudson Transmission Project</td><td>2007 – 2009</td><td>Edward Tsikirayi; Richard Levitan</td></tr>
<tr><td colspan="4"><u>Short Description</u>: LAI provided transmission planning and bulk power market support to NYPA in guiding the 660 MW HVDC Hudson Transmission Project through the PJM Large Generator and Merchant Transmission Interconnection Process. Ed represented NYPA on a wide range of PJM matters, including meeting with PJM and PSEG (the transmission owner), advised NYPA on PJM Rules (including PJM DFAX methodology for transmission cost allocation, Capacity Export Charges and Credits, and Incremental Capacity Transfer Rights), and counseled PJM on market dynamics affecting resource supply, demand and prices.</td></tr>
<tr><td>Long Island Power Authority
99 Washington Avenue, 10th Floor – Ste 1001
Albany, NY 12210-2822
[redacted]</td><td>PATH VA Transmission Project</td><td>2010-2011</td><td>Edward Tsikirayi; Seth Parker</td></tr>
<tr><td colspan="4"><u>Short Description</u>: Ed administered LAI's support services provided to LIPA in which he and others represented LIPA in NYISO, PJM and ISO-NE meetings, including (i) attending committee meetings on behalf of LIPA, identifying significant issues, recommending policy positions, and advocating on LIPA's behalf, (ii) administering LIPA's ISO working group conference calls, chairing the meetings, uploading meeting materials and other information to the LIPA PMP SharePoint system, and tracking related action items, (iii) providing LIPA with qualitative and spreadsheet analysis of relevant and current market issues, (iv) conducting power flow studies and validating PJM transmission cost allocations, (v) participating in LIPA internal policy development meetings to develop policy positions and responses to market structure issues, and (vi) supporting LIPA's identification and integration of public policy requirements into its Local and Regional Transmission Planning Process.</td></tr>
<tr><td>Virginia State Corporate Commission
Division of Energy Regulation
1300 East Main Street
Richmond, VA 23219
[redacted]</td><td>PATH VA Transmission Project</td><td>2010-2011</td><td>Edward Tsikirayi; Seth Parker</td></tr>
<tr><td colspan="4"><u>Short Description</u>: LAI provided transmission planning support to the Virginia State Corporation Commission Staff regarding the application of the 765 kV PATH (Virginia portion) backbone transmission project in PJM for a Certificate of Public Convenience and Need. Ed and his colleagues reviewed the PATH-VA application and pre-filed testimony, assessed the reasonableness of the assumptions and data inputs, replicated the application load flow study base case, conducted an independent transmission alternative solution analysis, evaluated PJM's RTEP process regarding transmission and generation deliverability, and submited written and oral testimony.</td></tr>
</table>

WILLIAM LIPFERT | RAIL POWER ANALYSIS/OPERATIONS/MODELING (LTK) Three (Minimum) Client References			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Arrow IV EMU – NEC Middle Zone Train Performance/Signal Capacity Analysis	2008 - 2009	Bill Lipfert; Dave Diaz; Chelsea Farnsworth
Short Description: Task Leader for simulation-based analysis that quantified capacity differences between existing Jersey Arrow III Electric Multiple Unit (EMU) and ALP-46 push-pull consist with multi-level coaches. This analysis focused on the critical "Middle Zone" segment between Midway and Union Interlockings on the Northeast Corridor. Quantified various levels of potential Amtrak signal system upgrades in this segment that would mitigate any losses in capacity due to train performance as part of support of overall strategic fleet expansion plans.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Atlantic City Rail Line Operations Study	2012 - 2013	Bill Lipfert; Walt Peters; Nick Willey; Rich Rauceo; Ben Spears; Chelsea Farnsworth
Short Description: Project Manager for a wide-ranging planning study that evaluated operational and infrastructure changes to enhance rail service between Philadelphia and Atlantic City; five future operating scenarios with service as frequent as two trains per hour per direction on this largely single track line were investigated, including new intermodal stations with PATCO at Woodcrest and with the Atlantic City Airport in Pomona/Galloway. Management responsibilities included environmental and cultural resource surveys as well.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Raritan Valley Line Third Track Feasibility Study	2011-2013	Bill Lipfert; Nick Willey; Ben Spears
Short Description: Project Principal for evaluation of long-term capacity enhancements to the Raritan Valley Line between Cranford and Raritan. The analysis focused on the most cost-effective, operationally-beneficial segments for restoring a third (express) track to portions of the rail line. Historic station, environmental, and structural impacts to the projects were assessed. An alternative zone express operating plan that would forego any third express track was also analyzed.			

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D. NJ TRANSIT References

JACOBS ENGINEERING GROUP INC. (JACOBS) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	**Project Title**	**Start & End Date**	**Key Personnel Involved**
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Design and Engineering Construction Assistance Services for the Replacement and Relocation of West Summit Interlocking on the Morris and Essex Lines, Summit, NJ (NJ TRANSIT Contract No. 13-038), Summit, NJ (E6X81300 & E6X81301)	06/2013-Present	Dale Legg; Richard Sirabian; Ted Turanick
<u>Short Description</u>: Project Management; Rail Systems Integration; Track; Electrical Traction/Power; Communications & Signals C&S) Coordination; Cable/Conduit Routing/Installation Layout; Surveying/Right-of-Way; Civil/Drainage; Environmental Permitting; Operations Analysis; Construction Staging; Contractibility Analysis; Force Account Coordination; Cost Estimating; Geotechnical; Soil Investigations.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Design, Engineering, and Construction Services for County Yard Improvements (NJ TRANSIT Contract No. 13-041), North Brunswick, NJ (E6X81800)	02/2014-2018	Thomas Decker; Dale Legg; Stephen Ricucci; Richard Sirabian; Jeff Stiles; Ted Turanick
<u>Short Description</u>: Preliminary and final design of a five-track rail storage yard capable of storing up to 10 12-car consists; a 1250 foot long 2-track Service and Inspection Facility; Crew Quarters; Spare Parts Storage; and the rehabilitation of four miles of Delco Lead to provide resiliency storage for up to 288 cars. Professional Services included Project Management; Rail Systems Integration; Track; Electrical Traction/Power; Communications & Signals (C&S) Coordination; Cable/Conduit Routing/Installation Layout; Surveying/Right-of-Way; Civil/Drainage; Environmental Permitting; Operations Analysis; Construction Staging; Contractibility Analysis; Force Account Coordination; Cost Estimating; Geotechnical; Soil Investigations.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Portal Bridge Capacity Enhancement Project (Tri-Venture) (E6X67800)	2008 to ongoing Design Est. 2013 Constr. Est. 2019	Kenneth Bienkowski; Thomas Decker; Bill George; Richard LaRuffa; Dale Legg; Schickel; Richard Sirabian; Ted Turanick
<u>Short Description</u>: Structural Engineering; Rail Systems Engineering (Communications, Signals, Electrical); Trackwork; Civil Engineering; Utilities Design; Drainage; MPT; Support for Environmental/Regulatory Approvals; Geotechnical; Value Engineering; Risk Analysis; Scheduling; Cost Estimating; Construction Staging; and Contract Packaging.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Northern Branch Rail Service DEIS and Transit Option Study, Bergen, NJ (060011018/Y6M01800)	2005 to Ongoing	Miles Cheang; Kimberly Glinkin; Stephen Ricucci; Richard Sirabian; Jeffrey Stiles; Ted Turanick; Jayne Yost
<u>Short Description</u>: Services performed include: Feasibility Study; Alternatives Analysis; Capital Costs; Operating and Maintenance Cost; Environmental Screening; Station Area Planning; Agency/Public Involvement; and Conceptual Engineering.			

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JACOBS ENGINEERING GROUP INC. (JACOBS) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105 [redacted] *Contracted w/ Somerset Development/ Wood-Ridge Development, LLC*	Design Services for New Wesmont Passenger Station, Wood-Ridge, NJ (E6X72700-01)	06/2013-Present	Kenneth Bienkowski; Ted Turanick
<u>Short Description</u>: Services performed include: Concept Development Planning and Conceptual Design; Memorandum of Understanding (MOU); Preliminary and Final Design; Structural Engineering; Civil Engineering; Geotechnical Engineering; Utilities Engineering; Track Design; ITS/Communications; Electrical Lighting; Construction Cost Estimates; and Bid Package.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Phase II Preliminary and Final Design, and Construction Support services Lackawanna Cut-Off Track Bed Restoration Project MOS-1, Morris and Sussex Counties (Y3M20302)	2009-2011 (Design)	Kenneth Bienkowski; Thomas Decker; Ted Turanick
<u>Short Description</u>: Services performed include: Preliminary & Final Design; Track; Structural Engineering; Civil Engineering; Environmental Permitting; Topographic Survey; and Stormwater Management/Drainage.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Bergen-Passaic Bus Study, Bergen and Passaic Counties, NJ (E6X68900)	2009 - Est. 12/2011 (ongoing)	Miles Cheang; James Dowling; Jayne Yost
<u>Short Description</u>: Services performed include: Public and Agency Outreach; Bus Route Analysis; GIS Database; Route Planning; Park-and-Ride Concept Plans; Short-Range Transit Plan; Post-ARC Service Plan; and Post-Implementation Monitoring.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Lackawanna Cut-Off MOS-1 Advanced Survey (E6X61103)	2008-2009	James Dowling; Jeff Stiles
<u>Short Description</u>: Services performed include: Highway Concepts; Park-and-Ride Concepts; Bus Planning; and Graphics/Mapping.			

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JACOBS ENGINEERING GROUP INC. (JACOBS)
NJ TRANSIT References – Last Five Years

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Meadowlands Intermodal Study Secaucus, NJ (060011021/Y6M02100)	2005-2009	Miles Cheang; Kimberly Glinkin; Richard Sirabian; Jeffrey Stiles; Ted Turanick; Jayne Yost
<u>Short Description</u>: Services performed include: Traffic and Transportation Planning; Structural Engineering; Environmental Engineering; Rail Design & Communications; Rail Signal Design; Civil Design; Utilities; Roadway and Parking Concepts; Traffic Analysis; Environmental/Wetlands Analysis; Surveying/Right-of-Way; Value Engineering; Geotechnical Engineering; Station Design; Pedestrian Flow; Scheduling; and Cost Estimates.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Lackawanna Cut-Off Passenger Rail Services Restoration Study Port Morris, NJ to Scranton, PA (030011203/Y3M20300/ Y3M20301)	2002-2009	Miles Cheang; James Dowling; Christopher Ellis; Kimberly Glinkin; Stephen Ricucci; Richard Sirabian; Jeffrey Stiles; Ted Turanick; Jayne Yost
<u>Short Description</u>: Services performed include: Environmental Assessment; Planning; and Conceptual Engineering.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Stormwater Support and Review of Regulations & Training Seminar for NJ TRANSIT Staff (E6X61400)	2007	Thomas Decker
<u>Short Description</u>: Prepared, presented, and participated in a one-day training seminar for NJ TRANSIT staff on the new Stormwater Management (SWM) Rules.			
NJ TRANSIT/NJSEA One Penn Plaza East Newark, NJ 07105-2246 [redacted] *Contract was with NJSEA*	Meadowlands Rail & Roadway Improvement Project, East Rutherford, NJ (050011033/Y5M03300)	2004-2006 (Design) Misc. Support Services Continued Until 2010	Kenneth Bienkowski; James Dowling; Christopher Ellis; Kimberly Glinkin; Michael Kaminski; Richard LaRuffa; Richard Sirabian; Jeffrey Stiles; Ted Turanick
<u>Short Description</u>: Services performed include: Traffic and Transportation Planning; Structural Engineering; Environmental Engineering; Rail Systems Design (Communications, Signals, Electrical); Civil Design; Utilities; MPT; Traffic Analysis; Environmental/ Wetlands Analysis; Surveying/Right-of-Way; Value Engineering; Geotechnical Engineering; Station Design; Pedestrian Flow; Scheduling; Cost Estimates; and Construction Support Services.			

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JACOBS ENGINEERING GROUP INC. (JACOBS) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Newark Drawbridge Rehabilitation, Harrison and Newark, NJ (050011019/Y5M01900)	2004-2009	Richard Sirabian; Ted Turanick
<u>Short Description</u>: Services performed include: Alternatives Design; Catenary; Conceptual Design; Drainage Design; Environmental Engineering; Environmental Impact Statement; Wetlands Analysis; Geotechnical Investigation; Permits; Rail Design; Railroad C&S Design; Structural Engineering; Trackwork; First Phase of Programming; and Standard Rehabilitation of Movable Bridge.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Penn Station 7th Avenue Concourse, and 31st Street Entrance, New York, NY (EB323500 & EB323501)	1993-2008	Lynne Baumann; Satish Patel
<u>Short Description</u>: Services performed include: Architecture; Structural, Mechanical, Electrical, and Geotechnical Engineering; Conceptual Engineering; Construction Phase Services; Station Design; Pedestrian Flow; Scheduling; and Cost Estimates.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	On-Call for Site Planning	2003-2007	Valarie Discafani; Kevin Hayes; Mark Kocienda; Robert Lennox; Joseph Matura; Scott Parker; Dave Schnabel; Neal Toglia
<u>Short Description</u>: Services performed include: Traffic Signal Design; Traffic Engineering and Planning; Access Permit; Electrical Engineering; Grading and Drainage Design; BRT Planning; and Bus Lane Geometry.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Park-and-Ride Facility (040011093/040011048/YM09300-04) *This is a specific Task Order from the above main On-Call for Site Planning Contract*	2003-2007	Kevin Hayes; Mark Kocienda; Robert Lennox; Joseph Matura; Scott Parker; David Schnabel; Neal Toglia
<u>Short Description</u>: Services performed include: Traffic Signal Design; Traffic Engineering and Planning; Access Permit; Electrical Engineering; Grading; and Drainage Design.			

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JACOBS ENGINEERING GROUP INC. (JACOBS) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	**Project Title**	**Start & End Date**	**Key Personnel Involved**
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted].	Gladstone ET, Philadelphia, PA (060035001/Y6P00100)	2005-2007	Anthony Zeloyle
Short Description: Jacobs provided design services to replace the existing wood catenary structures with steel catenary structures. Field inspection/survey; designed new steel catenary structures; and provided location, wiring, and staging plans for the structures that will be replaced.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Engineering Services for Undergrade Bridge Inspections, Statewide, NJ (040011077/Y4M07700 & 060011062)	2003-2006	Todd Schickel
Short Description: Services performed include: Bridge and Retaining Wall Inspection; Structural Evaluation; Bridge Ratings; Report Preparation; and Project Management and Control.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246 [redacted]	Monmouth-Ocean-Middlesex Rail Project EIS, Monmouth, Ocean, Middlesex Counties, NJ (020011206/Y2M20600)	2001-2006	Miles Cheang; James Dowling; Kimberly Glinkin; Stephen Ricucci; Jeffrey Stiles; Jayne Yost
Short Description: Services performed include: Alternatives Evaluation; EIS Preparation; NEPA Documentation; Community Relations; Outreach Coordination; Station Area Planning; GIS Mapping; and New Starts Evaluation.			

BURNS ENGINEERING, INC. (BURNS)
NJ TRANSIT Client References

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Power Generation System to Increase System Resiliency and Reliability	11/2013 – 02/2014	Bruno Fiorentino; Michael Walton; Michael Maziarz; Daren Petroski
Short Description: Hired to work with Sandia National Labs as a subconsultant to Jacobs, Burns undertook a comprehensive assessment of the economic, technical and operational feasibility of "TransitGrid." A significant focus was developing capital and operating cost estimates for a large central generation station to meet the highly variable traction power loads of the transit system. This work involved evaluating prime mover technologies including turbines and reciprocating engines, power plant configurations and innovative operating strategies. Burns evaluated distributed energy resources that would support non-traction power loads at outlying passenger facilities including cogeneration, solar PV, fuel cells, battery storage and demand response.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	NJ TRANSIT, Mason Substation Value Engineering	10/2014 - 12/2014	Michael Walton; Michael Maziarz; Daren Petroski
Short Description: Burns was part of Jacobs' team to provide value engineering support to NJ TRANSIT to review the 30% design of the replacement of Mason Substation at the Meadows Maintenance Complex. The substation, which provides traction power to the M&E line, was severely damaged in Superstorm Sandy and needs replaced. The new design called for a 230kV indoor GIS substation and a physically separated new traction power substation. Our team provided potential cost saving options for NJ TRANSIT to evaluate before moving the project forward.			

GTS CONSULTANTS, INC. (GTS)
NJ TRANSIT References – Last Five Years

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Subconsultant to: Jacobs Engineering [redacted]	West Summit Interlocking, Summit, NJ	2013-2014	Fredrick L. Voss; Joseph Messina; Kenneth Moscetti
<u>Short Description</u>: Services performed include: Survey, mapping, utilities, and right-of-way.			
Subconsultant to: Jacobs Engineering [redacted]	County Yard Improvements (New Brunswick and North Brunswick, NJ	2002-2009	Fredrick L. Voss; Joseph Messina; Kenneth Moscetti; Mikhail Zavyazkin
<u>Short Description</u>: Services performed include: Survey, mapping, utilities, and right-of-way.			
Subconsultant to: Jacobs Engineering Hatch Mott MacDonald Somerset Development	Wesmont Station, Wood-Ridge, NJ	2010 2012 2013	Fredrick L. Voss; Mikhail Zavyazkin
<u>Short Description</u>: Services performed include: Survey, utilities, right-of-way; HMM – Topographic Survey; Somerset – Construction Stakeout.			
NJ TRANSIT/NJSEA Subconsultant to: Jacobs Engineering [redacted]	Meadowlands Maintenance Complex, Kearny, NJ	2013 to Present (Ongoing)	Fredrick L. Voss; Mikhail Zavyazkin
<u>Short Description</u>: Services performed include: Aerial Mapping, survey control, topographic survey, utility survey.			
Subconsultant to: STV, Inc. [redacted]	Hoboken Yard	2014 (Ongoing)	Fredrick L. Voss; Joseph Messina; Mikhail Zavyazkin
<u>Short Description</u>: Services performed include: Aerial Mapping, survey control, topographic survey, utility survey.			

GTS CONSULTANTS, INC. (GTS) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Subconsultant to: Jacobs Engineering	Lackawanna Cut Off	2008-2014	Fredrick L. Voss; Thurman Golightly; Mikhail Zavyazkin
<u>Short Description</u>: Services performed include: Aerial Mapping, survey control, stream cross-sections, wetland location, grade crossing and bridge overpass survey, passenger station topographic mapping, off-site culvert and stream survey.			
Subconsultant to: Parsons Brinckerhoff	Penn Station, NYC	2014	Joseph Messina; Kenneth Moscetti
<u>Short Description</u>: GTS performed 3-D Laser Scanning of Penn Station Concourse and vertical access components.			
Subconsultant to: Parsons Brinckerhoff-STV-AECOM	ARC Tunnel, Secaucus, North Bergen, Hoboken, NJ	2006-2010	Fredrick L. Voss; Thurman Golightly; Mikhail Zavyazkin
<u>Short Description</u>: GTS performed field survey and mapping support for bridge design, environmental permitting, and geotechnical settlement investigation; deed and map research and preparation of right-of-way acquisition documents.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105-2246	Hudson Bergen Light Rail, Bayonne, Jersey City, Hoboken, Weehawken, Union City, North Bergen, NJ	2002-2012	Fredrick L. Voss
<u>Short Description</u>: GTS developed of parcel maps and descriptions, attendance at condemnation hearings, fact witness in Superior Court condemnation case, as-built survey of Jersey Avenue Station and determination of grading limits			

Section 4

MATRIX NEW WORLD ENGINEERING, INC. (MATRIX) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Sub to Jacobs Engineering Group, Inc., [redacted]	NJ TRANSIT, MMC/ROC Flood Protection and Pumps Project Meadowlands Maintenance Complex Kearny, NJ	2014 - Ongoing	Clare Sullivan; Thomas DeMichele; Donald Heck; Gavin Gilmore; Donald Wendt; Matthew Sheldon
<u>Short Description</u>: Following the initial cleanup of accumulated sediments and debris, Matrix was tasked to perform building assessments at the facility to determine the effectiveness of the cleanup. Matrix's staff of Certified Microbial Investigators (CMI) developed an investigative strategy that utilized a combination of visual inspections, Thermal imaging technics, direct read measurement and Indoor Air Quality (IAQ) sampling technics to identify and evaluate the presence and extent of microbial contamination remaining within the buildings at the complex. Matrix is also providing environmental and geotechnical engineering services. Matrix will advance soil boring in the areas of flood wall locations and new power and signal conduits to evaluate the suitability of on-site soils for reuse of offsite disposal. A subsurface investigation consisting of 225 soil borings is proposed to depths up to 10 feet. Matrix will provide field inspection of the subsurface investigation and the drilling contractor. Soil samples from select borings will be collected and composited for the purpose of laboratory analysis. The laboratory data will be evaluated and recommendations for the future use of the soils will be developed. A Site investigation Report summarizing the findings from the subsurface investigation will be prepared.			
Sub to STV, Inc., [redacted]	NJ TRANSIT, Superstorm Sandy Recovery Program Hoboken Terminal and Rail Yard Hoboken, NJ	2013 - Ongoing	Gavin Gilmore; Donald Wendt; Yetan Li
<u>Short Description</u>: Matrix was tasked to perform area specific Microbial Investigations throughout the Facility. Matrix assisted in identifying areas of microbial contaminant concerns in coordination with STV's general condition assessments for targeted passenger areas, retail spaces, employee welfare areas, facility areas and public spaces within the Hoboken Terminal and Rail Yard. Matrix's staff of Certified Microbial Investigators (CMI) developed an investigative strategy that utilized a combination of visual inspection, direct read measurement and Indoor Air Quality (IAQ) sampling technics in order to identify and evaluate the presence and extent of microbial contamination within and specific to NJ TRANSIT's Super-storm Sandy Restoration efforts.			
Sub to Systra, [redacted]	NJ TRANSIT, Post-Sandy Hardening Project North Jersey Coast Line & Atlantic City Line	2014 - Ongoing	Clare Sullivan; Andrew Raichle; Jim Sens; Charles Bassett; Robert Fiorile
<u>Short Description</u>: Matrix is providing geotechnical/marine engineering, surveying and permitting services in support of NJ TRANSIT's proposed hardening of shorelines adjacent to critical rail infrastructure. The Project is a post-Superstorm Sandy resiliency effort, and is in response to vulnerabilities experienced during the storm. To date, Matrix has evaluated geotechnical conditions, collected marine and upland survey data, and evaluated shore protection alternatives and permitting considerations for eight sites, encompassing over 5 miles of rail that traverses flood hazard areas.			

MATRIX NEW WORLD ENGINEERING, INC. (MATRIX) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Sub to Systra, [redacted]	NJ TRANSIT, Post-Sandy Scour Mitigation Project Brielle & Navesink River Bridges	2014 - Ongoing	Clare Sullivan; Andrew Raichle; Timothy Rioux; Jim Sens; Robert Fiorile; Rejina Sharma
<u>Short Description</u>: Matrix is providing underwater inspection, marine engineering, and permitting services in support of NJ TRANSIT's mitigation of scour that occurred at NJ TRANSIT's Brielle and Navesink bridges during Superstorm Sandy. Tidal surge and associated currents were substantial during Superstorm Sandy, and preliminary investigations indicated that the storm had undermined bridge piers. As part of the SYSTRA design team, Matrix was hired to deploy an underwater inspection team to document the seabed conditions in the vicinity of the Brielle and Navesink bridge piers and make recommendations for repairs. Matrix was tasked with securing permits for the work from the NJDEP and USACE.			
Sub to Systra, [redacted]	NJ TRANSIT, Sandy Hardening Surveys North Jersey Coast Line, Various Locations	2014 - 2015	James Sens; Aleksander Sorokin
<u>Short Description</u>: Matrix provided existing conditions and right-of-way locations at seven locations (in total approximately 9 miles of track location) along the NJ TRANSIT's North Jersey Coast Line. The surveys were utilized for the design of storm hardening systems. The surveys were completed using both ground run surveying methods and aerial photogrammetry. Matrix provided the ground control and field checks for the aerial mapping. The survey included mapping all existing conditions within the right-of-way including top of rails and ties, ballast, abutments, crib walls, sheet piling, piping, catenary towers and other features along the rights of way. In addition the surveys mapped the existing rights of way based on Valuation and right-of-way and Track Maps. The mean high water line was also mapped on the surveys.			
Sub to Stantec, [redacted]	NJ TRANSIT, Accessibility Improvements, Perth Amboy Railroad Station, Perth Amboy, NJ	2009 – Ongoing	Clare Sullivan; Gavin Gilmore
<u>Short Description</u>: Matrix is providing ongoing environmental services, including the performance of hazardous materials surveys and preparation of a comprehensive survey report and design document, as well as construction assistance, associated with the proposed renovation of the Perth Amboy Railroad Station. The station is being renovated by NJ TRANSIT to meet the ADA requirements, with the desire to maintain the historical preservation of the existing station elements. As part of this project, Matrix will survey and provide design services for the areas determined to be within the project limits of work (both interior and exterior surfaces/components), including the existing station, platform and track areas.			

Section 4

MATRIX NEW WORLD ENGINEERING, INC. (MATRIX) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
Sub to THE Partnership, [redacted]	Port Authority of NY & NJ/ NJ TRANSIT Trans-Hudson Express Project, NJ/NY	2006 - 2010	Clare Sullivan; Matthew Duffy; Jody Mack
Short Description: Matrix was responsible for performing all environmental investigation activities along the entire alignment corridor in both New Jersey and New York. Specific activities include the performance of Preliminary Assessments/Phase I Environmental Assessments, Site Investigations, and Remedial Investigations of properties along the project corridor, preparation of sampling and analysis plans, preparation of Preliminary Assessment/Phase I Environmental Assessment and Site Investigation Reports, Remedial Action Workplans, and preparation of Property Acquisition Environmental Cost Estimating Reports for properties to be acquired along the right-of-way.			
Sub to Systra, [redacted]	Port Authority of NY & NJ/NJ TRANSIT, Access to Regions Core, NJ/NY	2003 - 2010	Clare Sullivan
Short Description: Matrix was responsible for the preparation of the hazardous materials sections of the Environmental Assessment/ Environmental Impact Statement for this project. Work under this contract included the identification of areas of environmental concern in buildings and/or properties to be acquired (due diligence), impacted, and/or demolished through the performance of a Phase I Environmental Site Assessment (ESA)/Preliminary Assessment (PA).			
Sub to Gannett Fleming, [redacted]	NJ TRANSIT Portal Bridge Capacity, Enhancement Project, Kearny, NJ	2008 - Ongoing	Ahmed Osman; Jei Chon
Short Description: Matrix is performing hydrologic and hydraulic river modeling and bridge scour analyses for this bridge replacement and rail enhancement project. The project includes the construction of two (2) new bridge structures north and south of the existing Portal Bridge which carry's the Amtrak Northeast Corridor rail line over the Hackensack River in Kearny, NJ.			
Sub to Tishman Construction, [redacted]	NJ TRANSIT, Hoboken Terminal and Yard Complex New Wheel True and Employee Welfare Facility	2007 - 2011	Clare Sullivan; Matthew Duffy; Donald Wendt
Short Description: Matrix provided construction management and oversight for NJ TRANSIT on the Hoboken Ferry Terminal improvement project. The project includes the rehabilitation and modernization of the intermodal transportation hub for ferries, trains, buses, and the PATH subways. Matrix's responsibilities included daily inspection of contractor activities for conformance with project specifications and work plans, assisting NJ TRANSIT in reviewing special submittals for waste characterization and disposal, and serving as an environmental liaison to NJ TRANSIT for additional unforeseen issues related to environmental compliance during the construction phase of the project. Matrix is also providing an electrical inspector for oversight of contractor activities.			

RICHARD GRUBB & ASSOCIATES, INC. (RGA)
NJ TRANSIT References – Last Five Years

Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
HDR, Inc. One Riverfront Plaza 1037 Raymond Boulevard, 14th Fl. Newark, NJ 07102 [redacted]	Morgan Draw Bridge over Cheesequake Creek, Old Bridge Township and Borough of Sayreville, Middlesex County, NJ	2014-Est. 2015 (Ongoing)	Paul McEachen; Damon Tvaryanas; Sharon White; Allee Davis
<u>Short Description</u>: RGA is conducting a historic architectural resources background study (HARBS) and Phase IA archaeological survey, and effects assessment report in connection with NJ TRANSIT's electrical upgrades to the Morgan Draw Bridge over Cheesequake Creek, Old Bridge Township and Borough of Sayreville, Middlesex County, New Jersey.			
BEM Systems, Inc. 100 Passaic Avenue Chatham, NJ 07928 [redacted]	County Yard/Delco Lead Emergency Train Storage and Service and Inspection Facility Project, City of New Brunswick and North Brunswick Township, NJ	2013-Est. 2015 (Ongoing)	Paul McEachen; Damon Tvaryanas; Jesse Walker; Philip Hayden; Laura DiPasquale
<u>Short Description</u>: RGA completed a historic architectural resources background study (HARBS) and Phase IA archaeological survey, and effects assessment report in connection with NJ TRANSIT's Improvements to County Yard, City of New Brunswick and North Brunswick Township, Middlesex County, New Jersey.			
BEM Systems, Inc. 100 Passaic Avenue Chatham, NJ 07928 [redacted]	Bay Head Substation, Borough of Bay Head, Ocean County, NJ	2013-2014	Paul McEachen; Damon Tvaryanas; Ilene Grossman Bailey; Jennifer Leynes; Philip Hayden; Kelly Wiles
<u>Short Description</u>: RGA completed a Phase IA archaeological survey and intensive-level historic architectural survey in connection with NJ TRANSIT's Improvements to the Bay Head Substation, Borough of Bay Head, Ocean County, New Jersey.			
Heritage Design Collaborative 2 West Front Street Media, PA 19063 [redacted]	Cablevision-NJ TRANSIT WiFi Projects at Newark Penn and Broad Street Stations, City of Newark, Essex County; at New Brunswick Station, City of New Brunswick, and at Hoboken Terminal, City of Hoboken, NJ	7/2013-9/2013	Damon Tvaryanas; Jennifer Leynes
<u>Short Description</u>: RGA completed Applications for Project Authorization under the NJ Register of Historic Places Act for four Cablevision-NJ TRANSIT WiFi projects: at Newark Penn and Broad Street Stations, City of Newark, Essex County, at New Brunswick Station, City of New Brunswick, Middlesex County, and at Hoboken Terminal, City of Hoboken, Hudson County, NJ.			

Section 4

RICHARD GRUBB & ASSOCIATES, INC. (RGA) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza Newark, NJ 07105-2246 [redacted]	Lyndhurst Rail Station, Accessibility Improvements Project, Lyndhurst Township, NJ	2012-2013	Paul McEachen; Damon Tvaryanas; Ilene Grossman Bailey; Philip Hayden
<u>Short Description</u>: RGA conducted a historic architectural resources background study (HARBS) and Phase IA archaeological survey, and effects assessment report in connection with NJ TRANSIT's Accessibility Improvements Project at the Lyndhurst Station, Lyndhurst Township, Bergen County, New Jersey.			
AKRF, Inc. 440 Park Ave South, 7th Floor New York, NY 10016 [redacted]	Hudson-Bergen Light Rail, Route 440 Extension, City of Jersey City, NJ	4/2012-9/2012	Paul McEachen; Damon Tvaryanas; Michael Gall; Philip Hayden
<u>Short Description</u>: In connection with NJ TRANSIT's extension of the existing Hudson-Bergen Light Rail Line, RGA conducted a historic architectural resources background study (HARBS) and a Phase IA archaeological survey and effects assessment report.			
LTK Engineering Services 20 W. Park Street, Suite 219 Lebanon, NH 03766 [redacted]	Atlantic City Rail Line Operations Study, Double Track Feasibility Study, Pennsauken Township and Atlantic City, NJ	2010-2012	Glenn Modica; Paul McEachen; Philip Hayden; Sean McHugh
<u>Short Description</u>: RGA prepared a cultural resources screening to identify potential cultural resource constraints for NJ TRANSIT's Atlantic City Rail Line Operations Study between Pennsauken Township, Camden County and Atlantic City, Atlantic County, NJ.			
NJ TRANSIT/THE Partnership 2 Gateway Center, 17th Floor, Newark, NJ 07102 [redacted]	Access to the Region's Core/Trans-Hudson Express Tunnel Project, Hudson County, NJ and New York, NY	2009-2010	Michael Young; Glenn Modica; Megan Springate; Philip Hayden; Michael Tomkins
<u>Short Description</u>: On Behalf of NJ TRANSIT, RGA performed cultural resources services for (ARC Trans-Hudson Express Tunnel project. These services included documentary investigations, design consultations, Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) documentation, and assessments of archaeological sensitivity and monitoring for previously identified resources within specific project sites on the New York and New Jersey sides of the Hudson River.			

SJH ENGINEERING, P.C. (SJH) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105	Portal Bridge Capacity Enhancement Project	08/2008 – 06/ 2013 Est. Const. Compl. 2019 (Ongoing) Construction Not Started	Venket Tiruchirappalli
Short Description: Under this $1.7 billion design project, the existing swing bridge river crossing is being replaced and a new parallel crossing is being added. The design features 3-span tied-arch structures with adequate clearance for navigational traffic below. SJH provided cost estimating and design services, and prepared construction documents for the installation of Construction Access Platforms, estimated at $49 million.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105	Hurricane Sandy Repairs for Electrical Substation and Related Equipment at Hoboken, MMC and Bay Head	05/2013 - Ongoing	Venket Tiruchirappalli
Short Description: SJH is providing structural, civil and geotechnical engineering services. Project responsibilities include assessments, evaluation, analysis, alternatives, design, and construction assistance services for the repair, reconstruction and replacement of electrical substations and equipment. The first $200M task involves elevating buildings above grade, strengthening floors, demolishing buildings, and modeling HVAC/MEP components of buildings in REVIT.			

Section 4

SOWINSKI SULLIVAN ARCHITECTS, P.C. (SSA) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East, 8th Fl. Newark, NJ 07105-2246 [redacted]	Wesmont Station, Wood Ridge, NJ	2009-2011	Richard Sullivan; Rob Witte
Short Description: SSA was an Architectural Subconsultant: This new station is being developed in accordance with NJ TRANSITs sustainable design guidelines. The sustainable efforts for this new station are: utilizing Brownfield land (former site of the Curtiss-Wright industrial building) use of natural day lighting and natural ventilation. The station is comprised of an overpass, elevators, and a center high level platform.			
LTK Engineering W. Park Street, Suite 219, Lebanon, NH 03766 [redacted]	Woodcrest Station - Atlantic City Line Service Expansion, Cherry Hill, NJ	2010 - 2011	Richard Sullivan
Short Description: SSA was an Architectural Sub Consultant: develop design alternates to bridge the interface between PATCO's fare control system and the traditional train ticket system utilized by NJ TRANSIT. The two stations will be joined at Woodcrest and share many common spaces, making fare control a key issue.			
[redacted]	Pullman Building Inspection, Hoboken, NJ	2011-2011	Richard Sullivan; Robert Witte, Jr.
Short Description: : SSA was an Architectural Subconsultant: inspection of historic Pullman Building at the Hoboken Terminal. Scope included inspection and identification of remedial repairs to be performed to bring this historic resource to a state of good repair.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	Hoboken Terminal Substation/Crew Facility, Hoboken, NJ	6/2013 –Ongoing	Richard Sullivan; Robert Witte, Jr.
Short Description: SSA was an Architectural Subconsultant: Assist in the development of alternatives for substation development			

Section 4

SOWINSKI SULLIVAN ARCHITECTS, P.C. (SSA) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Trenton, NJ 07105 [redacted]	Meadowlands Maintenance Facility, Kearny, NJ	5/2013 – 7/2013	Richard Sullivan; Robert Witte, Jr.; Jessica McSulla
Short Description: SSA developed a Damage Assessment Report detailing the extent of damage caused by water infiltration during Superstorm Sandy at the NJ TRANSIT Meadowlands Maintenance Complex in Kearny NJ.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	Newark Penn Station East Entry Improvements, Newark, NJ	9/2012 – 6/2013	Richard Sullivan
Short Description: SSA coordinated SHPO submission for new canopy			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	County Yards Upgrades, New Brunswick, NJ	2014 – Ongoing	Richard Sullivan; Anthony Horler
Short Description: : Project involved the expansion of the existing County Yard site. Yard upgrades include a new two track S&I facility with support spaces, Material storage and Welfare Facilities, Replacement of Amtrak C&S building.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	New Brunswick Station, New Brunswick, NJ	2014 – Ongoing	Richard Sullivan; Robert Witte
Short Description: SSA was involved in a platform extension. The 230 foot extension is a continuation of the existing high level platform to the west, providing level boarding access for two additional train cars. The existing stair from platform level to the street below will be removed and replaced with a stair meeting egress requirements.			

Section 4

SOWINSKI SULLIVAN ARCHITECTS, P.C. (SSA) NJ TRANSIT References – Last Five Years			
Client Name Reference Contact Information	Project Title	Start & End Date	Key Personnel Involved
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	MNorth Brunswick Station, North Brunswick, NJ	2014 – Ongoing	Richard Sullivan; Robert Witte
Short Description: Station is subtask to the Mid Line loop project which will provide a loop for trains to cross the NEC tracks and return east. The station will provide access to passengers for the future TOD to be constructed on the former Johnson & Johnson site. An inbound and outbound platform will be provided with access over the NEC tracks via a pedestrian bridge.			
NJ TRANSIT One Penn Plaza East Newark, NJ 07105 [redacted]	Jersey Avenue Station, North Brunswick, NJ	2014 – Ongoing	Richard Sullivan; Robert Witte
Short Description: : SSA is the architect for replacement of the existing Jersey Avenue Station. scope of work includes modification of the existing site, replacement of the low level westbound platform with high level island platform, and decommissioning of the inbound siding track with low level platform.			

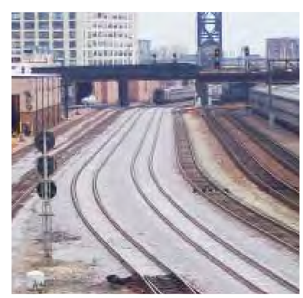
- Note:
  Levitan, LTK, InfraMap, exida, Jersey Boring, and Sullivan Cove have not completed any projects for NJTRANSIT over the last five years.

5 Work Plan









Section 5 | Work Plan

Project Understanding

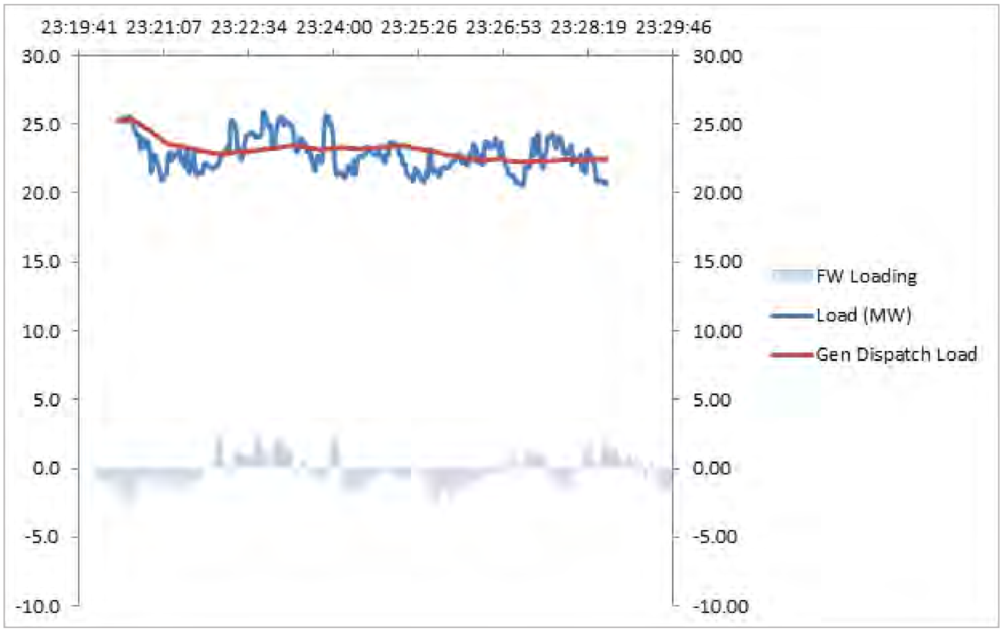
We assembled the Jacobs Team specifically for its experience related to NJ TRANSITGrid and in similar microgrid power generation and rail system applications. Our Team members have a deep and thorough understanding of the goal of this project in supporting the mission of NJ TRANSIT to provide a resilient electrical supply to the transit loads for NJ TRANSIT, HBLR, and Amtrak NEC. NJ TRANSITGrid must ultimately meet the mission of providing continuous rail services to the ridership in the area, even following catastrophic events, such as natural disasters, terrorism, or human error. The Jacobs Team is also poised to help NJ TRANSIT not only meet this resiliency goal, but also manage risk, navigate the regulatory process, support the FEIS process, deliver a comprehensive program with cost assurance, and achieve a return on investment. We will be your partners in providing bid assistance, and assisting in the management of stakeholders. We understand and are prepared to support you during the construction phase of this project providing professional services.

Equipment Selection – Right-Sizing

We understand the basis for the recommendations made in the Sandia study, the practical limitations of equipment, and also the need to think conventionally as well as outside the box to develop the most effective microgrid solution for your application. The ability to apply critical thinking, coupled with unique experience in the areas of microgrid, energy storage solutions, and unique blackstart sequencing as well as a track-record of delivering complicated projects on NJ TRANSIT and Amtrak right-of-way makes our Team the right choice to help NJ TRANSIT achieve project success. As demonstrated in our qualifications, we have invested significant effort into the early planning of potential design solutions, with the understanding that there will certainly be other ideas for consideration. This demonstrated critical thinking, combined with the broad and all-encompassing background of the Jacobs Team – enhanced by Burns' engineering understanding of the challenges of transmission distribution along the rail system – allows us to spend quality time focusing on other unique challenges.

We base our process of selecting the right technology mix for this application on sound science. We will develop detailed real time load projections for the aggregate load profiles, and then determine which technology options are capable of meeting the rate of change of load for long-term operation in island configuration. This process will yield a group of technology options for detailed consideration, which will be further expanded with the consideration of energy storage through flywheels or large-scale pump battery storage, etc. These options allow for smooth load transitions and a predictable load profile, and generation dispatch in island mode. By load shaping the curve to reduce the noise, generation options not otherwise considered become potentially viable for consideration, including combined cycle, combined

- *Our experience designing two frequency regulation plants in the PJM market gives us unsurpassed working knowledge of both the market and one of the premier suppliers of technology in this market. We designed a 20MW facility in Stephentown New York, and one in Hazle Township, both that dispatch into the PJM market for ancillary services. These technologies are ideally suited for application, such as the TRANSITGrid, to serve to integrate a noising profile over time and provide the rapid response needed.*



heat and power, etc. The concept of load shaping is shown in the below graphic; and discussed in more detail in Task 2 further on in this section.

Buy America Act Requirements

We also understand the FTA regulations regarding equipment sourcing and Buy America provisions. The Jacobs Team routinely selects and purchases major equipment and understand the limitations and challenges that Buy America presents. The basis of the Sandia report did not completely contemplate this requirement with the concept of the reciprocating engine facility. We have the background and understanding of the various generation technologies, where they are sourced and can help NJ TRANSIT meet the Buy America provisions where possible, and provide the required documentation for items (such as the static frequency converters for instance) that cannot be sourced from American suppliers.

Ancillary Markets

As a PJM resource interconnected to the bulk power system, the NJ TRANSIT plant will have opportunities to sell some ancillary services to the PJM marketplace. Depending on the selected equipment and technologies, options would include regulation up/ down and blackstart services. We will include the associated revenues in the economic screening analysis as well as in the final cost-benefit analysis we prepare for NJ TRANSIT. We will investigate all feasible options for the NJ TRANSIT plant to earn additional revenues through the opportunities to provide ancillary services as well as energy and capacity. Detailed discussions on this topic are included in Task 15 of this section.

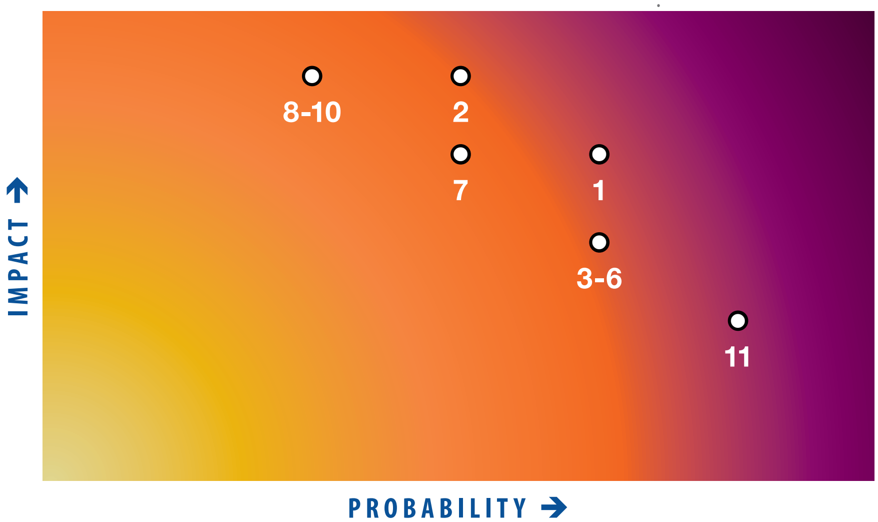
Section 5

Risk Management

We have conducted a preliminary risk review session on this opportunity and have identified some of the key risks to the project and operational success. We discuss these risks in more detail in Task 7. We view risks on a heat map, which drives attention to those that are most likely to cause the largest problems as shown on the below graphic. When taking the first pass at the risk review for this project, we identified the following as key risks that warrant immediate attention.

TOP RISKS

1. Long equipment lead times
2. Inadequate load data
3. Discord on basis of design
4. Distribution along Right-of-Way
5. Funding
6. BPU regulations for Amtrak
7. Inadequate construction QA
8. Stakeholders withdraw support
9. Environmental permitting
10. BPU prohibits T&D along NJ TRANSIT ROW
11. Inadequate basis for O&M future



As shown on the heat map, we identified the equipment selection as one of the key risk components. There are many project impacts that hinge on this selection, not only technology but suppliers also. The PJM interconnection process cannot begin until this selection is made; the air permit is contingent on it, as is the basis of design development for the 10% and 20% submittals. Equipment varies drastically not only in performance, but also in physical arrangements and design criteria between vendors and technology. Because of this, we have identified this step as crucial in the overall project implementation. As with most of our clients, we advocate risk mitigations measures to deal with this issue. The most effective and practical way to deal with this issue is to right-size the equipment, as discussed in Task 2 of our work plan, and then proceed to procure the equipment prior to design completion to allow these processes to advance. We will discuss the pros and cons of this approach, share numerous success stories of risk avoidance and cost assurance, and recognize the advantages with FTA funding timing, Buy America provisions, design and cost certainty, and schedule compliance. We understand that NJ TRANSIT typically would not take this path from a procurement philosophy, but our experience can help understand the risks of this and alternative approaches, and we trust we can develop a path to success.

Start-Up & Commissioning

An important risk for new microgrid/power generation projects is accepting systems prior to completion and thorough checkout and commissioning. Each system must be individually and thoroughly checked out to verify that each and every component is installed, calibrated, tested, and operating correctly. Failure to do a thorough checkout can result in the system not operating, reliability issues, equipment damage, and potential impact to human life. We take this task very seriously. Once the equipment and a path forward are selected, during the design and shop drawing phases of the project, we will collect data for each and every piece of equipment and subsystem. These documents will include the individual startup, installation, and commissioning procedures for these systems. However, the interoperability of the systems will not be thoroughly documented. The Jacobs Team will work with NJ TRANSIT, the installation contractors, the equipment suppliers, etc. to ensure that a valid and comprehensive testing and startup procedure is developed well in advance of system readiness. During startup and commissioning, our experience and the hands on approach of our key engineers will guide the process to success. More details on this topic are discussed in Phase 2, Task 6, and Task 9 of this section.

Operations & Maintenance

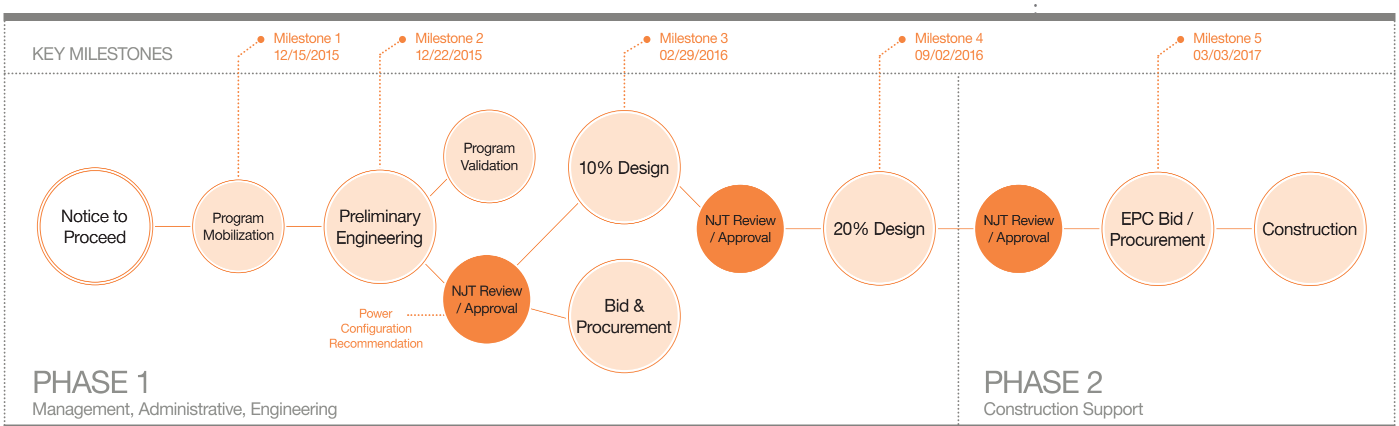
As a full service engineering and construction contractor, we have a thorough understanding of the marketplace for not only design, but construction, operation and maintenance (O&M), and other support services. We will leverage this knowledge to inform the project team on the logical and lowest risk project packages for each component and system. We will discuss in detail the contract packaging sections (Tasks 13 and 14) that focuses on the design through construction. We also have full service O&M personnel who currently run many of the largest federal facility and capital programs in the country (NASA for example). We are prepared to leverage this knowledge for NJ TRANSITGrid by informing what is reasonable in the marketplace, allowing for optimized O&M contract language.

Section 5

Approach To Achieving The Work

Our approach to achieving project success is to fully integrate and engage at all levels with your team. We will operate in a free and open book fashion to steer the project toward informed decisions in the most intelligent and efficient way. Our innovative thought leadership packaged with our strong project management procedures have been custom-tailored to direct and inform the NJ TRANSITGrid Team intelligently from the start. We, however, do acknowledge challenges with the design concepts as presented in the RFP, but our experience and skills will provide in-depth analysis and evaluation of logical alternatives that will drive success.

The key item we wish to highlight in our work plan is demonstrated in the following graphic that displays our high-level work sequence. It is important to note this approach includes selection of power generation technologies and equipment supply prior to completion of 10% and 20% design development. This approach is discussed in thorough detail in the following sections, but this concept is vital to project success and to achieve maximum value and meaningful progress in the 10% and 20% design phases.



This approach allows for design development of the power generation solution to proceed by designing around the actual equipment that will be installed. Given the vast differences in equipment size, connectivity, and auxiliary requirements between different manufacturers, the development of design documents based on generic information will most certainly result in a complete redesign once the equipment is selected by others – making the effort expended by NJ TRANSIT for the 10% and 20% designs a poor investment of time and money. We believe the schedule permits an intelligent evaluation of power generation options, selection of the overall configuration that best suits the needs of NJ TRANSIT, and initializing the procurement of major equipment to inform early design activities.

Right Sizing
Delivers Efficiency and Resiliency

Jacobs Approach
(Right Sizing, Procurement)
Delivers Cost Assurance

Jacobs Innovation
(Flywheels, Comb Cycle)
Delivers ROI

Section 5

Driving the Schedule

With the approach the Jacobs Team is proposing, we will drive the schedule to completion as needed, while developing strong and thorough procurement packages for the equipment – with contractual language for ultimate assignment to the installation team(s). This allows NJ TRANSIT the assurance of a microgrid power generation option that will function as intended as well as eliminating the variability that can come from a more traditional and less technically versed EPCm or DBOM offering.

Strong management and technical excellence drive the schedule

As shown on the preliminary schedule in Section 8, we are projecting that with our work plan approach we will be bid ready at NTP +15 months for the baseline plant/scope as contemplated. If the concept for more efficient combined cycle or energy storage solutions proves to be most viable, the duration of the design work will likely be extended due to the somewhat linear process of the submittal and optimization process. However, the time spent on this additional refinement will more than offset in the increased efficiency and project optimization.

Communications Protocol, Consensus Building and Stakeholder Coordination

Numerous factors will greatly influence the success or failure of this project. A key to success is clear, concise, timely, and coordinated communications across all phases of this project. The development of a communications protocol for the Team will be among the Project Manager's very first actions. The protocol will address both internal Team communications, as well as external stakeholder communications. The protocol will establish:

- The communications chain of command – indicating who is empowered to make decisions and communicate directly with stakeholders.
- The communication process – laying out steps and methods to be utilized for particular outreach and communications activities.
- The communications content – identifying the topics and specific technical information necessary for each communication transaction.
- The communication strategic schedule – showing the specific critical path activities, meetings, and decisions required from the outreach and coordination program.

The execution of our communications and coordination efforts will be relentlessly driven by our actions to build consensus around the advancement and implementation of NJ TRANSITGrid. Our experience has shown that project risk is often amplified due to external stakeholder dissatisfaction, confusion, or fear.

We will develop our program to engage those parties to the maximum extent possible, listen to their input and issues, systematically consider this input in unison with the design team and NJ TRANSIT, and finally develop a response that is clear, financially and environmental justifiable, and that meets project goals and objectives. This proactive approach will supply the Project Team with the necessary inputs and decisions as they are needed and allow the project to advance through the design and approval process in strict adherence to the project schedule.

We have found that the best way to build consensus is for us to play the role of an advocate for our client. Project development has become so complex and potentially risky that the provision of high-quality engineering services alone is not enough to create true success. These services are clearly one element of a project's success, but we believe the addition of a strong advocacy role as a central function within the design team is necessary to meet all objectives. We will work tirelessly to build consensus around this project. We will focus on the benefits and develop mitigation strategies to eliminate or minimize any potential impacts. We will do this by leveraging our existing relationships with the stakeholders and by clearly and succinctly managing our internal communications.

Given the need to often operate "outside the box" during periods of intense production, we will also identify protocols and responsibilities for resolving unexpected issues prior to them arising. Because of the complexity of this project and the multiple stakeholders providing input, there will undoubtedly be times when insufficient, unexpected, or contrary input or information is received from outside stakeholders. Having contingencies prepared ahead of time for dealing with these situations will allow us to respond quickly in an appropriate manner and continue to advance the project within the identified schedule.

Navigating PJM Process and Regulations Matters

This project will require interaction with PJM. The Jacobs Team brings the important relationships and experience working with PJM and other regulatory agencies that, coupled with the communications and consensus building strategies, will remove the potential administrative hurdles of navigating the regulatory process. Major stakeholders involved in the transmission, distribution, and generation interconnection will include NJ TRANSIT, HBLR, Amtrak, PJM, PSE&G, and the NJBPU. Some of these outside stakeholders have processes for applications or permits that we can help guide NJ TRANSIT through. Our long history with key individuals at these agencies will allow us avoid hitting unexpected roadblocks in the process of design development, and interconnection.

IV. Scope of Services – Detailed Description of Tasks

A Team Built on Leadership

Effective project management for a first-of-its-kind microgrid project is imperative. The Jacobs management team is focused on providing leadership across all levels of the technical and project management structure. The Jacobs Team has a thorough understanding of the needs of NJ TRANSITGrid and its stakeholders, and proactively works to address problems before they become crises. Our Team leadership includes key microgrid/power generation expertise, as well as experienced leadership in traction power and New Jersey specific challenges.

Phase I – Project Management and Engineering

Task 1 | Project Management

At Jacobs, we believe successful projects are achieved by combining corporate strength with individual experience and expertise. This combination is what we're providing to NJ TRANSIT, and explains our alignment for the management and execution of the NJ TRANSITGrid project. Our project approach, starting with management processes all the way through in-depth technical leadership, has been developed to deliver the following important values to NJ TRANSIT:

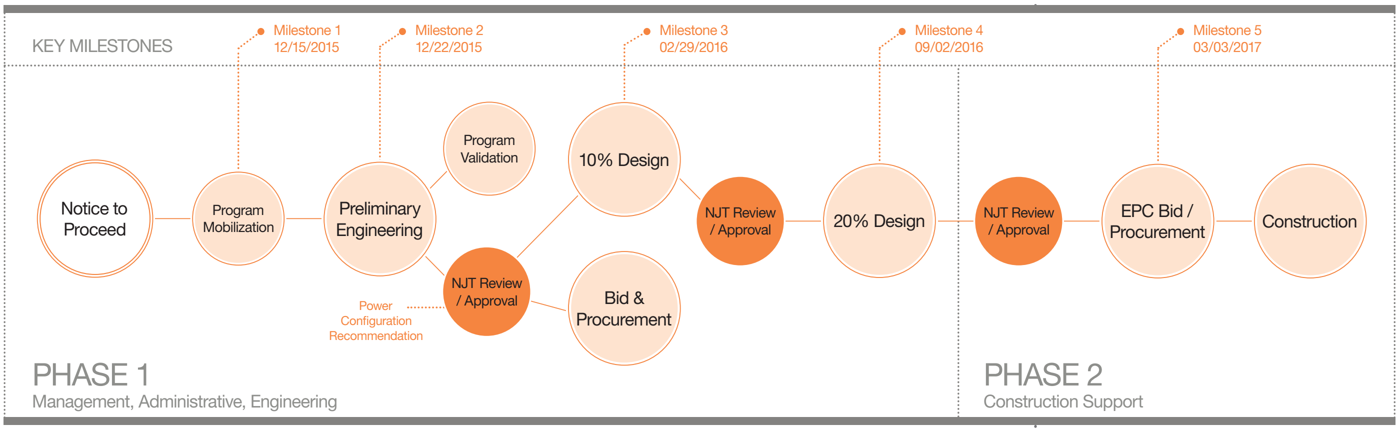
- Inform and Communicate
- Drive Schedule
- Manage Risk
- Cost Assurance
- Infrastructure Resiliency
- Return on Investment

Our proposed management team is structured to assist you in achieving these goals while addressing the complexity, scale, and interdependencies between power and rail that are fundamental to this project. The Jacobs Team will be led by Roger Copeland, who brings a long and successful track record of delivering innovative and complex power generation and infrastructure projects for microgrid and utility applications. The Jacobs Team is further strengthened by Deputy Project Manager, Diaa Elmaddah, who brings experience with rail and transportation projects. The Jacobs Team's in-depth technical knowledge, proven leadership, understanding of both power generation and rail projects, backed by decades of experience delivering successful projects, prepares us to lead and assist NJ TRANSIT with engineering and technical services to deliver a well-developed and comprehensive solution for the NJ TRANSITGrid project.

It is clearly important to implement and maintain clear, concise, and accurate communications to address all areas of program development from the outset of the NJ TRANSITGrid project. The success of your program depends on trustworthy communication; and this starts with Roger and our management and control process. Our project management approach is designed to provide timely communication, stakeholder collaboration, accurate reporting, and technical leadership. A formal and informal communication regime will be in place to make certain our Team integrates with yours to fully optimize the sharing of information and intelligent decision-making.

Section 5

Our previously introduced work flow diagram captures and communicates our strategy for developing the NJ TRANSITGrid project.



Work Flow Diagram – Summary

The above summary graphic captures the major elements envisioned in the development of the NJ TRANSITGrid Project. The management approach outlined in this section is built upon the foundation of multiple successful programs that Jacobs has delivered on time and within budget. Project Mobilization will establish and advance many of the procedures and requirements specifically addressed in this section.

Additional detail and more of the specific technical components comprising the major elements of the work flow diagram are addressed in the Project Management and Engineering sections of this proposal.

Subtask 1.1 | Project Management Plan

One of NJ TRANSIT's stated concerns is keeping apprised of technical progress and project financial status. Our program execution and communication strategy is orchestrated through our Project Management Plan (PMP), which connects the discrete functions of project administration, integrates scope and budget management, risk mitigation, quality, safety, resource management and financial tracking, among others, into a centralized repository to organize tasks and lead execution.

Jacobs' disciplined approach to project management strongly emphasizes thorough planning and tight control of project details, assuring a well-executed design criteria document, coordination, and preliminary engineering effort. The PMP is the playbook that keeps our Team's focus on the core mission of the project and communicates to NJ TRANSIT the crucial elements of cost, schedule, and technical progress associated with the overall program.

Section 5

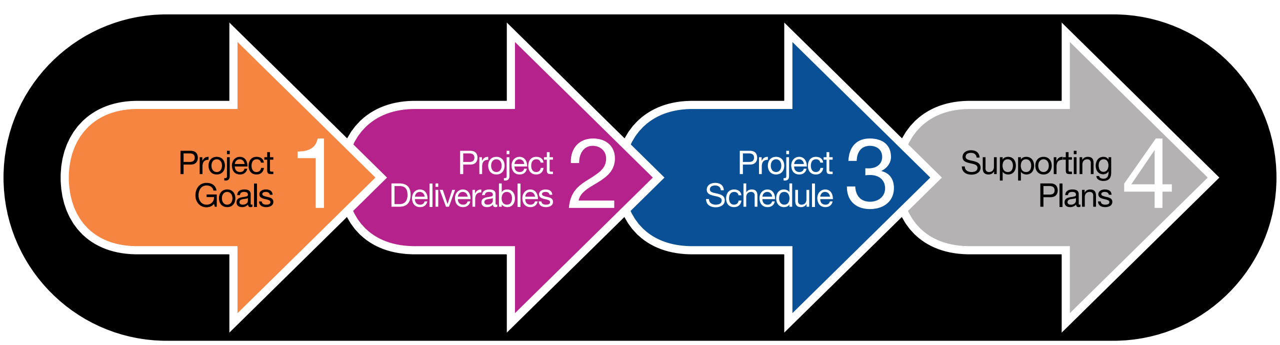
Our management plan, which addresses project scope and execution, roles and responsibilities, communication protocol, design management, project control, quality assurance, schedule, resource management, third party coordination, safety, risk management, and design value enhancement will be structured to share vital information and instill stakeholder collaboration in addition to driving the complex technical and multi-agency coordination requirements required of this project from Notice-to-Proceed (NTP).

The PMP is a guide for everyone involved in the project. It helps to ensure all effort is expended in a direction consistent with the needs and priorities of the NJ TRANSITGrid project. It functions as a tool for communications across the entire project team, including NJ TRANSIT.

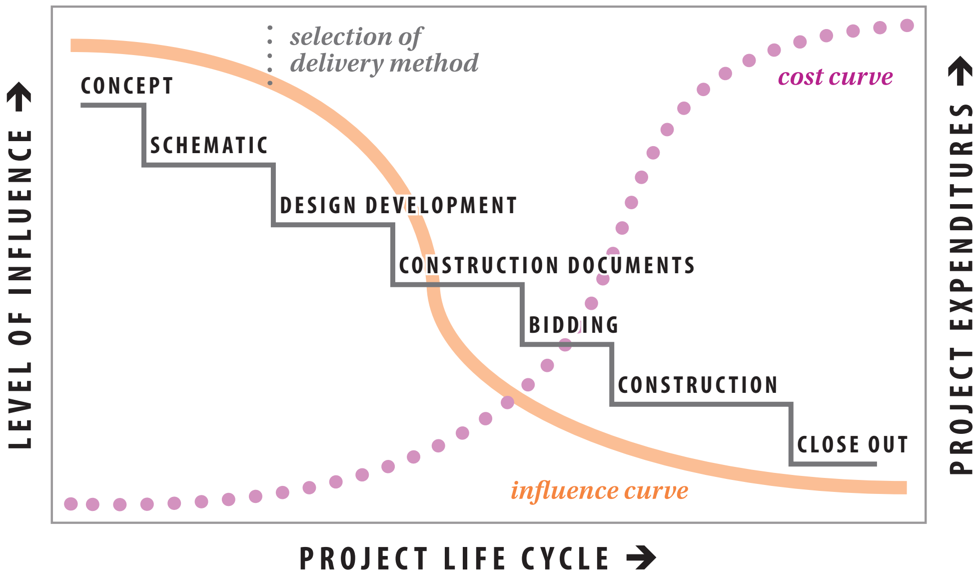
Developing the PMP requires input from a wide range of stakeholders, including NJ TRANSIT business managers, engineering staff, construction, and operations and maintenance personnel. The process of preparing and maintaining the PMP as a relevant tool is as important as developing the Plan in the first place, and provides a team-building exercise that quickly orients and unifies the Team toward the common vision of a successful outcome for the NJ TRANSITGrid project. As illustrated at right, the ability to influence the outcome of a project is greatest in the early stages when the cost is lowest. The time devoted to this strategic planning element is invaluable.

To kick-start this effort, we will facilitate a project management planning workshop, attended by key project team members, both Jacobs and NJ TRANSIT, as well as third party influencers and stakeholders, as appropriate. Key directives and inputs from this meeting will be used to guide the specific elements of the PMP. Once established, an initial draft will be published and circulated to the Team.

Project Planning **Step-by Step**



Update the plan as project progresses. | Measure progress against the plan.



The PMP is a living document however, and it is continuously maintained to reflect latest conditions. It is reviewed and updated at regular intervals to ensure that it reflects best available data and any changes in the program or execution approach.

Within 30 days of receipt of NTP, the Jacobs Team will prepare the draft PMP to define, forecast, and communicate the administrative functions and requirements necessary for the successful execution and delivery of the NJ TRANSITGrid project. Upon approval by all parties, the PMP will be distributed to project team members, so that all personnel are integrated directly into our program organization and fully understand the project scope, the anticipated schedule, associated budgets, and how the project will be implemented. The PMP will address the following major project areas, many of which are documented in other sections of this proposal:

ORGANIZATION AND STAFFING

- Project Organization – Phases 1 & 2
- Key Roles/Responsibilities
- Organization Chart
- Key Contacts and Interfaces with NJ TRANSIT
- Personnel Directory
- Environmental Coordination with BEM

PROJECT SET-UP

- Scope of Work
- Contract Terms and Conditions

- Deliverables
- Schedule
- Work Plan
- Project Technology Plan
- Quality Management Plan
- HASAP
- Invoicing
- Quality Assurance Plan

MANAGEMENT & PROJECT CONTROLS

- Functional and Technical Control
- Cost Control
- Schedule Control
- Configuration Management
- Document Management
- Baseline Management
- Change Management
- Cost Management
- Critical Path Method (CPM) Project Schedule
- Records Retention and Disposition
- Interface and Integration Management

RISK MANAGEMENT

- Scope
- Risk Identification
- Risk Evaluation
- Risk Control

ENGINEERING PROGRAM

- Requirements and Standards
- Design Supervision
- Design Coordination – Internal & External

Section 5

- Design Review Process
- Value Engineering
- Peer Reviews
- Constructability Reviews
- Cybersecurity

STAKEHOLDER & COMMUNITY OUTREACH

- Permitting, Approvals and Regulatory Stage Gates
- Roles of Stakeholders and Responsibility Matrix
- Interagency Coordination
- Community Outreach/Coordination Plan
- PJM Application Process Plan

COMMUNICATIONS PROTOCOL

- Personnel Directory
- Document Distribution and Management
- External Communications Procedures

PROJECT CONSTRUCTION

- Construction Inspection and Observation
- HASAP
- Document Reviews
- Project Controls
- Field Procedures
- Record Drawings
- System Coordination and Testing
- Project Close-Out

ADDITIONAL

- Procurement/Contract Packaging
- Right-Of-Way and Real Estate Acquisition
- Market Revenue Opportunities

Subtask 1.2 | Project Control

The execution of a successful project is based upon a robust Project Controls Plan (PCP) and can only be achieved through an effective schedule and cost control methodology. The Jacobs Team understands that successful project performance is dependent upon a dedicated and independent project controls systems being established with skill and experience to assist NJ TRANSIT. Jacobs' project controls follow an Earned Value Management System (EVMS), which uses and monitors schedule and cost at individual task and work breakdown structure (WBS) levels. Our Project Controls Leader tracks and coordinates the progress of the project on a month-to-month basis to ensure the project is on-track. The Project Controls Leader will evaluate the actual position of the project, and review with the Project Manager to allow appropriate corrective actions to be taken. Our Project Controls Leader will assist in overseeing project control management systems, including managing the development and updating master and detailed schedules; developing and implementing web-based financial and performance reporting systems for internal and external stakeholders; undertaking "bottom-up" construction cost estimates; and deploying a robust set of configuration management, document control, and management support software applications.

Project control functions as the guiding force to keep the project cost, schedule, and accounting functions on track to ensure a well-run, cost assured, and timely project delivery.

Major deliverables under this task will include development of a WBS consistent with NJ TRANSIT standards, developing a draft baseline schedule and a final baseline schedule to be provided two weeks after receiving NJ TRANSIT's comments, providing monthly progress and status reports, and assisting in the preparation of monthly reports.

OUR EXECUTION OF THIS TASK WILL BE DRIVEN BY:

TEAM WORK to provide seamless coordination among NJ TRANSIT, our Project Management Team and other stakeholders

NO SURPRISES in order to establish and sustain communication and coordination protocols with NJ TRANSIT staff, and develop procedures to promote coordination with governmental entities and other agencies. Early and frequent coordination/ communication with stakeholders, including NJ TRANSIT customers achieves much in the way of keeping this project within budget and on schedule.

DEMONSTRATED ABILITIES, bolstered by prior experience and the successful completion of similar complex power and transportation projects, successful past relationships working together and experience with NJ TRANSIT, State and Federal regulatory agencies provides to you the best Team for your needs.

Section 5

The individual to lead this Task is Michael Pytlik. This section outlines a few of the processes and procedures that will be employed to help NJ TRANSIT and the Jacobs team maintain focus on the core goals of the project.

Within 35 days of Notice to Proceed, the Jacobs Team will prepare and submit to NJ TRANSIT for approval a Project Controls Plan (PCP) for NJ TRANSITGrid. The PCP will be the guide for monitoring cost and schedule performance, and will be developed to optimize project staffing, productivity and cost effectiveness. The PCP will be written to ensure the project progresses in accordance with Project Management Plan and contract requirements. The PCP will define:

- Major phases and milestones of the project
- Major work items/activities and their planned completion dates
- Planned approach for completion of major work items/activities
- Listing of planned deliverables and due dates expected for each major work item/activity
- Listing of anticipated input from NJ TRANSIT and third parties required to progress and complete each major work item/activity
- Identification of the staff responsible for delivery of each major work item/activity
- Planned budget and hours for delivery of each major work item/activity
- Scheduling software (Primavera P6)
- Cash flow requirements

COST CONTROL

We closely monitor progress by task and subtask on a weekly basis, comparing it with actual costs and milestones. Schedules and budgets do not allow for missteps; the work must be done correctly the first time. Jacobs' management and technical experience makes that happen. We implement the project organization, communication, and document control necessary to make each task organized and preserved as the official project record. We will develop concise cost reports to monitor and communicate performance on a weekly basis using proven systems for cost tracking, forecasting, variance analysis, subcontractor management, and project reporting. We will alert NJ TRANSIT to potential risks on projects and help to prepare risk avoidance strategies.

The best tool available to our Team is a proactive approach to Earned Value Management (EVM) that looks ahead to upcoming tasks, anticipates issues, and coordinates efforts to keep the task on track.

EARNED VALUE: TRACKING PROGRESS VERSUS BUDGET

One of the most important roles of Project Controls will be to keep NJ TRANSIT informed about the progress of work and the status of the budget. We will utilize advanced project monitoring and control techniques to evaluate the project schedule, budget, and scope including EVM. We will use EVM to compare target versus actual progress and will submit it as part of the monthly progress reports. Project Controls will issue appropriate WBS task codes associated with the program. The Project Manager will instruct appropriate staff and subconsultants of the WBS task codes and of their respective assignments, schedules, and budgets; and authorize them to start the work. The design staff will record their project efforts via weekly input sheets utilizing the project number and respective WBS task codes.

This information is then incorporated into a monthly Project Progress Report, which lists all WBS codes, budgets, current charges, and cumulative charges to date. This report is issued to the Jacobs Project Manager on a weekly basis and is the foundation for the generation of monthly progress reports provided to NJ TRANSIT. The progress schedule will compare the budgeted and expended man-hours and labor cost to the actual man-hours and labor cost, and report the actual percent complete. Invoiced billing totals are compared to the costs/budgets to ensure the project is within budget.

INVOICES

Jacobs' project controls monitor cost and commitment through requisition and invoice review; assists in ensuring all of the team members' adherence to recommended best practices; assists in coordinating and regulating various meetings, such as project progress review meetings and quality circles; and promotes application of various project progress methods to make sure the project schedule is on track to meet deadlines or deliverables. See Subtask 1.7 Payment Procedures for more information on invoicing.

Subtask 1.2.1 | Final Scoping/Preliminary Engineering Schedule

We will prepare a design schedule upon receiving NTP, and submit it to NJ TRANSIT for approval. The approved schedule will be used to monitor and control the many complex, multidisciplinary and interrelated activities, so the project will be completed on schedule. We will structure the schedule control process to enable the project schedule to be effectively developed, monitored, and evaluated throughout the project life cycle.

We will develop the schedule in Critical Path Method (CPM) format using Oracle's Primavera P6 Project Management software. Included in the schedule will be all NJ TRANSIT and third party activities affecting the project progress, such as reviews of deliverables. Additionally, all contractual deliverables will be included in the schedule as milestones.

The project schedule will serve as a tool to verify adequate planning, scheduling, management, and execution of the project and enable NJ TRANSIT to evaluate the project progress. It will also allow variances and deviations from the schedule to be reviewed, analyzed, and discussed in order to identify problems early and implement actions to either revise the schedule or mitigate the delays. The approved project schedule will be used to establish a baseline spend “S” curve at the overall project level and as a means to measure actual performance versus planned.

We will submit a progress schedule for each reporting period. Additionally, a 60 day look ahead, presented in tabular format, will be extracted from the schedule and used at regularly scheduled progress meetings attended by the Jacobs Team and NJ TRANSIT. The 60 day look ahead will clearly and succinctly identify what activities are scheduled for completion within the next 60 days, as well as identify upcoming design milestones. The look ahead schedule will also be utilized as a control tool for the discipline leads to prioritize work and coordinate with other disciplines.

CPM SCHEDULING

We utilize Primavera P6 for all of NJ TRANSIT’s schedules. Primavera, combined with the expertise of our schedulers, provides NJ TRANSIT with the tools needed for progress and resource management. Following the program’s kick-off meeting, Jacobs will develop detailed WBS task codes and a draft scoping and engineering schedule for NJ TRANSIT’s review; and upon approval, it will become a final baseline schedule that will be updated on a monthly basis. Monthly updates will compare target versus actual progress and will be submitted as part of the monthly progress reports.

The schedulers will develop a detailed baseline program schedule for all aspects of the program, including, but not limited, to survey, right sizing, investigation, testing, and design phases of a project from NTP to Construction NTP (NTP+15 months). This schedule will include all necessary milestones, as well as all agency review periods and applicable meetings. This schedule will focus on the discipline coordination and site coordination to limit the demands on resources such as track outages and other capacity restrictions, including interfaces with adjacent projects/programs.

We will accomplish the detailed program schedule by providing interactive planning. Interactive planning allows all project participants and stakeholders to plan a project schedule from planning and scoping, through design, and into construction. Interactive planning is a work session where all stakeholders and involved parties gather to identify their scheduling requirements and the exchange of data and deliverables for a project. The information is used to mutually agree upon a reliable and accurate schedule that minimizes the risk of project delays.

Jacobs will alert the NJ TRANSIT Project Manager to potential risks on the project and help to prepare risk avoidance strategies. We will also manage and communicate to the NJ TRANSIT Project Manager when the Team is threatened with scope creep. In those instances, we will identify the potential impacts on budget and schedule and assist in assessing the merits of scope expansion.

Jacobs has experience with the NJ TRANSIT Superstorm Sandy Recovery and Resilience Program document formats and requirements, and will issue reports consistent with these requirements.

A preliminary schedule is included in Section 8 of this document for review.

CONSTRUCTION CONTRACT TIME DETERMINATION

The key to managing and optimizing the construction schedule is to establish the most effective project duration possible, then monitoring and adjusting for timely completion of each phase or task. The schedulers will rely on the developed outage plans, operational interface issues, construction phasing, site logistics, right-of-way (ROW), traffic control, permitting, and material selection in order to establish the most effective, constructable, and logical project duration possible given the scope of work from pre-construction submittals and permitting through project closeout; phasing the project to limit the number of operational outages. This schedule will follow FTA principles for scheduling. The Jacobs Team's intimate understanding of transit operations will allow for schedule optimization with minimized impact to the ridership.

This process begins in the interactive planning sessions where we bring together our specialty staff and relevant design disciplines to develop the best technical approaches. We will also invite and encourage representatives of NJ TRANSIT and other agencies to participate in this process. Interactive planning helps identify efficiencies and implement schedule delay avoidance strategies before start-up and throughout the life of the task order. Our interactive planning team analyzes and evaluates alternative technical and design solutions, work sequencing, and resource demand.

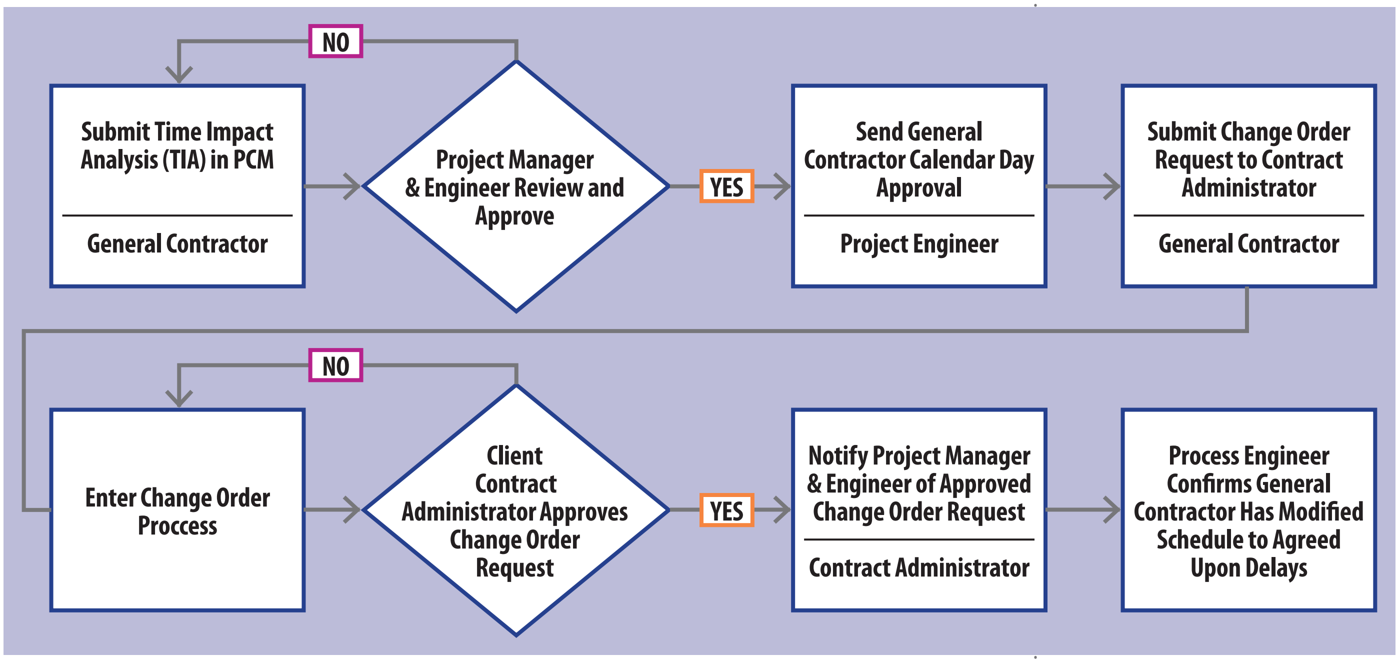
We can develop or review detailed CPM schedules for all phases of a project. We provide CPM schedule updates with reports that highlight activity deviations between the baseline and current schedule. When delays are encountered we can prepare or review recovery schedules. We may also perform Time Impact Analysis (TIA) or Forensic Analysis to incorporate approved changes into project schedules.

Time Impact Analysis

The TIA and narrative will include a 'forward-looking' or prospective analysis to demonstrate the effect of the proposed change on the schedule. The analysis will demonstrate the time impact based on the date of the change, the status of construction at that point in time; and the event time impact computation of all affected activities. The activities used in the analysis will be those included in the latest updated copy of the construction schedule or as adjusted by mutual agreement.

Forensic Schedule Analysis

An additional tool for successful Project Management is to use FSA. In general, we conduct a 'backward-looking' or 'retrospective analysis' method of evaluating impacts to the schedule that is performed after a delay event has occurred. Upon receipt of the documents, our Scheduler will perform a technical review. Once the analysis is done, the Project Controls Leader will present findings to our Project Manager and the NJ TRANSIT Project Manager for concurrence.



Time Impact Analysis Process

CONSTRUCTION SCHEDULING

Schedule management starts with incorporating the PCP in the construction contract documents. After award, we will have a schedule expectation meeting with the contractor to verify the schedule expectations are understood and any scheduling strategy questions can be discussed prior to the baseline schedule submission. Once the baseline schedule is submitted, we will review the submission with NJ TRANSIT for completeness and accuracy. All schedule requirements will be incorporated into the construction specifications.

Subtask 1.2.2 | Records Management Control System

Document control is essential to effectively manage communication and facilitate team coordination and understanding. To accomplish this, a document management system that catalogues all inbound and outbound program documents coded to align with the WBS is essential. The system will be designed around the evaluation and analysis of NJ TRANSIT's work flow and business practices. Since project documents will originate from multiple sources and affect not only multiple project team members, but also NJ TRANSIT staff and project stakeholders, it is essential that documents be available to appropriate personnel in an expeditious manner using a balance of control and simplicity. For NJ TRANSITGrid, we propose using *ProjectWise*, a project collaboration and information management software developed by Bentley Systems Inc. *ProjectWise* provides work sharing, content reuse, document creation and storage, retrieval, and audit trail functions. We have recently used *ProjectWise* successfully on several large, multi discipline railroad design projects for clients including NJ TRANSIT and Amtrak.

Using *ProjectWise*, our Team members will have access to files and folders structured to allow interdisciplinary team collaboration of design work. Off-site Team members will be able to develop their designs at their own locations, while allowing them to seamlessly and in real time update drawings, files, and design calculations housed in the project file repository. Through *ProjectWise* users will be able to quickly find, share, and interact with other interrelated engineering content. This functionality promotes design collaboration among all participants.

With all project information residing on the *ProjectWise* platform, document deliverables and progress copies of all types, including Microsoft Office and Outlook, CAD, Technical Specifications, Estimates, Reports, etc., will be consistent, relevant, and timely. Deliverables of electronic files, drawings, and PDFs can be sent to devices such as printers, plotters, and e mail links. Project specific standards and output configurations are deployed and enforced. Using *ProjectWise*, managed electronic project documents would include:

- Contracts, scope of work narratives
- Budget logs, cost reports, finance data, and invoices
- General correspondence
- Email messages and attachments
- Project Management Plan
- Quality Control Plan
- Inspection reports, site records, and related information
- Drawings, plans, and images

- BIM models and data
- Technical specifications
- Calculations
- Equipment cut sheets
- Project deliverables
- Log of CDs, DVDs, and other hard media data
- Native files and image files of all documents
- Management of project documents on *ProjectWise* includes:
- Central storage of all project documents
- Categorization of inbound traffic
- Document dates, subject, to and from
- Filing of scanned documents
- Email distribution and notification. Only project email that includes decisions or email that materially affects decisions or approvals will be retained in the RMCS
- Backup and maintenance of the data and system
- Printing capability of all document sizes and formats

The *ProjectWise* system includes the following functions:

- Document collaboration capabilities
- Check in and check out protocols. It is important to note that while a user has a document checked out for editing, that document cannot be edited by other users. This makes sure the current version of the document is on the server at all times.
- Revision control/ audit trail
- Security (document by user/ group)
- Workflow
- Deliverables

We will also implement a hardcopy document inventory control system, ensuring organized filing and positive control of:

- General correspondence (excluding email)
- Contracts and specifications
- Drawings, plans, and images
- Log of CDs, DVDs, and other hard media

Hardcopy project documents will be first scanned as searchable PDF files and then filed electronically. Hardcopy documents will be marked with the corresponding sequence number and then filed. Upon upload, categorization and metadata capture of project documents, individuals responsible for action on those documents will be notified via alerting tools.

Records management and control is also a key component of Interface and Integration Management, which directs overall communications, relationships, and deliverables among stakeholders. The Records Management platform is an important part of this larger management topic, addressed in Task 10.

Subtask 1.2.3 | Monthly Progress Reporting

Prior to submission of the first progress report, and together with NJ TRANSIT, the Jacobs Team will establish a reporting calendar that defines the anticipated reporting periods. Each period will be, at a minimum, four weeks in duration and will be closely aligned with the Jacobs Team's internal reporting system being used for NJ TRANSIT Superstorm Sandy Recovery and Resilience Program to allow for timely and accurate reporting of costs. The calendar will identify period closing dates and progress report submission dates. The progress report will be submitted within 20 working days of the close of the reporting period. Our Quality Manager will certify for the previous month full compliance with quality reviews and the Quality Management Plan. We will submit a Quality Certification with the report. A sample template of the progress report will be submitted for NJ TRANSIT review.

The Jacobs Team will carefully monitor project progress during the life cycle of the project and provide NJ TRANSIT with periodic progress reports as scheduled in the reporting calendar. The report, together with the invoice and progress schedule, will be of sufficient detail to enable NJ TRANSIT to evaluate project progress and review and approve requests for payments by the Jacobs Team. We will submit one hard copy and one electronic copy of the progress report to NJ TRANSIT within 20 working days of the close of the reporting period.

The progress report will include and/or reference the PMP and feature the following information:

- A brief narrative of work completed during the reporting period and as planned for the next reporting period
- Details of any delays will be specifically highlighted together with details of the Team's actions/ proposals for corrective action and schedule recovery, if required
- Areas of concern and proposed resolution (if applicable)
- Items that require resolution or input from NJ TRANSIT (if applicable)
- A comparative progress S curve and histogram at the overall project level
- Percent of work completed
- Status of minority business participation goals
- An update to the contract deliverables list showing status of deliverables
- Identification of budgeted tasks that have actual costs in excess of 80% of budget

Jacobs will assist and provide support to NJ TRANSIT staff in the preparation and submittal of project reports to the FTA. We have experience in developing FTA reports and will contribute to the quality of FTA submissions.

Subtask 1.3 | Quality Control

Jacobs requires the use of quality assurance, quality control, and quality improvement processes as a standard practice for all our project deliverables. This Quality program is a vital element in delivering a project that fulfills NJ TRANSIT'S goals and requirements. Jacobs' quality control is based on a minimum of "two sets of eyes" participating in the review of all client deliverables and in all management decision-making and operations.

Our approach to Quality Management outlined below complies with ISO 9001:2008 and the U.S. DOT Federal Transit Administration Quality Management System Guidelines – FTA-PA-27-5194-12.1. These established guidelines supersede ISO 9001:2000, ISO 10013:2000 and ISO 8402:2000 Described in Tasks 1.3.2 and 1.3.3.

We will provide Quality Management, Quality Assurance, and Quality Control services as part of this task. Major deliverables include the Quality Management Plan (QMP), the Quality Management System, and the Design Control Plan. The most significant risk to be mitigated during this task is receiving external comments back in a timely manner to produce the plans and develop them through to approval within the allotted schedule.

Russell Ferretti, Jacobs Regional Quality Manager, and Bruno Fiorentino (Burns Engineering), Quality Control Task Leader, will lead this task. Russell will report directly to Stanley Rosenblum, the Project Executive.

Bruno will report directly to Diaa Elmaddah for day-to-day guidance and to our Project Manager, Roger Copeland for overall project quality reporting and updates.

The Quality Manager is responsible for making sure the Quality Control procedures are followed. Russell will:

- Implement the Quality Management Plan
- Initiate action to prevent the occurrence of nonconformity by performing audits at various stages of the project
- Identify and record quality concerns
- Verify the implementation of solutions
- Control further work or delivery of items until the deficiency or unsatisfactory condition has been corrected

The Quality Control Task Leader is responsible for working with the different groups to establish the Quality Control Plan and job specific quality plans. He will also be responsible for the quality control of the documents produced. No documents will be released without his review or approval. Bruno will be responsible for following up on all quality concerns and quality Performance improvement notices issued by the Quality Manager.

Our quality procedures apply to all our employees, subconsultants, and activities including project management, planning, design, construction, construction management, accounting, project controls, administration, and marketing. By following our procedures, we are able to deliver the following results:

- Production of quality documents and projects
- Establishing an environment where there is continuous striving for improvement
- Installing quality from the start rather than restoring it later
- Encouraging communication
- Improving understanding of NJ TRANSIT requirements
- Build teamwork and cooperation in solving problems

Subtask 1.3.1 | Quality Management Plan

Specific to NJ TRANSITGrid, Jacobs will implement a Project Quality Management System to cover project design, planning, and construction support. We will develop a documented Project Quality Management Plan (QMP) specific to the requirements of this project, which will outline our quality management processes. Subsequently, we will develop Project Specific Quality Plans (PSQP Matrix) unique to each deliverable.

The key actions required under this subtask include matching the plan to the project scope; obtaining management inputs to the plans and processes; approvals of the plan; and roll out of the plans processes to the project team.

Jacobs will develop this plan in compliance with ISO 9001/2008 as well as the ISO 10013:2000 Guidelines for Quality Systems and development of Quality Manuals and FTA Guidelines. As ISO 8402: 2000 is being revised by ISO/FDIS 9000, we will implement the Quality Vocabulary and terminology into the QMP.

Successful execution of the QMP requires collaborative development of processes that are tailored to the scope.

This approach provides the project team with a full understanding of the processes, roles and responsibilities related to quality, which results in deliverables of the highest quality.

The Project Specific Quality Plans or PSQP Matrix unique to each deliverable. The PSQP Matrix is designed to effectively communicate and plan quality control functions by phase and deliverable, the staff required to perform QC, the level of QC, and deadlines. It also provides for additional comments as needed.

The following quality system elements comprise the Quality Management Plan:

- Project Management Quality Responsibilities
- Quality Reporting Requirements
- Design Quality Management System
- Construction Phase Services Quality Management
- Quality Records
- Quality Control Processes and Checking Procedure
- Audits- Internal System Audits as well as “Gatekeeper” Deliverable Audits
- Non-Conformances
- Corrective Action Requests
- Performance Improvement Notices (PINS)
- Client Surveys
- Training

Quality

- *We custom tailor our Quality Plan to meet the specific needs and requirements of the NJ TRANSITGrid project.*
- *Prior to each new submittal, we will verify that all Client comments from the previous submittal were addressed.*

Subtask 1.3.2 | Quality Management Plan Requirements

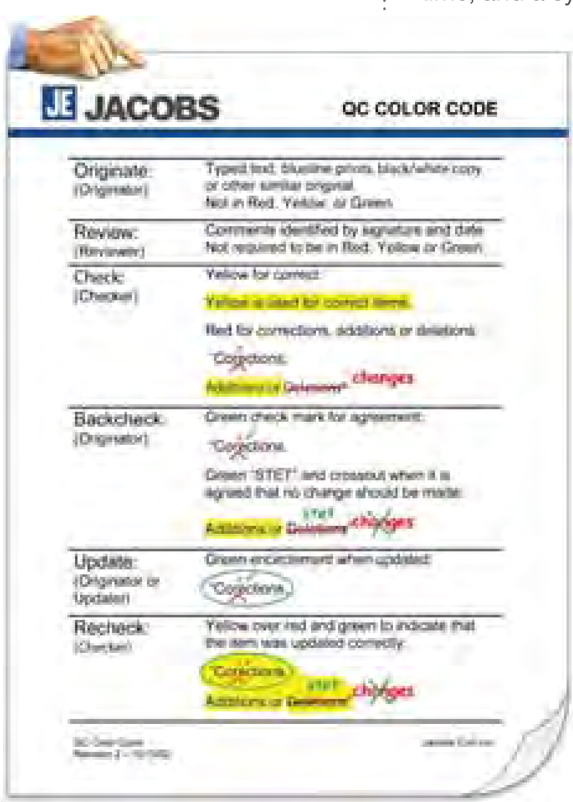
Immediately following the NTP, the Project Manager will convene a meeting to define how to implement the quality system. The Project Manager, Deputy Project Manager, Quality Task Leader and Quality Manager, and representatives from all subconsultants will attend. At the meeting, the various components that make up the QMP, including design control, document control, personnel responsible for quality, and audit process will be defined and documented in the plan. We will emphasize the design control procedures, and will require that all subconsultants follow the QMP and Jacobs Project Procedures and have their work checked by Jacobs.

We will also prepare minutes of this meeting and identify action items.

Documents controlling and/or monitoring the quality process will be discussed and agreed upon. Lead engineers will identify persons who will check/back-check the drawings, calculations, reports, etc.

A quality schedule, identifying dates when Jacobs quality controls are carried out, will also be agreed upon. These dates will fall within approved project milestones.

Our procedures are customized to the project. The purpose of this plan is to set forth a procedure that will provide a quality product conforming to NJ TRANSIT and FTA requirements. To achieve this end, every effort will be taken to do the work right the first time, and a systematic procedure of checking and reviewing will be followed before the product is submitted to NJ TRANSIT. The check and review procedures are applied at various and distinct stages of the development process. The procedure used, and when it is applied within the design process, depends on the product or service provided.



JACOBS QC COLOR CODE

Originate: (Originator)	Typed text, blueline prints, black/white copy or other similar original. Not in Red, Yellow, or Green.
Review: (Reviewer)	Comments identified by signature and date. Not required to be in Red, Yellow or Green.
Check: (Checker)	Yellow for correct: Yellow is used for correct items. Red for corrections, additions or deletions: Corrections. Additions or Deletions changes
Backcheck: (Originator)	Green check mark for agreement: Corrections. Green "STET" and crossout when it is agreed that no change should be made: Additions or Deletions STET changes
Update: (Originator or Updater)	Green encirclement when updated: Corrections.
Recheck: (Checker)	Yellow over red and green to indicate that the item was updated correctly: Corrections. Additions or Deletions STET changes

Although originally developed for contract documents, the QC Color Coding System, levels of checking and review, and discipline matrices, have been designed to provide guidance for all services we routinely perform. A brief explanation of each level of checking and review is as follows:

Level 1 Check is a thorough inspection of a completed contract document to verify the product meets the requirements and is ready for deliver to NJ TRANSIT, and includes a numbers check performed by a technically qualified individual, other than the Originator.

Level 2 Check is a more general review of work in progress, or of a completed deliverable package. Level 2 Peer Reviews, Constructability Reviews, and/ or Intra-discipline Reviews are intended as a review by a qualified individual (or team of qualified individuals) assembled to assess the performance, conduct, and progress of a project or document during various stages of its development.

The Peer Review (independent of the project) verifies the work is complete, logical, has followed the required procedures, and has used the correct specifications. The intent is for the reviewer(s) to apply their accumulated experience and professional judgment to verify the work is being performed to the established standards of both NJ TRANSIT and Jacobs. The Level 2 Review, however, is not intended to provide detailed check as required in a Level 1 Check.

Level 3 Check is a review of the product by senior management where a signature by an appropriate authority level is required before work can proceed through the rest of the process. Similar to the Level 2 Reviews, the Level 3 Review verifies the work is complete, logical, and has followed required procedures. The type of Level 3 Review performed is dependent upon the level of authority required. The PMP and QMP are examples of this type of review and approval. Each will be reviewed and approved by Stanley Rosenblum as Project Executive.

Gatekeeper Audit is a documented review performed by the Quality Manager on the complete submittal package when the coordinated QC efforts have been completed for a milestone submission to NJ TRANSIT. The submittal must pass the audit or it will not be submitted. The Gatekeeper Audit is implemented to eliminate and mitigate errors and omission for all deliverables. The process involves reviewing the QC documents, Intra-discipline review log, Decisions Log, and your comments, and then listing any findings and sending back to the responsible part to have corrective actions taken. All findings must be corrected, and then verified by the Gatekeeper in writing prior to the release for submittal.

Subtask 1.3.3 | ISO 9001 Requirements

Our Quality Management approach outlined herein complies with ISO 9001:2008 and the U.S. DOT Federal Transit Administration Quality Management System Guidelines – FTA-PA-27-5194-12.1.

We will abide by current ISO Standards applicable to the project. Our execution of this task is driven by NTP of the contract and developing our QMP and Quality Management System to exceed the ISO Standards. The most significant risk to be mitigated during this task is verifying that the superseded standards below are carefully reviewed and implemented with the most current ISO Standards for each.

ISO 9001:2000: Quality Systems Model for Quality Assurance in Design, Development, Production, Installation, and Servicing: We will develop and manage our Quality systems in compliance with ISO 9001:2008 (Quality Management Systems) the current version of the standard. Jacobs' quality system is currently established to be in compliance with the requirements of ISO 9001:2008 and the QMP will describe the system in detail.

ISO 10013:2000: Guidelines for Quality Management System Documentation: We will use the Guidelines in the development of the plan. Jacobs has purchased the current ISO revision of this standard to apply the most current processes to the plan. We will develop all processes, work instructions, forms, and checklists in compliance with 10013:2000.

ISO 8402: 2000: Quality Management and Quality Assurance – Vocabulary

This standard has been withdrawn by ISO and is under development /revision by ISO/ FDIS 9000. Nevertheless, we will provide applicable acronyms, terms, and vocabulary descriptions related to Quality in the QMP i.e. QA – Quality Assurance. This will be to the benefit of Jacobs, our subconsultants, and NJ TRANSIT as it provides mutual understanding of terminology.

Subtask 1.3.4 | Quality Manager and Other Resources

It is Jacobs' policy that everyone who touches a project is responsible for quality. Although there are individual detailed Quality Control (QC) checks within each discipline, the project management and Jacobs' senior management are responsible for overseeing the overall quality of the product. Responsibility for the overall quality on any project lies with Roger Copeland as the Project Manager, who will be directly accountable to NJ TRANSIT. Roger will work closely with Bruno Fiorentino to verify and deliver quality work product. Bruno's role as the Quality Control Task Leader is to focus on quality execution of the work performed. No work will be released to NJ TRANSIT until Bruno has completed the quality control review.

Russell Ferretti's role as the Quality Manager is to confirm that the procedures identified in the QMP are being followed. Roger will have no input or responsibility regarding the production of the project documents, and will be directly answerable to Stanley Rosenblum as the Project Executive. Russell will be at the same organizational level as Roger, but completely independent of the PM. Russell will also be responsible for conducting Internal Audits in compliance with Jacobs' procedures and NJ TRANSIT requirements.

Russell has the authority and responsibility to stop the project if and when a significant non-conformance has been identified during a quality audit. He will be responsible for conducting Internal Audits in compliance with Jacobs procedures and will submit the audit reports, findings, and corrective actions to NJ TRANSIT on a quarterly basis. All non-conformance findings will be reviewed by Roger, Diaa, Bruno, and the individuals responsible for the non-conformance. A non-conformance report will also be sent to Stan who will review the findings with Roger.

Subconsultants quality is controlled by Bruno as the Quality Control Task Leader and audited by Russell as the Quality Manager, and their deliverables are subject to Jacobs Level 2 reviews outlined below. Russell is responsible for making sure these procedures are followed, and will:

- Audit the implemented Quality Control Processes and Quality Assurance for the project
- Has the authority to stop the project
- Has direct access to and by the NJ TRANSIT Quality Director
- Submit a monthly certification to NJ TRANSIT verifying all deliverables have been processed with procedures outlined in the QMP; and that Quality Controls for checking have been completed by Jacobs and our subconsultants
- Provide a bi-monthly quality report outlining progress and issues related to quality for the project
- Initiate action to prevent the occurrence of nonconformity by performing reviews at various stages of the project
- Identify and record any quality issues
- Verify the implementation of solutions
- Control further work or delivery of items until the deficiency or unsatisfactory condition has been corrected
- Perform quarterly audits and report them to the PM, Deputy PM and the Quality Control Task Leader, Project Executive and NJ TRANSIT
- Track non-conformances through to completion of corrective actions and report to NJ TRANSIT
- Assign “Gatekeeper” Audits of design deliverable prior to each milestone submission

We will prepare three in-house quality documents for each project Phase, which are elements of the overall PMP discussed earlier. These consist of the Project Procedures Manuals (PPM), Project Criteria Document (PCD), and the Quality Management Plan (QMP). These documents are prepared within 30 days of receipt of NTP. Russell, as the Quality Manager, will provide these documents to Roger to guide compliance with the contractual requirements. Both their signatures are used to attest to the fact that all critical elements of the contract have been addressed; thus providing another check for the contract review. Once these documents are edited, we will distribute copies of the PPM/PCD and QMP as part of the PMP to the project team for implementation. We will also obtain input and approvals for the PCD/QMP from NJ TRANSIT.

The subconsultants working on the project are required to adhere to these documents as part of our Team.

Also upon NTP, Stan Rosenblum will conduct an initial Client Expectation Survey (CES) with the NJ TRANSIT Project Manager to gain a mutual understanding of expectations, goals, priorities, and responsibilities.

Quality

A Jacobs’ Senior Manager will conduct a Client Survey to evaluate our performance and our effectiveness in meeting NJ TRANSIT’s project needs. The results are reported to our headquarters, and a low score requires an action plan be developed and implemented.

Roger Copeland, as the Jacobs PM, also attends, so he hears first-hand what the client expects – making sure nothing gets lost in the translation. This information will be documented and frequently monitored throughout the course of the project. Periodically, Stan will conduct Client Satisfaction Surveys (CSS) to monitor our performance, identify how we can better serve NJ TRANSIT, and where we can make needed improvements or corrections.

Subtask 1.3.5 | Design Control

The key actions required under this subtask include matching the plan to the project scope, obtaining management inputs to the plans and processes, receiving approvals of the plan, and rolling out the plan's processes to the project team and subconsultants for full understanding.

We will successfully execute the plans development through communications with NJ TRANSIT and the entire project Team, including subconsultants, on a regular basis. Our approach to the plan will provide our Team with a full understanding of the processes, roles, and responsibilities.

The lead person responsible for the delivery of this subtask is Bruno Fiorentino – Quality Control Task Leader with inputs from the Project Manager, Roger Copeland, Diaa Elmaddah, the Deputy Project Manager and Russell Ferretti, the Quality Manager. The Quality Manager will review and approve the Design Control Plan.

Immediately following the NTP, the PM will convene a meeting to define how to implement the quality system and to provide inputs into the Design Control Plan. The PM, Deputy Project Manager, Quality Control Task Leader, Quality Manager, and subconsultants will attend. NJ TRANSIT is invited to attend the meeting as well. At the meeting, the various components that make up the Design Control Plan (DCP) will be refined and documented in the Plan. We will emphasize the design control procedures and review processes. Constructability, Peer Review, and Value Engineering inputs and guidelines will also be included in the DCP.

Documents controlling and/or monitoring the quality process will be discussed and agreed upon. Lead engineers will identify persons who will check/back-check the drawings, calculations, reports, etc.

A quality Design Review Schedule, identifying dates when Jacobs quality controls are carried out, will also be agreed upon. These dates will fall within the contractually approved project milestones and incorporate into the project schedule.

Jacobs will implement Quality Reviews throughout the project. The Quality System will incorporate Senior Management Reviews, Intra-discipline Reviews, and QC checks. Intra-discipline reviews (including subconsultants and their deliverables) are performed and documented prior to our "pencils down" Level 1 checking procedures implementation.

We believe that having the coordination between each discipline performed first is critical, so that when the QC process – a Level 1 (Checker, Back-Checker, Updater, and Rechecker) is performed, the coordination needed is already in place and each discipline can focus on checking their individual deliverables.

Jacobs also recommends the use of a "decisions log" to document, track, and verify all approved design inputs and changes are incorporated into the drawings, specifications, estimates, reports, and any additional milestone submittal products. The PM will maintain the log; and only inputs or changes approved by NJ TRANSIT and Jacobs are incorporated.

The documents generated for a project could be either internal or external. The documents will be readily retrievable and available for NJ TRANSIT review. The internal documents and their control include:

Drawings, Calculations, and Specifications: The documents that will be retained in Jacobs' offices until the end of construction are only the documents that have been checked, back-checked, and rechecked.

Standards, Codes, and References: The books and manuals, such as ASTM, AASHTO, Building Codes, etc., that were used for a particular project, will be maintained in the central library. These books/manuals will be retained through the construction phase. Changes, revisions, addendums, etc. to these documents will be so noted and retained alongside the original documents.

Construction Phase: During the construction phase, a shop drawing log indicating submittal type, date of receipt/review and return, name of reviewer, and status of approval will be noted. The Request for Information (RFI) from the field will be controlled in a manner similar to shop drawings (i.e. the PM or designee will maintain the RFI log.)

PRODUCT IDENTIFICATION AND TRACEABILITY

Upon receipt of the NTP, each new task will receive a specific project number. This number will be retained throughout the life of the project, and will parallel that particular NJ TRANSIT Contract number. All contract modifications will also be included in this job number. For example, if the design component of a package has a specific unique job number, the construction phase services for that project will also have another unique job number.

All products generated for a particular project, a contract drawing, calculation, specification, or report are identified with that particular job number. The different disciplines will have their own letter suffixes attached to the job number. For example, Architectural would have the suffix "A," Structural would be "S," Civil would be "C," and Construction Inspection would be "CI." Each drawing and specification will have its own unique drawing number or specification number.

Each deliverable or submittal will carry that particular submittal completion percentage. For example, the number "EB4203.A.101.30% indicates job number EB4203, A = architectural drawing, 101 = drawing number, and 30% = submittal percentage.

Revision controls are maintained by providing the documents revision status. Documents that are in draft are marked as draft and given a sequential letter assignment, (i.e. Draft A for the initial draft followed by Draft B, etc.) for subsequent updates to the document.

Once a document is officially issued, it is given a numerical revision number starting at Revision 0. Revision 1 follows and is sequential if changes are made to the document.

Documents that are superseded are identified through revision control and are immediately removed from circulation and stored as archived documents assuring the latest revision is made available and retrievable.

When jobs are completed and the documents are archived, they will bear the unique job number, thus retrieval of project documents from archives is quick and accurate.

CORRECTIVE ACTION

The QC process details how non-conformities are detected, investigated, and corrected. If the corrective action is local and minor in nature, it will be handled at an individual stage. If the investigative process discovers a non-conformity, which affects the work products of other disciplines (for example, CADD layering in survey work), a meeting will be convened for all involved parties to determine a corrective course of action. The non-conformity is documented, addressed, and a corrective action developed. The Quality Manager will verify that the corrective action plan is implemented. In certain instances, the Quality Manager may stop the project until corrective actions have been completed and verified.

Non-conformances are logged and tracked by the Quality Manager. The QM will assign the corrective actions, verify actions are taken and report to NJ TRANSIT.

Subtask 1.3.6 | Control of Quality Records

The quality records that will be filed and stored are scanned or hard copy documents that have undergone our QC procedures described above. In order for the documents to be accepted for filing, they must contain the proper stamp and signatures of the checkers/originators. Prior to accepting the quality records for filing, the PM will verify each stage of the QC procedure has been carried out. The Quality Manager will also verify this during the secondary audit review. Files will be kept for seven years following completion of construction.

Subconsultants will also maintain their quality records, in a manner similar to that carried out by Jacobs. An Auditor from Jacobs will visit the subconsultants' offices to verify if the quality documents generated by them have been identified and maintained to specified requirements.

We will also assign a document control administrator to provide document management and support for the Team in all aspects of document management. They will be responsible for developing, implementing, and training the Jacobs Tteam on the document control processes and methods. A document control plan will be created and established to define the management and control of documents as they move through the document life cycle from creation to final storage or destruction. Upon arriving on site, they will review applicable NJ TRANSIT procedures, records retention policies, and regulatory requirements, and establish defined policies and procedures, inclusive of document file naming conventions, filing structures, and document distribution matrices to ensure all documents are managed and controlled. Once the document control system is established, training will commence for the Team, and through the life of the program audits will be conducted to verify documents are stored in accordance with policy and procedures.

Subtask 1.3.7 | Internal Quality Audits

A Jacobs Regional Quality Manager assigned Auditor will carry out internal quality audits. The quality audit procedure typically consists of two stages: a preliminary Initial audit at 30 business days post NTP and a secondary audit at about 60 percent levels of effort of the project or tasks. The requirements of this project are for an audit to be performed quarterly. The QMP will detail the audits and audit schedule, which will include the single Initial audit and then Progress Audits to be performed quarterly. The preliminary audit is a review of the project set-up and establishment of the procedures. The progress audit reviews adherence to the QMS procedures and also includes reviews of the project's QC and deliverables for verification of adherence to the processes. The progress audits will occur quarterly throughout the life of the project. All audit reports will be reviewed or performed by the Quality Manager and reported to the NJ TRANSIT PM/Director of Quality as directed.

All audit reports will be filed in the projects Quality Records as well as on the Jacobs QDS – Quality Data System, which reports audits and audit results to our headquarters and highest level of management at our headquarters in Pasadena, CA.

Subtask 1.4 | Peer Review of Design

The key actions required for design Peer Review includes the designation of an independent team consisting of personnel who are not associated with or have knowledge or involvement with the technical details of the development of the project. Successful execution of this assignment requires the designation of individuals who can critique the design and have expertise in rail, microgrids, and regulatory requirements. The success of the Independent Peer Review also requires setting clear expectations for the Peer Team and a full understanding of their deliverables. The Peer Review Team also needs to be provided a complete set of material in timely manner, so they can be prepared for the Peer Review meeting.

The Jacobs Team will provide an independent set of reviews to offer a multi-disciplinary Peer Review of the proposed design prior to completion and submittal of the 20% design deliverable. This review is envisioned as not just a review of the project deliverables, but confirmation of the Jacobs Team's progress toward and compliance with the elements and requirements of the NJ TRANSITGrid program as a whole.

Our Peer Review Team will be isolated from the project and team prior to the actual review, and all results will be documented in a report for review by NJ TRANSIT.

We will successfully execute the Peer Review by working with NJ TRANSIT to set the expectations, scope, and deliverables of the Peer Review. We will also develop a complete background package for the Peer Review Team consisting of the basis of design, economic analysis report of the chosen technology, summary of key regulatory and environmental compliance requirements, and the drawings. The package will also include our PMP, and our plans for quality, design control, risk mitigation, and integration management. This information will be provided to the Peer Review Team two weeks prior to the peer review meeting. Our proposed Peer Review Team consists of a Chairperson who serves as a facilitator. Trained to maximize participation and interaction of the Peer Review Team, our facilitator is responsible for documenting the findings of the Peer Review Team. Our proposed Peer Review Team has expertise in microgrid design, rail electric traction, structural design, civil and utility design, transmission and distribution, signal and train control, SCADA, and cybersecurity. The Peer Review Team also has constructability experts with experience working on commuter or intercity railroads. The Peer Review Team will also review PJM, NERC, and FERC requirements for design compliance. We also propose that we include a consultant firm that successfully implemented a microgrid system in the New Jersey/New York metropolitan area and a national laboratory similar in nature to Sandia.

We anticipate delivering the Peer Review using engineering discipline review leads that may interface directly with NJ TRANSIT engineers, all working under the supervision of Peter Rasmus, Peer Review Leader. Peter will be supported by our Quality, Safety, and Risk Managers. Both Roger and Diaa will be fully engaged in the organization of the Peer Review, but neither will be participants. Peter has broad utility and consulting experience, and is recognized as a specialist in power systems analysis.

He has a long history of involvement in technical reviews and currently is a Chief Electrical Engineer managing 34 predominantly professional engineers with direct accountability for their results and performance. Our approach provides a combination of engineering talent and optimal cost performance by leveraging the depth of Jacobs' resources, coupled with the tight communication between our review team, NJ TRANSIT stakeholders, and the design team. Jacobs routinely manages work between multiple offices and has the systems and the processes to facilitate outcomes identical to having all staff working in a single location.

Peer Review will include checks for congruence with overall project objectives and committed approach, technical review of the design for compliance with applicable standards and good engineering practice, design efficiency, cost estimate check, constructability, operability and with coordination and integration reviews between the engineering disciplines. Safety in design, construction, and operability will be evaluated as well.

To facilitate review, we propose the use of a two-day workshop. The first day the Peer Review Team will review quality, integration, and design control plans. They will assess the completeness of the plans and provide valuable feedback on areas where improved processes may be warranted. The second day of the Peer Review will focus on safety in design, procurement, constructability, and risk. At the conclusion of the review period, the Peer Review Team will prepare a written report and identify recommendations as high risk, medium risk, and low risk. At the completion of the study and receipt of the findings, we will schedule a one-day work session with NJ TRANSIT to review the findings and determine appropriate responses.

We are confident that our approach to the technical Peer Review will provide complete independence, with the depth of skill and expertise required to thoroughly vet all aspects of the project using engineers with a long history in the criticality of safety in design, compliance with standards and congruence with project objectives. This team will be aligned to support the overall team to help deliver to NJ TRANSIT the key values of informing and communicating results, driving schedule, managing risk, assuring cost, delivering infrastructure resiliency, and validating NJ TRANSIT's return on investment.

Subtask 1.5 | Configuration Management

Under this task, the Jacobs Team will provide document control and configuration management services. We will fulfill these requirements by committing skilled professionals using proven and intuitive software platforms tested and refined over a multitude of Jacobs projects.

Major deliverables under this task will include the development a Configuration Management Plan consistent with NJ TRANSIT standards and the Contract Documents Log. LKG-CMC, Inc. (LKG) will be responsible for Configuration Management and Document Change Control as a project discipline. As part of the Jacobs Team, and in accordance with NJ TRANSIT requirements, LKG will establish an electronic system for the configuration management of drawings, specifications, and documents that establish the baseline of the project. This type of technical coordination is achieved by establishing a baseline description of the system and controlling changes to this baseline as the design progresses. In this manner, overall accountability for the project may be achieved.

The Configuration Management Plan (CMP) will be in accordance with the requirements of ISO 10000. The CMP will utilize a proven, auditable electronic-based configuration management system to its design of the Project. The Jacobs Team will maintain document change control, including engineering plans, drawings, and specifications, and will update all project documents as the design progresses. Configuration management will provide an accurate historical record that can trace decisions made throughout the life of the project.

The Contract Documents Log created in an electronic data base format acceptable to NJ TRANSIT for review and approval. The Log will list all design drawings, specifications, design calculations, analyses, reports, and other documents to be prepared by the Jacobs Team. Only one version of a document may be effective at any one time. The Log will function to keep a history of each document created by the team and its evolutionary status. The Log will form an integrated part of the Records Management System.

Establishing a configuration management for the project starts with the development of a configuration management plan and its implementation schedule. In particular, this plan should:

- Define the purpose of the configuration management program.
- Describe the project in terms of the documentation required to produce it, including plans, designs and procedures.
- Identify the agencies with authority over the program, their organizations, and their interrelationships involved in the production and review of designs.

- Identify the organizational entities to be directly involved in the program including a configuration management staff and a change control authority.
- Establish criteria for determining what project documents are subject to control and who receives controlled copies.
- Set forth the goals and processes of basic configuration management procedures including baselining, design reviews, and change control.

The basic purpose of configuration management is to obtain a definition for, then control, refinements and changes to the project baselines. Configuration Management basic functions include record keeping, coordination and dissemination of information. The way in which changes to the project baseline are adopted is the primary function during four major phases, which include Configuration Controls, Interface Management, Design Review, and Document Control. By requiring the entire team to work under the Configuration Management Plan, all will have unlimited access to project documents as well as:

- A more efficient document control system since all items are tracked via ball-in-court (BIC) to drive better accountability
- Faster turnarounds of approvals due to better tracking and history of reviews and a common access to all logs
- Document control warehoused in one location resulting in easy access from anywhere over the internet as well as a more efficient document closeout

As part of the required processes, LKG will develop and maintain a Document Control Log in electronic format that is acceptable to NJ TRANSIT. The log, at a minimum, will track design drawings, specifications, design calculations, analyses, reports, and other documents that will be prepared by the Jacobs Team. LKG understands the need for Configuration Management and the Controls systems necessary to establish a true status history of the changes to the project. The approved Configuration Management System will establish the necessary processes to identify and maintain the project baseline while complying with ISO standards.

At the end of the Project, the Jacobs Team will provide NJ TRANSIT a complete configuration management history in electronic format, fully documenting all required project information, including the final revision status of all design elements that will allow for the progress of the project design to proceed into full project delivery.

Subtask 1.6 | Project Meetings

Project meetings will become the lifeblood of the project, the forum where important ideas are shared, progress is discussed, and the vision of the NJ TRANSITGrid program fully developed and set into motion. The importance of running organized and productive meetings is paramount to the success of the project.

KICK-OFF MEETING

The initial kick-off meeting is of obvious importance. We will work with NJ TRANSIT to develop the agenda. We understand the kick-off meeting will be led by NJ TRANSIT. Introducing key stakeholders, discussing project goals, drivers, and constraints are but a few of the topics that will be addressed. Many of the project management programs, protocols, and procedures contained in this section will be initiated at this time, in addition to discussion of the technical elements of the power and rail sides of NJ TRANSITGrid. Proposed agenda topics may include:

NJ TRANSIT

- NJ TRANSIT Organization, Key Personnel and Locations
- NJ TRANSIT Lines of Authority, Relationships, and Management
- Confidentiality Agreements/Requirements

JACOBS TEAM

- Team Organization and Areas of Responsibility
- Reporting Structures
- Subconsultants

PROJECT OBJECTIVES

- NJ TRANSIT Business Objectives and Key Drivers
- Known Project Objectives/NJ TRANSIT Expectations (Subsequently Documented in the Client Expectations Survey discussed in Section 1.3)
- Changes that have occurred since submission of the proposal, negotiation of the contract, or during the preceding phase of the project
- HSE Philosophy/Objectives/Issues
- Business and Contractual Requirements (e.g., Invoicing, Relocation, Travel)

PROJECT SCOPE

- Project Scope of Work, Major Subdivisions, including any scope issues to be resolved
- Technologies, including Identification of any New/Unproven Technologies

Section 5

PROJECT LOCATION & LAYOUT

- Project Location, Layout and Key Site Issues
- Rail Issues and Rules of Engagement

NJ TRANSIT'S CONTRACT STRATEGY

- Contracts Awarded by NJ TRANSIT to Execute the Project
- Anticipated Contracting Strategy, Scope of Work and Major Interfaces among the Contractors during Project Execution

PROJECT SCHEDULE AND BUDGET

- Project Schedule & Funding Milestones
- Project Budget
- NJ TRANSIT Funding and Cash Flow Restrictions

PROJECT EXECUTION STRATEGY

- Overall Strategy for Successful Project Execution including Roles, Responsibilities, Coordination, Communications, and Resources/Staffing.
- Constructability Objectives
- Use of Jacobs Value Enhancing Practices$^{\text{SM}}$ (JVEPs$^{\text{SM}}$)
- Correspondence and Other Communications Requirements/Preference
- Reporting Format, Frequency, and Distribution

RISKS

- Internal and External Risks to Successful Project Execution and Mitigation Actions
- Development of Project Risk Register & Mitigation Plan

PROGRESS MEETINGS AND INTERFACE & INTEGRATION MEETINGS

Beyond NJ TRANSIT's initial kickoff meeting where the major elements of the program will be discussed and confirmed, the Jacobs Team will organize and facilitate progress meetings at least monthly, and almost assuredly more frequently, with a group of stakeholders vetted through NJ TRANSIT. Separate systems interface and integration meetings will occur after the conclusion of the progress meeting.

Project coordination and progress meetings will evaluate the weekly status of project drivers, overall coordination, progress, scope, budget and schedule. The intent is to facilitate communications within the project, identify potential problems before they occur, and prevent them.

Suggested agenda items include:

- Safety Moment
- Health, Safety, and Environmental Review
- Design Progress, Change, and Review
- Construction Progress/Status
- Schedule
- Budget
- Review QA/QC Issues
- Design Changes, Change Notices, and Change Orders
- Critical Submittals
- Critical RFIs
- Action Items

The Project Manager will chair the Project Coordination Meeting. Roger will assign responsibility for actions arising from the meeting. Resulting action will be immediate and not dependent on the issue of meeting minutes. The following team members are anticipated to attend on a full-time or as-required basis.

- Deputy Project Manager/Project Engineers
- Project Controls Manager
- Cost Engineer
- Planner/Scheduler
- Discipline Lead Personnel
- Materials Manager
- Expediter
- Construction Representative
- Estimator

The meeting recorder will issue minutes in the form of a Project Note within one day following the meeting per the defined project document distribution matrix.

Ad hoc meetings to discuss and review specific items of importance will be hosted and facilitated by the Jacobs Team including stakeholders and team members as needed to address topics of relevance and importance to the progression of Phase 1 and Phase 2 activities.

REVIEW MEETINGS

As part of our overall Quality Management Plan, Jacobs will facilitate formal review meetings with NJ TRANSIT to officially review progress deliverables including the program validation report and 10 and 20 percent design reviews. These meetings are anticipated as open forum, where questions can be raised and Jacobs Team members will be present to answer questions, explain methodology and approach, and receive comments and direction from NJ TRANSIT and stakeholder reviewers.

All comments will be collected and entered into a design review comment log. The comment log includes the following fields for tracking and management:

- ID to Individually Track Unique Comments
- Date
- Name of Comment Originator
- Organization Represented by Comment
- Discipline of Comment Assignment
- Comment Text
- Scope Impact Determination
- Cost Impact Determination
- Responsibility Delegation to Address and Resolve Comment
- Organization of Responsible Party
- Formal Response and Resolution of Comment
- Due Date of Response
- Action Code to Assign Priority Status
- Completion Status (Open, Closed, Pending)

The design review comment log is a formalized document that resides with the PMP, and is disclosed to NJ TRANSIT for full disclosure and documentation of design review meeting discussions.

Subtask 1.7 | Payment Procedures

Our payment procedure methodology follows an orchestrated process that offers full disclosure and accountability of the project team. Jacobs project controls and accounting staff will first establish the contract terms and conditions to make sure the project is setup correctly and all invoicing requirements specific to the project are correctly established. Stephanie Kudrowitz will lead this task.

In order to streamline the invoicing process, all subconsultants will be given our accounting calendar and advised when they need to submit their invoices to us, so they can be included with our monthly billing for that time period. This will allow time for us to review their invoices and resolve any issues, and ultimately verify there are no mistakes that would prevent prompt payment of our subconsultants.

As part of the monthly project reporting task, the Project Manager will include a summary of work in-progress and completed to demonstrate progress in support of our invoiced effort. We will collect and report upon the progress reported by our subconsultants as well. We recommend these progress reports along with a draft invoice be reviewed with the NJ TRANSIT Project Manager before submittal of the official monthly invoice, to confirm acceptance of progress and resolve any discrepancies that might be identified.

NJ TRANSIT will ascertain whether the claimed progress has been achieved or not during the status review meetings and by review of valid Progress Reports as prescribed above.

Applications for payment at a minimum will contain:

- Consultant name and address.
- The remittance address or bank to which payment is to be made
- The Contract name or title, Contract number, and Purchase Order number
- An actual invoice for the amount identified above plus any other amounts due the Consultant under any other provision of the Contract signed by the PM
- Certification that the amount requested is due and payable under the Contract and has not been previously invoiced or paid
- Certified payroll reports
- Supporting documentation for all expenses incurred
- DBE participation reports

Invoices are processed on a monthly basis unless other direction is received by the client. When payment is received from the client, all DBE invoices and charges attached to that invoice are released and paid. We encourage payment via the electronic payment transfer to speed the process of subconsultant payments.

Task 2 | Engineering

The traction power for the NJ TRANSIT and adjacent systems is a challenging opportunity in microgrid design. The highly variable load profile, remote location, multiple frequencies, and systems configurations make this anything but a typical power generation facility. Careful attention must be given to developing the right equipment mix that not only reliably supplies the traction and associated loads during emergency conditions, but also provides a positive source of revenue for NJ TRANSIT so it does not impact the tax base or ridership from a cost perspective. To accomplish these goals, the front-end engineering phase is of vital importance. As such, we are focusing much attention on that phase in this discussion.

RIGHT-SIZING FOR ELECTRIC POWER LOADS

The overall performance objective is to enable rail transportation capability even in the event that electricity cannot be supplied from the existing grid as a result of regional electrical outage. This load profile is rapidly fluctuating and significantly imbalanced due to the single-phase nature of the traction power systems. Accurate representation of the actual load profile as verified by real time metering data, at the utility service point, will be vital in accurately developing a generation portfolio that can effectively and efficiently serve the intended loads.

The goal of right-sizing the microgrid will be to find the optimal solution that will provide grid isolated operation of the intended loads, while providing the most efficient and financially optimized system when grid connected. The design will provide for a power plant that has two operating modes; 1) a normal grid connected mode that will supply continuous power and export to the grid; 2) an emergency Islanded Mode that will reliably meet the power needs for the Incident Transportation Plan.

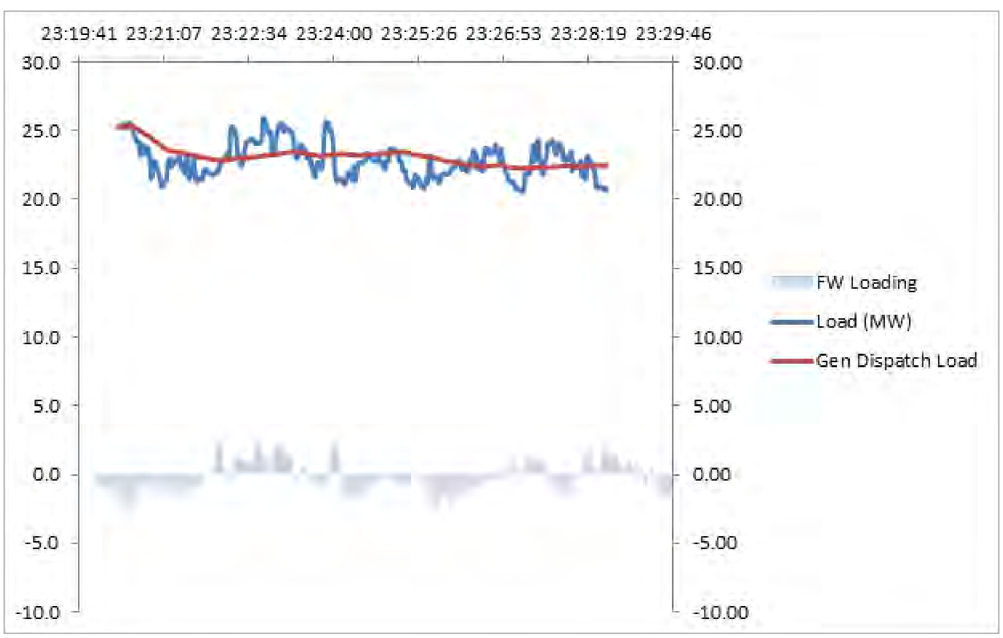
The NJ TRANSITGrid design will include traction power microgrid comprised of a large gas-fired generation plant, potential storage components, electrical infrastructure for distribution and frequency conversion components, including foundations, earthwork, plant enclosures, natural gas supply and plant interconnections, transmission and distribution infrastructure, plant function, and control architecture and hardware. The electrical power supply to support train operations must accommodate traction, signal, ventilation, pumps, compressors, track switches, snow melters, and communications. House power will be powered by the central power plant, as required. The system will be designed to minimize the need for significant upgrades to existing utility distribution or transmission systems, to the extent possible.

To optimize the electricity supply system of generation, storage, and distribution, a detailed dynamic model of the electrical loads will be required. This model will reflect the real-time load to be seen by the generation system over a power cycle and will have to effectively represent the rapidly changing load profile seen in a short time many times per minute. Normal power plant equipment has significant limitations for rapid load changes.

Section 5

This is further complicated when consideration is given to combined cycle or other potentially more efficient solutions. Our dynamic model will be similar to that used to develop dispatch models for flywheel applications in other microgrids. By utilizing active dispatch models developed by LTK for NJ TRANSIT and Amtrak based on the proposed train schedule, combined and verified against real-time utility supplied metering and protective relay data, we will be able to predict the system performance of the individual models. With energy storage components such as utility scale flywheels or pumped battery storage, we will be able to integrate the load of time and in effect smooth out the dispatch load profile for the fossil derived power generation equipment to allow for expanded options of technologies for consideration. Sizing of the storage devices will be a function of real estate, acceptable ramp rates of a given technology (both ramp up and ramp down), and ramp rate of the selected storage technologies to meet the load profile.

It will also be important in the real estate allocation for the plant site that space is set aside for future growth and development. As NJ TRANSIT grows and the NJ TRANSITGrid success is recognized, it is highly likely that additional services for traction power and other loads will be added to the system. By having the tools developed and available to NJ TRANSIT, Jacobs will allow for this flexibility in expansion. Sizing of the expansion would simply require adding the load profiles to the aggregate load curves, and running the storage sizing components to make sure that the generation dispatch curve is still achievable by the installed assets, or if further expansion of storage and or generation is required.



Representation of Storage and Generation Dispatch Sizing Model

ELECTRIC POWER LOADS REPRESENTATION

We will determine time-based loads on the microgrid, cumulative of commuter rail and light rail operations, including supporting demands such as station lighting, signal power, and switch heaters. As detailed in the Sandia Report, the NJ TRANSIT microgrid will protect the "inner core" rail system from regional power blackouts, by supplying independently generated electric power directly to:

- NJ TRANSIT Morris & Essex lines (Maplewood to Hoboken),
- Amtrak's Northeast Corridor Line (North Brunswick to New York only),
- NJ TRANSIT Hudson-Bergen Light Rail system

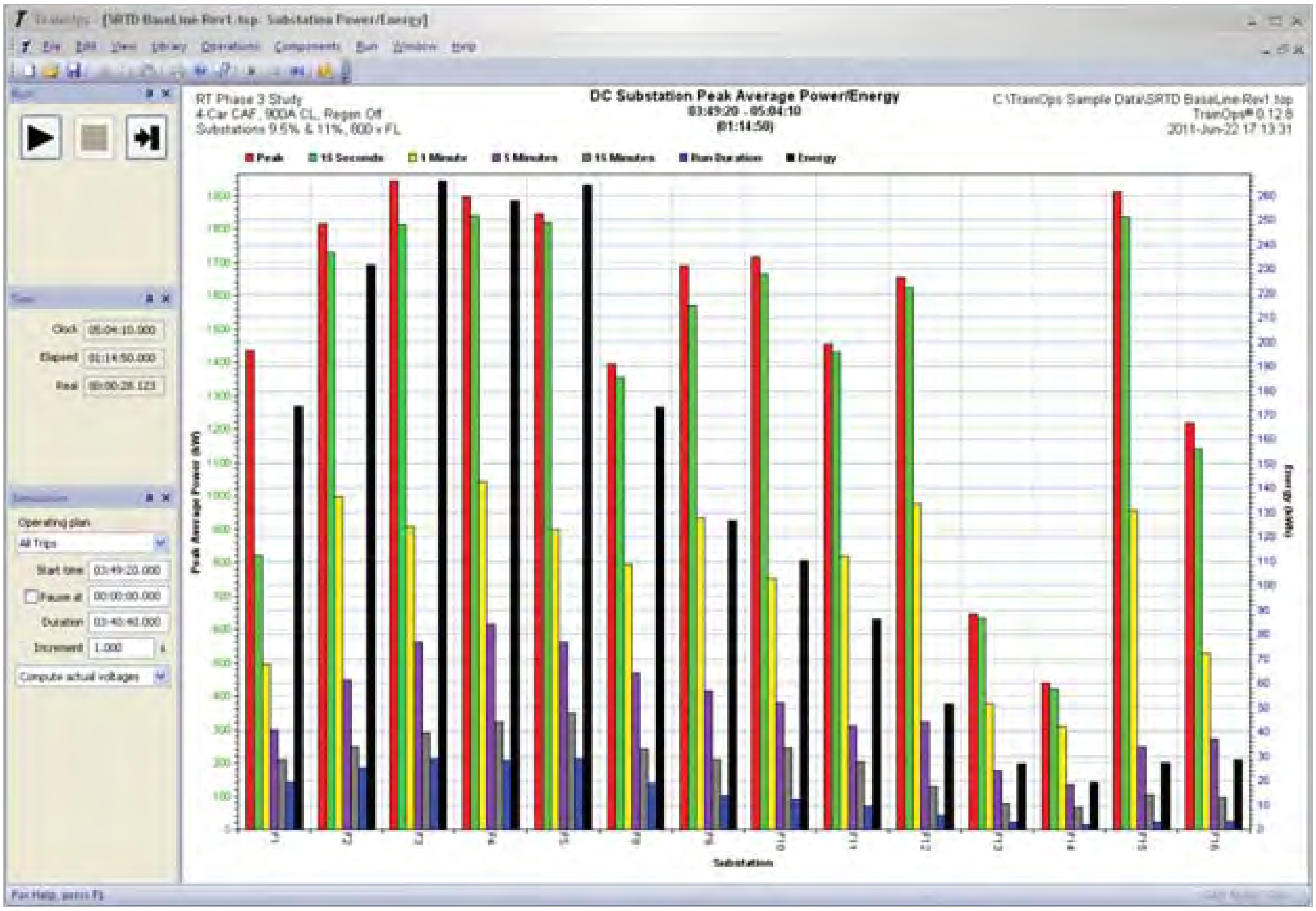
It is understood that the electrical power supply to support train operations must accommodate traction, signal, ventilation, pumps, compressors, track switches, snow melters (switch heaters), and communications

With LTK on the Jacobs Team, we are able to accurately predict what the required load curve will look like, including necessary conservatism and growth provisions. LTK will use its industry-leading *TrainOps*® simulation software to predict the time-varying loads and to evaluate strategies for managing peak demand as part of the right sizing calculations for the microgrid design. This includes:

- Forecast of annual diversified peak load to be served by new generation and or storage.
- Typical seasonal and daily load curves and load duration curves of the load to be served.
- Estimated operating energy consumption data for each element required to implement the transportation plan.

The *TrainOps* simulations will initially reflect unimpeded operation (no speed restrictions or tractive effort limitations) within the NJ TRANSIT network to be operated during a Design Basis Threat. The simulations will reflect the assumption that the reduced network is managed to balance demand on public transit services more evenly over four-hour AM peak period (6-10 AM) rather than the current rail-focused peak of less than two hours. Outside of the four-hour morning and four-hour evening peaks, transit service will continue outside of this peak period time but at a lower frequency and capacity.

TrainOps has been successfully calibrated to NJ TRANSIT operations on the Northeast Corridor, NJCL, RVL, M&E, and ACRL. Though *TrainOps* has not been applied to HBLRT, it has been successfully calibrated to actual operations at numerous light rail systems in North America. *TrainOps* includes alignment, train control, vehicle, schedule, and traction power inputs. The model includes DC network (HBLRT) and AC network (NEC and M&E) capabilities.



TrainOps Output of Peak and Average Power Demand and Energy Consumption by DC Substation

LTK will use *TrainOps* to identify the optimal rail operation mitigation strategies to be implemented to reduce stress on power system during microgrid operation as required based on the optimal power solution. This work will also support Subtask 2.2.10 (Concept of Operations) by identifying specific strategies for reducing demand where appropriate. We will investigate optimal trade-offs between trip time (which translates to system efficiency and peak fleet requirements) and energy savings, verifying that all concept of operations stay within the rated capacity of the microgrid.

While the RFP notes speed restriction caps, we propose to expand this Concept of Operations analysis to also evaluate tractive effort ("notching") restrictions as well. In addition, imposing both types of restrictions simultaneously has synergistic ("1 + 1 = 3") type benefits. The tables below detail a *TrainOps*-based analysis for another rail network facing similar needs for limiting peak power demand.

Scenario	Average Overall 8-Car Current Draw (A)	Average Maximum 8-Car Current (A)	Average Trip Time	Average Line Capacity (Trains Per Hour)
Baseline	5757	11648	0:29:16	23.8
45 MPH Speed Cap	5482	11674	0:29:27	24.0
P3 Tractive Effort Cap	4385	10984	0:30:36	22.7
45 MPH & P3 TE Caps	4202	10345	0:31:14	22.7

Table 1: Typical Trip Performance By Scenario

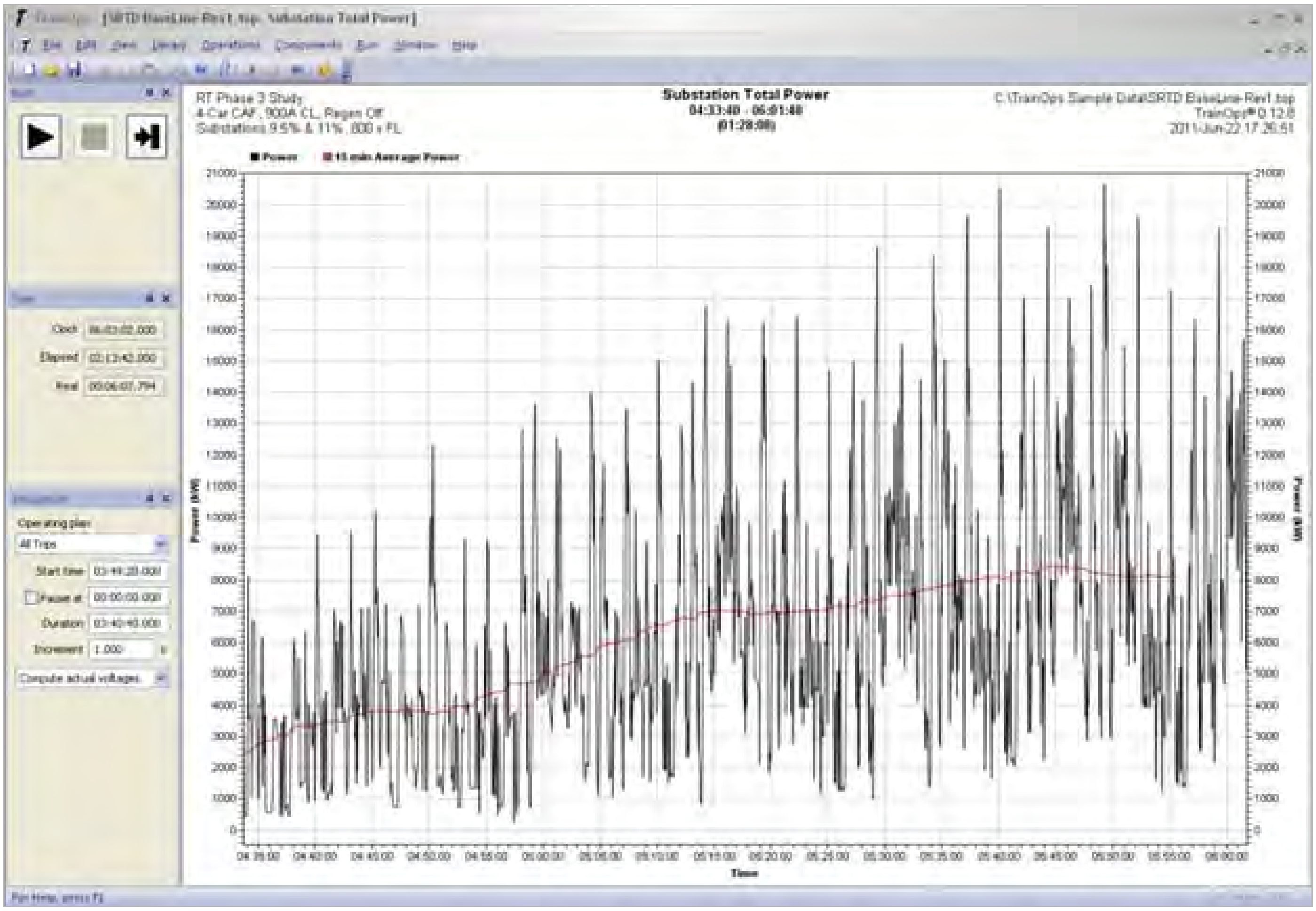
The typical impact of the operational constraints, in terms of percentage change from the current unrestricted operation, is summarized in Table 2.

Scenario	Average % Change in Current Draw	Average % Change in Maximum Current	Average % Change in Trip Time	Average % Change in Line Capacity
45 MPH Speed Cap	-4.64%	0.22%	0.63%	0.71%
P3 Tractive Effort Cap	-23.93%	-5.60%	4.62%	-3.52%
45 MPH & P3 TE Caps	-26.99%	-11.10%	8.57%	-4.27%

Table 2: Operational Impacts of Current-Limiting Strategies Versus Unrestricted Operations

Should both velocity and tractive effort caps fail to adequately constrain "peak of the peak" demand, we could possibly look at potential modifications to planned service. With the concurrence of NJ TRANSIT, we will also look at phased rolling stock replacements to occur concurrently with microgrid deployment. One fertile area is recent improvements in on-board energy savings through regenerative braking.

While NJ TRANSIT's electric locomotives have such capability, older software limits the extent to which this occurs automatically. Recent data provided by NJ TRANSIT for its ALP-46 and ALP-46A locomotives reveals savings of about 1 percent of energy consumed. Amtrak's more recent ACS-64 locomotives, with similar engineer controls, are achieving savings of about 6 percent of energy consumed.



Simulated instantaneous power demand trace (black) along with 15 minute running average (red) for one traction power substation in the rail network, supporting evaluation of the microgrid generation capacity duty cycle.

Retrofit or replacement of NJ TRANSIT locomotives over the medium term offers the prospect of 5 percent energy savings, which will likely translate into a higher “peak of the peak” demand reduction. With proper training and engineer coaching, there are opportunities for additional savings. LTK’s *TrainOps* work will quantify these savings.

Although not currently a driving force in the equipment selection for the NJ TRANSITGrid, Jacobs will evaluate potential heat recovery options for consideration. For a heat recovery and combined heat and power option to be considered viable in this application, it must have zero impact on the system resiliency. The heat recovery mode will require all necessary bypass provisions for grid islanded mode. However, given the native climate in the area, there is a large potential revenue stream that could utilize the waste heat to not only optimize the cycle performance, but also provide heating to NJ TRANSIT facilities on site, as well as adjacent facilities that may be developed in the same area.

A solution that includes a district energy/heating option could help provide a positive cash flow to NJ TRANSIT as well as make the project qualify for other state and federal funding streams that apply to combined heat and power facilities.

DESIGN DEVELOPMENT

As discussed throughout our proposal, the next step to project success will be for the equipment selection and procurement phase. This step provides cost certainly and allows the design phase to commence based on the technology and equipment that will actually be installed. Developing the design further based on a theoretical power plant concept will be virtually pointless given the significant differences in the equipment physical arrangements, auxiliaries required, foundation requirements, etc.

Jacobs will develop detailed equipment procurement specifications for the generation equipment (turbines, reciprocating engines, exhaust systems, heat recovery units, storage components, cooling towers, etc.) as determined in the right sizing modeling, and will issue those documents for review by NJ TRANSIT. Once approved, we will work with NJ TRANSIT to issue these documents in appropriate packages, with the contractual assignments to the future to be selected installing contractors. The contract/procurement mechanism utilized to enter into these purchase agreements with the selected vendors is flexible and can be by NJ TRANSIT directly with Jacobs support, or can include a pass through procurement by Jacobs to manage directly. Details of procurement strategies is included in Task 13 and 14 that follows.

Once we have equipment selected and ordered, we will begin to receive detailed equipment submittal drawings that will allow the design effort to progress to the 10% level. These general arrangement submittals, foundation design criteria, auxiliary requirements, etc. will then be utilized to develop a concept layout of the equipment on the proposed site for consideration. Careful attention will be given to several key design criteria including:

Resiliency – The system must be able to function and provide reliable system supply during and following and potential event that would have impact the grid. This will involve flood protection, storm hardening of the structure, redundancy, and emergency communications provisions.

Operability – The generation and distribution system must be able to operate locally for contingency situations, but should also include provisions for operation from the remote NJ TRANSIT control center. Provisions for fuel availability, distribution system exits, emissions control system management, and generation system dispatch will all be given significant consideration.

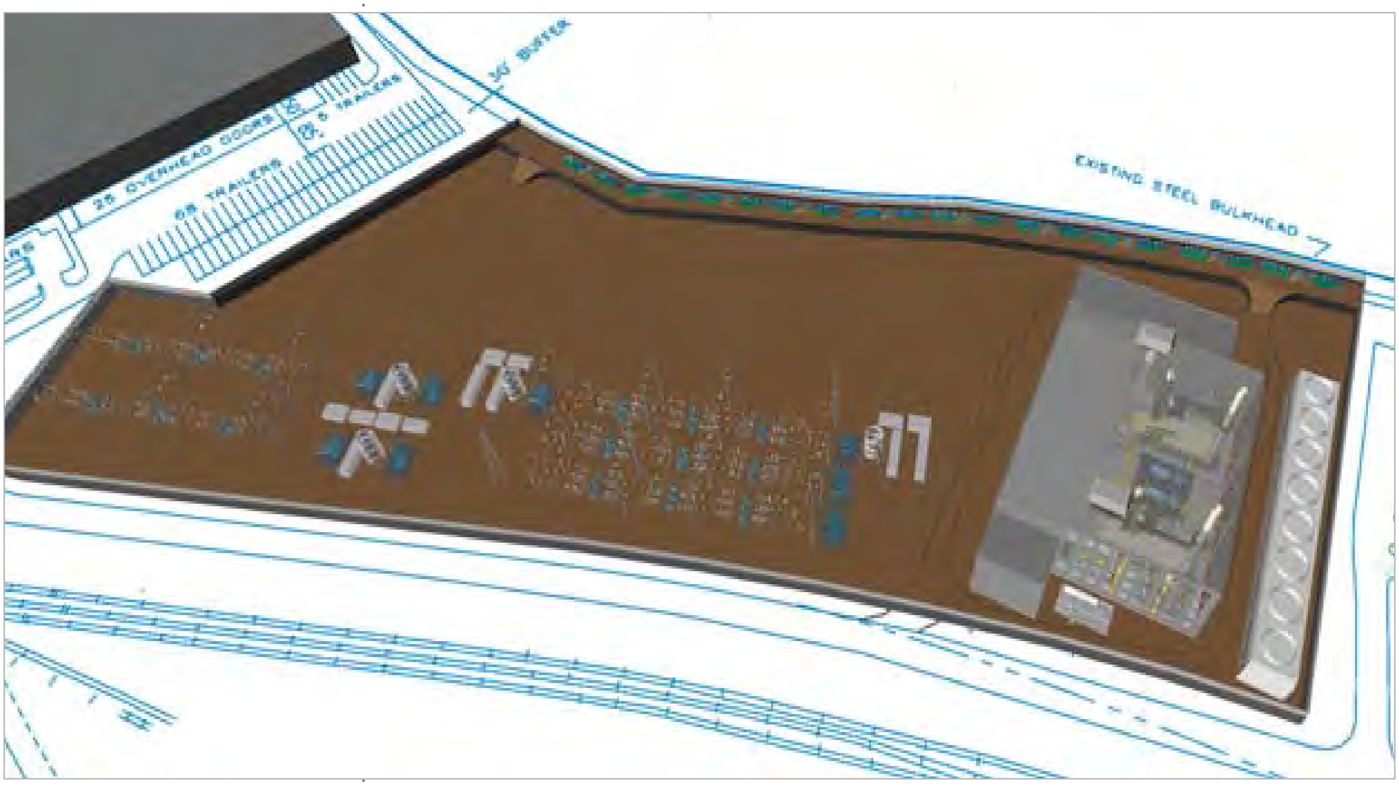
Maintainability – All of the equipment for the NJ TRANSITGrid will require routine maintenance. Space allocation for this maintenance is an important consideration. Additionally, the system must include sufficient redundancy and additional capacity such that maintenance outages do not limit the ability of the system to meet the core mission of providing resilient electricity supply to the transit operation.

Emergency Management – As the core mission of the NJ TRANSITGrid, by definition, is to provide emergency power to critical infrastructure transportation assets, the ability to safely and effectively generate and distribute the electricity during severe emergency situations is of utmost importance.

Consideration will be given to elevated, hardened facilities to operate the microgrid as well as floodwalls, pumping systems, and all aspects of cyber and physical barrier intrusion detection and prevention measures.

Efficiency and Environmental Considerations – To optimize the financial performance of the NJ TRANSITGrid project, the project should deploy technologies that reduce potential emissions or most importantly improve energy efficiency. Optimal efficiency will provide optimal project financials.

Expandability – Care will be taken to develop a microgrid solution that is appropriately sized for the NJ TRANSIT load profiles as noted herein. However, given the unique nature of this NJ TRANSITGrid application, there is a high probability that additional transit and related loads will be added to the system in the future that are not currently contemplated.



Conceptual NJ TRANSIT site showing expansion area based on 138MW plant with 30MW of flywheels

This additional load should be able to be served through simple expansion of the system. By allocating space for expansion, we allow for simple expansion and increasing the positive impact of the NJ TRANSITGrid.

As the system design is developed, the first milestone after the equipment is selected and procured will be to advance the design to 10% completion. The actual level for each element will be coordinated with the NEPA, Permitting and Regulatory Compliance engineering data requirements as well as Risk Assessment, and Contract Packaging tasks to produce the best value for NJ TRANSIT to move the project forward to completion, and will be a function of equipment submittal details, air permit data, PJM interconnection, etc.

The plans will be in depicted on 24" x 36" format with standard NJ TRANSIT title box and include, but not be limited to: Key Map, Location Map, Estimate of Quantities, Distribution of Quantities Sheet, Site Plan, Elevations, Sections, Typical Sections Standard Details, etc.

The design will include site construction plans for each site showing all elements to be constructed showing applicable natural gas supply and connection, electrical power distribution/transmission and interconnection, water, sewer, communications, parking, roads, traffic signalization, and rail signalization modifications as well as catenary energizing as applicable. The RFP requested that the electrical plans include location of cable and conduit runs and lighting as applicable, however, at the 10% and 20% design levels, these items will not be fully developed.

We will have lighting levels determined with NJ TRANSIT and major transmission/distribution circuits/routes identified. Full development of the cable and conduit routing will be part of the detailed design efforts.

Site/civil drawings will graphically depict the proposed power plant layout and NJDEP Land Use Program as well as USACE regulatory limits of disturbance for the selected Project footprints. Demolition of structures and utilities will be identified as applicable. The hydraulic design will include the delineation of the drainage patterns for impacted areas. The location of drainage features will be defined and sized. A report describing the entire drainage program for the project will be prepared discussing the impacts and requirements of NJDEP and USEPA and taking into account guidance per AASHTO/NJDOT criteria.

The geotechnical design will include a report and foundation recommendations. The structural drawings will depict the type of structures necessary and the size and type of foundations to be proposed. The geotechnical design criteria for power plant equipment is highly technical, much more so than for other building applications. The rotating equipment for power generation has stringent vibrations limitations imposed by the equipment manufacturers. A dynamically tuned foundation is required to meet these requirements. The geotechnical investigation will require additional soils tests not normally performed for building design.

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A construction-staging plan will describe potential methods and sequence of construction to complete the project while maintaining passenger service where applicable. Preliminary Design drawings, specifications, schedules, and associated documents will be prepared consistent with the applicable New Jersey and national standards, as well as applicable power industry pressure vessel code standards and will include at least the following information:

1. Cover Sheet
2. Index of Drawings
3. Site Drawings
4. Plant Plans, Profiles, and Cross Sections
5. Plans, Elevations, Sections, and Other Details Pertinent to the Feature of Design.
6. Design Analyses (Basis of Design Document) will be prepared and separately bound and labeled to permit review of:
    a. Structural Analyses
    b. Mechanical Analysis with Line Diagrams
    c. Electrical Analysis with Line Diagrams and Load Protection
    d. Special Features (e.g. Automated Systems, Corrosion Prevention, etc.)
    e. Site Security (as applicable)
    f. Project Utilities such as Telephone, Communications, Lighting, etc.
    g. An estimate of total connected loads, power factors, demand factors, diversity factors, load profiles where required, resulting demands and sizes of proposed transformers and frequency converters to serve either the complete project or the various portions involved will be provided
    h. The basis for selection for primary and secondary distribution voltages and of overhead or underground construction
    i. Computations
7. Technical Specifications
8. Statement of Estimated Construction Costs and Schedule will be provided. The format of the Cost Estimate reports will be consistent with NJ TRANSIT's Superstorm Sandy Recovery and Resilience Program requirements.
9. Modifications to Electric Traction Power Supply, Catenary and Signal Power Sectionalization Plans.

CYBERSECURITY

Throughout our design, the Jacobs Team will employ the industry's best practices and meet the North American Electric Reliability Corporation Critical Infrastructure Protection (NERC-CIP) standards to make sure that the all parts of the industrial control system are safe from cyber-attacks.

We understand that a power plant serving a critical part on New Jersey's transportation infrastructure must be protected against cyber-attacks from both external and internal threats. A perimeter defense is not enough. The Jacobs Team will develop the design criteria to employ a defense in depth strategy that applies multiple countermeasures in a layered manner to defend against cyber-attacks.

Our design will include:

1. Physical Security
2. Policy and Procedures to reduce Cyber Security risks
3. Virtual Private Networks to segment the system
4. Firewalls between network segments
5. A Demilitarized zones between systems
6. Secure architectures in each network segment
7. Account Management
8. Role-Based Access Control
9. Patch Management
10. Virus Scanners

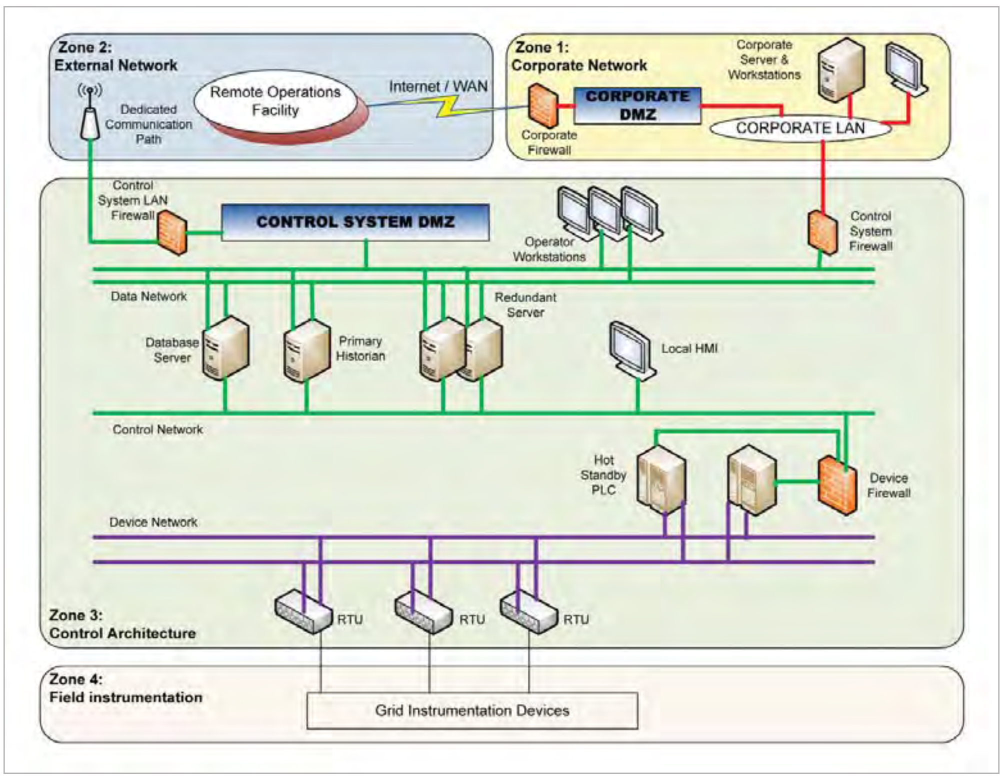
A second critical component to cybersecurity is detection of attempted attacks. Our design will employ detection in depth calling for alarms, logs, and detection methods to identify the following:

1. Unusual data transfer patterns
2. Unexpected protocols being used
3. Out-of-time Data Traffic
4. Communications to unknown or unexpected MAC or IP Addresses
5. Logs to Monitor Activity

6. Firewalls configured to Identify any Traffic that is not part of the expected traffic across zones

7. Detection of unknown devices.

Cyber threats are continually changing. For this reason, our design will call for a security life cycle to make sure that the industrial control system's cyber security countermeasures are maintained. Testing for countermeasures will be defined at regular intervals to determine if the target security level is being achieved.
If necessary, the countermeasures will be modified during the maintenance of the system. An industrial control system network designed with the above criteria will make sure that the NJ TRANSITGrid will meet the present standards for defense against cyber-attacks now and in the future.

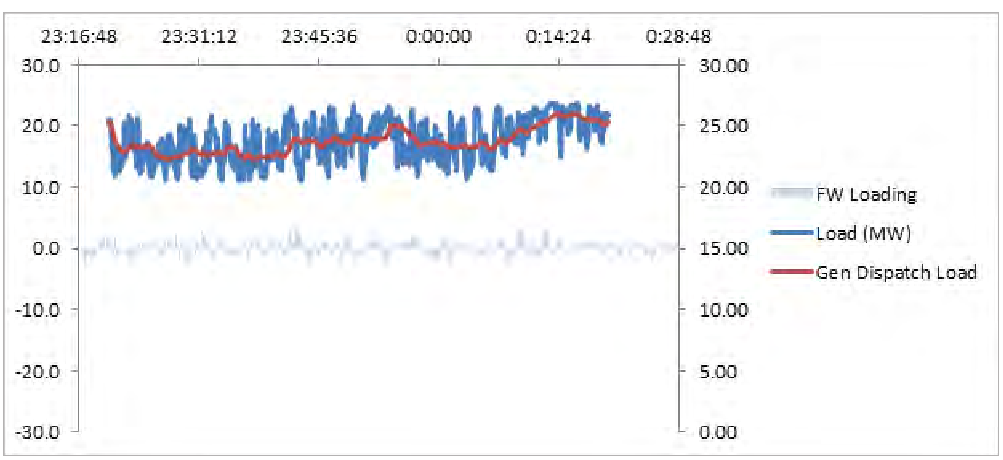


Subtask 2.1 | Verification of Concept Design Criteria

The objective of this subtask is to ensure accuracy and update information and engineering/design data developed during previous NJ TRANSIT efforts to develop the project Design Criteria. The Design Criteria will be used to develop the 10% design documents. This activity is a prerequisite to initiating further engineering on the Project and will inform key design decisions going forward. This phase represents the highest risk component to NJ TRANSIT given that a bad selection or load to generation match at this phase will result in a system that is either not functional or less than optimized financially.

Design considerations include but are not limited to:

- Analysis of power usage with regard to peak and non-peak loading. Similarly, ramping of power demand will also require characterization. Project/System Power demand characterization from a generation, transmission, and distribution perspective relative to operation of the NJ TRANSIT Mason Substation, HBLR operational demands, and the Amtrak Northeast Corridor Project segment must also be analyzed.
- Power Plant configuration accounting for physical footprint and general layout requirements will also be determined.
- Physical design requirements associated with connectivity to the distributed electrical loads to support railroad operations.
- NJ TRANSIT Mason Substation currently programmed for replacement with a new 230kV GIS substation adjacent to the existing yard.
- Amtrak Sub 41 and Sub 42 and associated 138kV 25Hz Frequency converter equipment.
- HBLR transformer auto-throw-over operation
- Power distribution to rail signal, control and communication systems to continuity of service



Another key component of Concept Design verification is the selection and verification of appropriate gas-fired power generation technology. The discussion of ancillary market participation and the use of flywheel or battery technologies for storage application will be a key component in this technology evaluation. Through a comprehensive review and summary of available gas-fired technologies to achieve the requisite power generation capability for the NJ TRANSITGrid, combined with various storage technologies to alleviate the challenges of the noisy load profile, NJ TRANSIT will be able to make an informed decision of the appropriate reliable and efficient technology for this application.

The analyses by Sandia considered Combined-Cycle Gas Turbine Technology, Reciprocating Engine Technology, or a combination of the two technologies in order to accommodate requirements related to minimum operating load, ramping capability, and cycling (start-stop) that must be met in order to operate an islanded scenario versus grid connected. As part of this evaluation, it is important to further develop the cost-benefit analysis of gas turbine power generation versus reciprocating engine power generation.

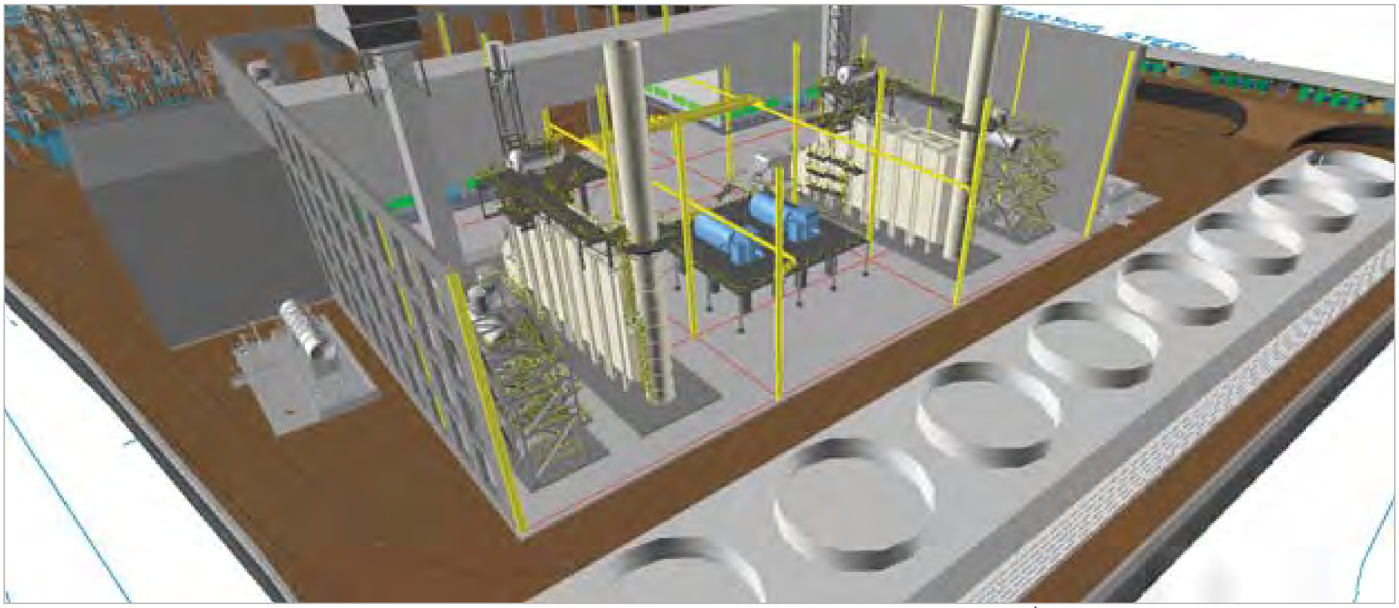
This should account for maximum operational efficiencies in the grid connected mode and islanded modes, related emission characteristics, the use of simple cycle generation versus combined cycle generation as applicable, along with the use of heat-recovery steam generators as practicable, all in consideration of storage technologies.

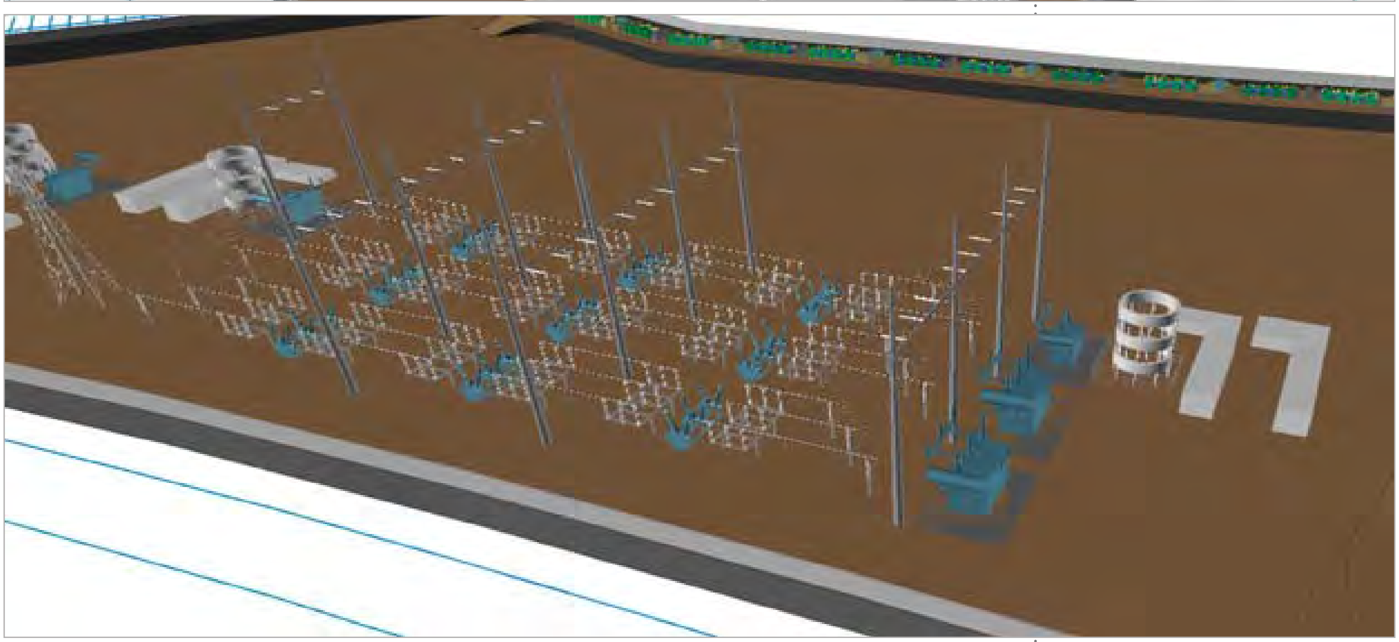
It will also be important to verify the peak load assumptions of the Power Plant to optimally achieve the stated electric traction and associated rail infrastructure power demands. This review needs to account for both Grid Connected and Islanded modes of operation. Additionally, this plant must be capable of starting and running without receiving power from the grid given that it is a resiliency project. Any plant configuration given consideration must be designed to be black-start capable. A life cycle cost analysis will serve as the basis of the recommendations as the appropriate path forward.

We routinely supply these right sizing and program validation services to our campus and utility/microgrid clients. The results of our study will be provided to NJ TRANSIT in report form for review and approval. As noted above, this effort is a pre-requisite before commencing Preliminary Engineering, and will serve as the basis for equipment bidding and selection, permitting, PJM interconnection, etc.

DELIVERABLES

- 10% Design Documents
- Design Criteria Manual
- Gas Fired Technology Analysis Report for NJ TRANSITGrid





Subtask 2.2 | Engineering and Design

Based upon the extensive studies and planning analyses to confirm the design intent, the design of the new Power Plant and associated electric power distribution/transmission facilities will be coordinated with other related task to provide a robust microgrid solution to NJ TRANSIT that is resilient and financially viable.

DESIGN DEVELOPMENT

The construction plans will be in 24” x 36” format with standard NJ TRANSIT title box and include, but not be limited to: Key Map, Location Map, Estimate of Quantities, Distribution of Quantities Sheet, Site Plan, Elevations, Sections, Typical Sections Standard Details, etc.

The design will developed to the 10% level then to the Preliminary Design level (approximately 20%) to reflect the requirements for bidding. The design will include site construction plans for each site showing all elements to be constructed showing applicable natural gas supply and connection, electrical power distribution/transmission and interconnection, water, sewer, communications, parking, roads, traffic signalization, and rail signalization modifications as well as catenary energizing as applicable. In addition, the electrical plans will include location of cable and conduit runs and lighting as applicable. Note, that for the 20% level design, these will be shown as performance requirements unless NJ TRANSIT requests further development to exceed 20%. We will need to discuss detailed project deliverables for each bid package with your team prior to starting the Design Development work to verify that you are able to get the design details you need, while making sure that the scope is covered in our proposal hours etc.

Site/civil drawings will graphically depict the proposed power plant layout and NJDEP Land Use Program as well as USACE regulatory limits of disturbance for the selected project footprints. Demolition of structures and utilities will be identified as applicable (primarily at the sites remote from the Koppers Coke site.)

The hydraulic design will include the delineation of the drainage patterns for impacted areas. The location of drainage features will be defined and sized. A report describing the entire drainage program for the project will be prepared discussing the impacts and requirements of NJDEP and USEPA and taking into account guidance per AASHTO/NJDOT criteria.

The geotechnical design will include a report and foundation recommendations. The structural drawings will depict the type of structures necessary and the size and type of foundations to be proposed. Note that detailed foundation designs for the large rotating equipment for the power plant will be possible until the equipment is procured (see the section in our response on contract packaging for further details).

A construction-staging plan will describe potential methods and sequence of construction to complete the project while maintaining passenger service where applicable. Preliminary Design drawings, specifications, schedules, and associated documents will be prepared consistent with the applicable NJ and national standards as well as applicable power industry pressure vessel code standards and will include at least the following information:

1. Cover Sheet
2. Index of Drawings
3. Site Drawings
4. Plant Plans, Profiles, and Cross Sections
5. Plans, Elevations, Sections, and other details pertinent to the feature of Design
6. Design Analyses (Basis of Design Document) will be prepared and separately bound and labeled to permit review of:
    a. Structural Analyses
    b. Mechanical Analysis with Line Diagrams
    c. Electrical Analysis with Line Diagrams and Load Protection
    d. Special Features (e.g. automated systems, corrosion prevention, etc.)
    e. Site Security (as applicable)
    f. Project Utilities such as telephone, communications, lighting, etc.
    g. An estimate of total connected loads, power factors, demand factors, diversity factors, load profiles where required, resulting demands and sizes of proposed transformers and frequency converters to serve either the complete project or the various portions involved will be provided
    h. The basis for selection for primary and secondary distribution voltages and of overhead or underground construction
    i. Computations
7. Technical Specifications
8. Statement of Estimated Construction Costs and Schedule will be provided. The format of the Cost Estimate reports will be consistent with NJ TRANSIT's Superstorm Sandy Recovery and Resilience Program requirements.
9. Modifications to Electric Traction Power Supply, Catenary, and Signal Power Sectionalization Plans

GENERAL CENTRAL POWER PLANT DESIGN ATTRIBUTES

The overall design concepts for the NJ TRANSITGrid will be driven by the following guiding principles.

Reliability – First and foremost, this is a resiliency project. The power plant must meet or exceed all reliability standards necessary to enable transit operations in a grid outage.

Maintainability – Power plant arrangement including all auxiliaries must permit reasonable access for operation and maintenance of equipment. Careful attention must be given to the arrangement of equipment, valves, mechanical specialties, and electrical devices so that rotors, tube bundles, inner valves, top works, strainers, contractors, relays, and like items can be maintained or replaced. Adequate platforms, stairs, handrails, and kickplates must be provided so that operators and maintenance personnel can function conveniently and safely.

Future Expansion – The specific site selected for the power plant and the physical arrangement of the plant equipment, building, and support facilities such as natural gas supply connection systems, circulating water system, trackage, and access roads should be arranged to not preclude future expansion.

Inter and Intraplant Communications – Installation of a high-quality voice communication system in a power plant and in adjacent facilities is vital to successful and efficient start-up, operation and maintenance. The communications system selected must be designed for operation in a noisy environment, and not be subject to outside influences (cybersecurity). Additionally, consideration should be given to development of an emergency Transit Operations Center at the power plant facility.

Efficiency and Environmental Considerations – To optimize the financial performance of the NJ TRANSITGrid project, the project should deploy technologies that reduce potential emissions or most importantly improve energy efficiency. Optimal efficiency will provide optimal project financials.

Machine Foundations

PHASE 1:

The goal of the Phase 1 structural design for vibrating machine foundations is to establish baseline design criteria and deliver a 20% design drawings and specifications package that will be advanced to the final design by the design-builder in the next Project Phase. Since the design of vibrating machine foundations is heavily dependent on soil-structure interaction, the baseline design criteria will include structural as well as geotechnical parameters obtained from the geotechnical investigation.

The 20% design documents will include the following items:

1. A drawing sheet containing general notes, applicable design criteria, geotechnical requirements, subgrade preparation and a description of material requirements (concrete strength, grade of rebar, etc.).
2. Site plans showing the location of the machine foundations.
3. Foundation plans showing the plan dimensions of the surface of the machine foundation. Surface plan dimensions will be dictated by equipment arrangement.
4. Preliminary cross sections of the machine foundation. Preliminary proportioning of the foundation will be based on approximate methods based on previous experience with similar machines.
5. Preliminary typical details for the foundation system such as subgrade preparation, drilled pier details, rebar details and isolation from surrounding structures and other foundations.
6. A preliminary set of applicable specification sections
7. A narrative describing the required dynamic analysis procedure to make sure the final design meets general design conditions as follows:

STRUCTURAL ANALYSIS

A detailed analysis is required to be performed to verify proper functionality of machine foundations. The analysis will consist of three general parts – an enveloped static analysis, a dynamic modal analysis, and a dynamic time-history analysis.

The static analysis is a conventional structural analysis in which the force demands on the concrete and supporting soil and/or piers are obtained when subjected to all possible combinations of loads, including transient loads. The loads considered in the static analysis will include the conventional structural loads as defined in the IBC and ASCE-7 (Dead, live, wind, earthquake, buoyancy, soil pressure, snow, and rain). In addition to the conventional structural loads, transient loads provided by the machine manufacturer will also be included in the static analysis.

Some typical transient machine loads include torque loads created by a fault or a blade-out condition in a turbine, or by a short circuit or faulty synch in a generator.

The transient loads developed by the machinery are oftentimes large and govern the design of the foundation. The force demands obtained through the static analysis are then used to determine concrete reinforcing requirements, verify allowable soil and/or bearing pressures given in the geotechnical report and verify that the foundation will adequately resist sliding and overturning when subjected to large transient forces.

The modal analysis is the first part of the dynamic analysis and is used to determine the natural frequencies of the foundation system for every possible mode of vibration. Determining the natural frequencies of the foundation system is critical in predicting the behavior of the foundation when subjected to vibrating machine operating loads. While machine operating loads are significantly smaller than machine transient loads, an undesirable foundation response (in regards to excessive deflections) is possible when certain conditions exist. These conditions are typically created when the operating frequency of the machine and any of the natural frequencies of the foundation system are too close in proximity (usually within 30% of each other) and in the presence of inadequate damping. Due to the potential dynamic amplification of foundation deflection response in this condition (termed "resonance"), the modal analysis is a necessary step in determining the proportions of the foundation system; however, a modal analysis alone does not yield quantitative results related to the magnitudes of deflection that will be generated in the foundation system.

In rare instances, undesirable deflections of machine foundations have been reported in which case studies have determined that a resonant condition did not exist. A time-history analysis will be subsequently performed in order to fully obtain the foundation response.

A time-history analysis is a computer-based numerical method that will explicitly solve the equation of motion and yield quantitative results for deflection, velocity, and acceleration at all points of interest on the foundation. While a modal analysis is helpful in avoiding a resonant condition that is widely known to have potentially destructive effects on vibrating equipment and foundations, the time-history analysis is further helpful in verifying the long-term serviceability and operability of the machine.

Most machine manufacturers publish serviceability criteria along with loading conditions that are required to be met with the foundation design. This serviceability criteria is typically based on permissible operational eccentricities within the machine or on physiological considerations on personnel working near or around the machine. This criteria is typically expressed as a maximum peak-to-peak amplitude for any combination of deflection, velocity, or acceleration. In the absence of serviceability criteria provided by the manufacturer, charts and graphs published by entities such as the American Concrete Institute or the International Organization for Standardization can be consulted to establish permissible values for deflection, velocity, and acceleration for different types of machinery. The results of the time-history analysis typically result in significantly less maintenance and repairs required over the lifetime of the machine.

SOIL-STRUCTURE INTERACTION

The static analysis will be based on standard geotechnical investigation and testing procedures. The dynamic analysis will be based on dynamic stiffness and damping characteristics of the soil-structure interaction obtained by use of the following geotechnical parameters:

A. Dynamic shear modulus of soil at strain levels consistent with expected loading

B. Material damping of soil at strain levels consistent with expected loading

C. Poisson's ratio

D. Soil density

The final design will utilize these geotechnical parameters to determine values for dynamic springs and damping ratios to be used in the structural computer model in which the modal analysis and time-history analysis will be performed. Additionally, the final design will consider other effects, such as stiffness and damping effects due to embedment of the foundation, potential for detrimental effects on adjacent structures through dynamic consolidation, potential for excessive settlement due to dynamic loads, and consideration of effects that could have an impact on vibration wave attenuation or damping within the soil (such as shallow layers, non-uniform layering, and presence of hard layers).

Subtask 2.2.1 | Power Plant Design

To support NJ TRANSITGrid functionality across the various modes of potential operation, it is vital that the focus remain on the selection and optimization of the power island generating equipment. System and equipment selection will focus on solutions that are resilient, efficient, and maintainable for long-term reliable operation.

The goal of this subtask is to establish baseline design criteria compatible with the 20 percent design package that will be advanced to final design in the next Project Phase. Final criteria will be developed through detailed discussions with NJ TRANSIT and Amtrak personnel in the engineering, maintenance, and operations departments as well as representative staff of regional power generation, transmission and distribution agencies, and regulatory authorities. There will be several design components that factor into the overall project application as discussed below:

BUILDINGS

The power plant main building size and arrangement will depend largely on the selected plant equipment and facilities. A gas turbine plant has a different footprint and layout as compared to a reciprocating engine plant. Even within these individual concepts, there is significant variability between different equipment manufacturers.

As discussed in the contract packaging section that follows, selection of this equipment will be vital in developing detailed design documents and accurate project cost projections. Additional options that will impact equipment selection include: heat recovery and Rankine cycle power generation to optimize combined cycle performance, thereby increasing power generation thermal efficiency; the source of cooling water supply or heat rejection relative to the plant site; the relationship of the switchyard to the plant; provisions for future expansion, aesthetics, and environmental considerations. These among other options and details will drive the size and configuration of the building and the layout of the overall site.

Generally our assumption is a plant building will include the basic components discussed below:

1. The plant will consist of engine and turbine bays with traveling crane; an auxiliary bay for feed water heaters, pumps, and switchgear; a steam generator bay and general support spaces as may be required for machine shop, locker room, laboratory, and office facilities;

2. The general support spaces will be located in an area that will not interfere with future expansion, and isolated from main plant equipment to mitigate noise;

3. For semi-outdoor or outdoor areas, enclosures for switchgear and motor controls will be housed in manufacturer supplied walk-in metal housings or site fabricated closures;

4. Structural Design – Building framing and turbine pedestals. The pedestal for supporting engines and/or the turbine generator (and potentially turbine driven boiler feedwater pumps) will be dynamically designed reinforced concrete. The building shell may be reinforced concrete or masonry construction, or other material selections as coordinated with NJ TRANSIT and site development stakeholders.

OTHER LOADS

In addition to the live and dead loads associated with the power generation and distribution equipment, the following loadings will serve as the basis of engineering design:

1. Wind Loading. The building will be designed to resist the horizontal wind pressure available for the site on all surfaces exposed to the wind and in accordance with any applicable code or standards requirements;

2. Seismic Loading. Buildings and other structures will be designed to resist seismic loading per the seismic zone in which the building is located and in accordance with applicable codes, standards, and requirements;

3. Equipment Loading. Equipment loads will be furnished by the various

manufacturers of each equipment item. In addition to equipment dead loads, impact loads, short circuit forces for generators, and other pertinent special loads prescribed by the equipment function or requirements will be included.

4. Foundation Design. Foundations will be designed to safely support all structures, considering type of foundation and allowable bearing pressures

SAFETY

The following general requirements with regard to safety will be incorporated:

1. Equipment will be arranged with adequate access space for operation and for maintenance. Wherever possible, auxiliary equipment will be arranged for maintenance handling by the main turbine room crane.
2. Safety guards will be provided on moving parts of all equipment.
3. All valves, specialties, and devices needing manipulation by operators will be accessible without ladders, and without using chain wheels where avoidable. This can be achieved by careful piping design, but some access platforms or remote mechanical operators may be necessary.
4. Impact type handwheels will be used for high-pressure valves and all large valves.
5. Valve centers will be mounted approximately seven feet above floors and platforms so that rising stems and bottom rims of handwheels will not be a hazard.
6. Stairs with conventional riser-tread proportions will be used. Vertical ladders, installed only as a last resort, will have a safety cage if required by the Occupational Safety and Health Act (OSHA).
7. All floors, gratings, and checkered plates will have non-slip surfaces.
8. No platform or walkway will be less than three feet wide.
9. Toe plates, fitted closely to the edge of all floor openings, platforms, and stairways, will be provided in all cases.
10. Adequate piping and equipment drains to waste will be provided.
11. All floors subject to washdown or leaks will be sloped to floor drains, with provisions for oil water separation/containment.
12. Adequate illumination will be provided throughout the plant. Illumination will comply with requirements of the Illuminating Engineers Society (IES) Lighting Handbook
13. Comfort air conditioning will be provided throughout control rooms, laboratories, offices, and similar spaces where operating and maintenance personnel spend considerable time.

14. Mechanical supply and exhaust ventilation will be provided for all of the power plant equipment areas to alleviate operator fatigue and prevent accumulation of fumes and dust. Supply will be ducted to direct air to the lowest level of the power plant and to areas with large heat release such as the turbine or engine room and the boiler feed pump area. Evaporative cooling will be considered in low humidity areas. Ventilation air will be filtered, modulated, and heated for climate control.

15. Noise level will be reduced to at least the recommended maximum levels of OSHA. Use of fan silencers, compressor silencers, mufflers on internal combustion engines, and acoustical material is required. Control valves will be designed to limit noise emissions.

16. A central vacuum cleaning system may be considered to permit easy maintenance of plant.

17. Color schemes will be psychologically restful except where danger must be highlighted with special bright primary colors.

18. Each equipment item will be clearly labelled in block letters identifying it both by equipment item number and name. A complete, coordinated system of pipe markers will be used for identification of each separate cycle and power plant service system. All switches, controls, and devices on all control panels will be labelled using the identical names shown on equipment or remote devices being controlled.

Princeton University Chilled Water Expansion Thermal Energy Storage, Princeton, NJ

DELIVERABLE

- Design Plans and Specifications of the new Power Plant and associated electric power distribution/transmission facilities as detailed above

POWER PLANT BUILDING

General

The goal of the structural design is to establish baseline design criteria and deliver a 20% design drawings and specifications package that will be advanced to final design by the design-builder in the next Project Phase.

Foundation

The structural design for the power plant building will follow the Power Plant Engineering and design standards and will be in accordance with NJ TRANSIT and Amtrak Standards and Specifications. The applicable requirement from AREMA, AASHTO, and NJDOT will be utilized in the structural design.

The requirement for concrete and steel design stipulated in ACI and AISC will be followed for the design and detailing of the structure steel elements and the concrete foundations.

The proposed main power plant building and facilities will be designed based on the geotechnical recommendation, which is expected to be deep foundation system comprised of piles. Building foundations will be comprised of reinforced concrete pile caps for building columns and pile supported reinforced concrete mat slab at the ground floor. The ground floor elevation will be coordinated with the site/civil plans to meet the requirement of 2.5 ft. above the FEMA 100-year flood level.

The pile caps will be analyzed and designed for the building column loads along with the ground floor slab loads based on the corresponding tributary area. The ground floor slab will be analyzed and designed for all anticipated equipment loads on the building floor.

The main building foundation will be isolated from the foundation of other facilities such as the combined cycle gas turbine or reciprocating engines through the use of expansion joints. The foundation slab deflection will be analyzed against vibration and frequency of the equipment at operating speeds and will be limited to avoid values of natural frequency by at least 30 percent above or 30 percent below operating speed. This will verify resonance is avoided and will prevent any damage to the equipment or cracking of the concrete.

Uplift and lateral pressure due to flooding will be considered in the foundation design. Base shear due to wind or seismic will also be considered. The foundation design will be based on the seismic parameters given in the geotechnical report and other applicable data.

Building Structure

The proposed building will be a structural steel frame consisting of structural steel wide flange columns supporting wide flange spandrel beams and girders. The lateral load supporting system will consist of structural steel diagonal bracing located along the exterior column lines and other locations that will not impede the operations of the power plant. The building exterior walls will be of masonry construction with provisions to support piping and conduits along the walls.

Cranes are anticipated to be supported on brackets of the building steel columns or, depending on the crane capacity and building clearances, can be supported on isolated steel columns within the building and individual footings. Reinforced concrete pedestals will be designed for supporting engines and turbine generator.

The roof structure will consist of structural steel girders and steel joists supporting metal roof decking. Roof top HVAC equipment is considered, then the roof joists will be designed to support the equipment loads.

The building structure will be designed in accordance with the applicable code or standard requirement. Load cases and combination will be considered for:

- Wind Loads
- Snow Loads
- Flood Loads
- Equipment Loads
- Live Loads
- Railroad Surcharge Loads
- Mechanical/Electrical Loads/Collateral Loads
- Crane Loads
- Dead Loads
- Impact Loads
- Short Circuit Forces for Generators
- Other Pertinent Special Loads Prescribed by the Equipment Requirements

POWER PLANT BUILDING INTERIOR STRUCTURES AND ASSOCIATED SUPPORT STRUCTURES

Thegoal of the structural design is to establish baseline design criteria and deliver a 20% design drawings and specifications package that will be advanced to final design by the design-builder in the next Project Phase.

The 20% design documents will include the following items:

1. A drawing sheet containing general notes, applicable design criteria, geotechnical requirements, subgrade preparation, and a description of material requirements (concrete strength, grade of rebar, etc.)
2. A drawing sheet outlining the applicable construction inspection requirements.
3. Site plans locating the Power Plant and all support structures.
4. Preliminary foundation plans identifying the foundation system for all structures. Foundation plans will contain the general layout and quantity of all foundation elements as well as preliminary proportions for major elements.
5. Preliminary framing plans identifying the gravity systems for all elevated floors and roofs as well as the lateral system for all above-grade structures. Framing plans will contain the general layout and quantity for gravity and lateral systems as well as preliminary proportions for all major elements such as beams, girders, columns, walls, and diagonal braces.
6. Typical details defining the structural systems and general connection information. Typical details will include information related to steel, concrete, masonry, and foundation elements as applicable to each structure.
7. A preliminary set of applicable specification sections.
8. Partial plans of existing structures providing general descriptions, areas, and quantities of existing structures to be demolished and/or modified.
9. Typical sections and material types for culverts and retaining walls.
10. A narrative describing structural requirements in order for the final building design to meet general design conditions as follows::

POWER PLANT SUPERSTRUCTURE

Several alternatives will be evaluated during the preliminary design phase. The 20% design documents will establish the structural systems to be used in the final design.

Cranes are anticipated to be supported on brackets of the building steel columns or, depending on the crane capacity and building clearances, can be supported on isolated steel columns within the building and individual footings.

The building structure will be designed in accordance with the applicable codes and standard requirements. Load cases and combination will be considered for:

- Wind Loads
- Earthquake Loads
- Snow Loads
- Flood Loads
- Equipment Loads
- Live Loads
- Railroad Surcharge Loads
- Mechanical/Electrical Loads/Collateral Loads
- Crane Loads
- Dead Loads
- Impact Loads

SUPPORT STRUCTURES

Elevated structures for substations and support of transmission lines will be purchased items. Foundations for these items will be provided based on vendor loading information and geotechnical requirements. Foundations for large pieces of equipment will also be determined based on vendor loading requirements. Site structures such as culverts and retaining walls will be designed for earth pressures as defined in the geotechnical report.

Section 5

Subtask 2.2.2 | Electric Traction Power Facilities and Power Management Design

Under this task, we will provide engineering design services for the power distribution, transmission, and traction power substations. Since Team members Jacobs and Burns Engineering were involved in the preliminary assessment of the project with NJ TRANSIT, our Team will use this existing knowledge of the proposed system and already identified areas of concern to complete this task and its deliverables. A major subtask will be designing the Amtrak components of the system, which are discussed in more detail following this section. Our execution of this task will be driven by the load calculations established to size the generation plant along with our T&D, the feasibility/cost/risk analysis of running new distribution in over 20 miles of railroad right-of-way, and lastly by clearly identifying every piece of equipment that needs to be powered from the NJ TRANSITGrid to meet the concept of operations.

The most significant risk to be mitigated during this phase of the work is establishing the interconnection requirements with PSE&G at Mason Substation. Another significant risk is establishing that the major T&D components along with traction power substation components can be routed through the existing Railroad Right-of-Way and within the established project budget. We have identified a number of areas of concern to focus on to establish the final procurement documents to keep within the project budget.

The connection of the NJ TRANSITGrid to the railroad facilities requires a detailed assessment of all facilities and systems that require power to safely operate transit service both in the normal operating mode and the islanded operating mode. The complexities that must be analyzed and overcome for proper implementation of the new microgrid include the significant load diversity presented by traction power facilities, the requirement for phase balancing to the different traction power and railroad signals and control facilities, the regulations for possible connection and/ or parallel operation with the utility and railroad transmission network, modifications to the relay protection, control, and operation plans for normal and islanded service, and the integration of the multiple SCADA control points in each of the independent operating systems.

The analysis and design of the power supply to the railroad facilities will need to be tightly coordinated with the concept of operations developed by the power generation team, the right-of-way development for spatial constraints during construction and future maintenance, and the individual rail and transit operating entities to make sure the operating procedures comply with the railroad or DOT regulations and the best practices and standard operating procedures of the agencies.

Section 5

Detailed Assessment of the NJ TRANSITGrid System by System

NJ TRANSIT MORRIS AND ESSEX FACILITIES

In normal operation the microgrid facilities will operate in parallel to the PSE&G incoming transmission lines. The system must be evaluated for load sharing, phase balancing, and utility interconnection. In islanded mode, the M&E lines will be served by diesel operations but will still require power for signal power and rail operations and control. New facilities will include:

- New 230KV yard at generator plant site. Medium voltage to 230 kV, 3 phase 60 Hz.
- New transmission lines from generator yard to Mason substation. We understand that the design is currently underway by others for the replacement of Mason substation. The selected alternative for the Mason substation replacement is an indoor GIS substation. Two positions within this substation lineup have been accounted for in the design for the addition of the microgrid transmission lines. (See figure on page 77)
- Power to signal, switching, and rail operations control.
- Bergen County and Pascack Valley Lines between Hoboken and Meadowlands Sports Complex – Distribution must be provided to the signal power system and rail operations and control center to support diesel service in this corridor in islanded mode.

NJ TRANSIT HUDSON BERGEN LIGHT RAIL FACILITIES

In normal operation the microgrid facilities would strictly be standby for this system. In islanded mode the feasibility study focused on rail operations power including traction power, signal power, and power for operations control center. As part of the concept of operations, decisions will need to be made on what the requirements would be for power to the station platforms with specific operating plans required for the emergency mode.

- Medium voltage distribution (3 phase, 60 Hz) from generator site to a distribution point at Hoboken. The RFP proposes that this distribution be at the 13.2 kV level. An analysis will be performed to determine if this voltage will support the system-wide power demand anticipated or if a more cost-effective solution might be to raise the distribution voltage, with conversion back to 13.2 kV at the Hoboken yard.

- Distribution from Hoboken to each traction power substation along the route both north to Tonnelle Avenue and south to 8th Street. The original concept is to run this distribution circuit underground, but an analysis will be performed to determine the most cost-effective solution either underground, aerial, or some combination of both that will meet the budget while maintaining the resiliency requirements.
- Transfer switchgear (and step down equipment if a higher distribution voltage is used) at each of the 15 traction power substations along the route. (See figure on page 74)
- Distribution circuits to the signal power system along the route. It is our understanding that except for the traffic signals in the street running section of the line, the signal power for the HBLR emanates from the feeders at the traction power substations. This will be confirmed as part of the document review in the first part of the project.
- Distribution circuits to the operations and maintenance facility at 20 Caven Point. This distribution can be derived from the distribution adjacent to yard substation YB1 if not already existing.

AMTRAK FACILITIES AS DISCUSSED IN SUBTASK 2.2.2.1 BELOW

The key actions required under this subsection include the following:

1. Establish the final paths for physical routing of the transmission and distribution.

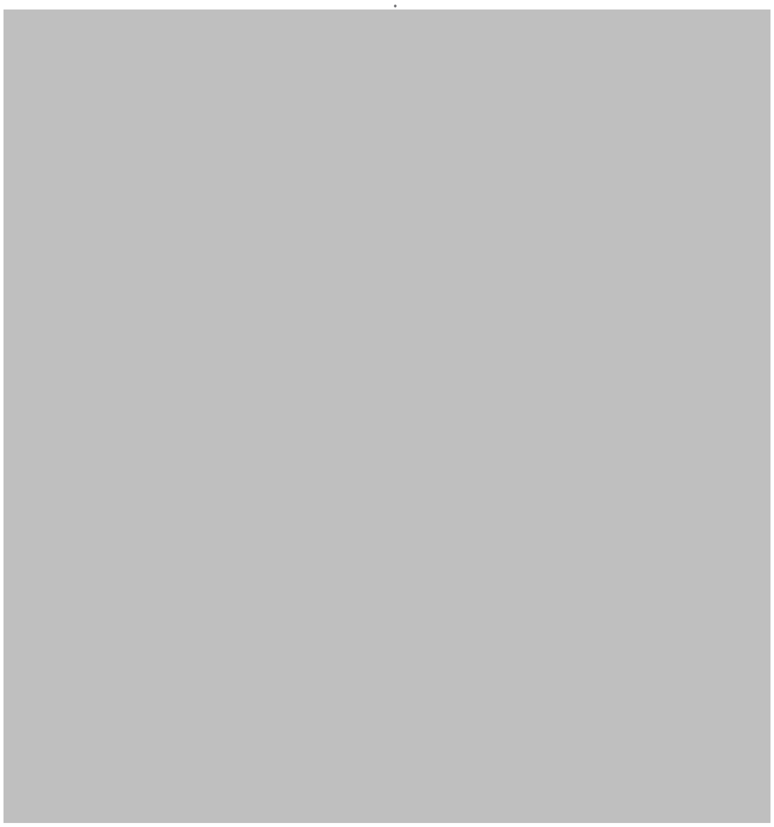
NJT TRANSITGrid – Kearny Site

230kV Transmission to NJ TRANSIT Mason (~0.5 miles)

There will be approximately 0.5 miles of new 230kV transmission to connect the new plant to NJ TRANSIT's Mason Substation. We will evaluate multiple methods for this installation, including underground and aerial. Mason Substation will serve as the point of interconnection with PSE&G and it will be important to coordinate with PJM requirements for this interconnection. We understand that the Mason Substation is currently under design, but the 30% design included a new 230kV GIS Substation that would be separate from NJ TRANSIT's traction power substation. The 230kV portion was proposed to be in a new location on the MMC site and would require reconfigured PSE&G transmission towers, by others.

138kV Transmission to Amtrak Substation 41 (~1.5 miles)

There will be approximately 1.5 miles of new 138kV transmission to connect the new plant to Amtrak's Substation 41. We will evaluate multiple methods for this installation, including underground and aerial but Amtrak's standard has been aerial. We are intimately familiar with Amtrak and its design standards as we are currently working on completing the design for 22 miles of new 138kV transmission from Amtrak's Zoo Substation to the Paoli Substation on its Keystone Corridor. As seen in the graphic below, these transmission structures are typically in existing railroad right-of-way's and we understand how the work needs to be done. It is not a standard utility transmission line.



13kV Distribution to 15 HBLR Substations (~18 miles)

There are approximately 18 miles of power distribution required to power all 15 HBLR Substations. The route proposed will follow the existing M&E and HBLR railroad right-of-way's. Our Team will utilize the knowledge gained in our preliminary assessment of the distribution during the Sandia study to hit the ground running and focus on areas of concern already identified. These areas are highlighted in the graphic below. The Team will also perform a risk/cost evaluation of underground/overhead distribution along the route. All of this will be done in tight coordination with the civil, subsurface and utility investigations, and right-of-way assessment. Ideally, we would like to utilize any existing underground ductbank that was installed with the original HBLR project.

Typical Amtrak 138kV Transmission Towers

2. Clearly identify every piece of equipment that needs to be powered from the NJ TRANSITGrid to meet the concept of operations.

After establishing the concept of operations, it will be critical that every piece of equipment that requires power to run is connected to the NJ TRANSITGrid generation plant or distributed generation that will be covered in another scope of work. We would want to make sure we have power distribution to critical loads that may include: traction power substations, signals power, tunnel ventilation, NJ TRANSITGrid Operations Center, and possibly station power. Status feedback of all of these operations components will be required at the NJ TRANSITGrid control center to verify safe conditions prior to operation of the transit systems.

3. Use load analysis established for the generation plant to run power flow analysis and establish distribution requirements.

Not only is the load analysis critical for sizing the plant but also for the power flow analysis of the distribution system. For example, after we perform these calculations we may have to increase the distribution voltage or provide other voltage regulation means to HBLR to make sure we can provide power without significant voltage drops for the 18 miles of distribution.

4. Assess modifications required to existing HBLR Substations

If all 15 HBLR substations require connections to the NJ TRANSITGrid, the Team will need to evaluate space for new electrical and communications equipment in every substation. Ideally, this new equipment will fit within the existing footprint of the substation without any substantial modifications to the substation's existing electrical equipment or space. If that is not feasible, we will have to evaluate phasing, outdoor equipment, or adding space to the substation.

The Team would also work to establish a new standard service configuration that could be applied to each substation. This will be important for the operations and maintenance (O&M) personnel so that they can work on the equipment safely and keep the system working reliably. This would include standards for protection and controls in the HBLR substations

5. Early coordination with the current Mason Substation design

Coordination with NJ TRANSIT's ongoing effort to replace the existing Mason Substation will be critical since this is the point of interconnection with PSE&G. Our Team has already had the opportunity to coordinate with the project and assessed the 30% design for potential value engineering options.

We would review the 230kV connections for both the NJ TRANSITGrid and PSE&G in the new GIS substation as well as the current plan for PSE&G to modify their transmission towers. These new tower structures and aerial transmission will have to be coordinated with our new transmission lines and structures.

Our successful execution of this work requires the following

1. Using our previous experience on the project to hit the ground running

Our Team was brought in by NJ TRANSIT during Sandia's study to help evaluate the concept, feasibility of construction, and identify areas that need further evaluation. We will capitalize on this unique experience to hit the ground running and focus on areas we know may be more challenging or take the most time. More importantly, our Team will already be up the learning curve and we will not have to spend months to get up to speed on a project as complex and unique as this.

2. Coordination and collaboration with major stakeholders

Coordination with major stakeholders is critical for every task for a project of this size and complexity and the distribution and protection system is no exception. The major stakeholders involved in the transmission and distribution include NJ TRANSIT, HBLR, Amtrak, PJM, PSE&G, and the NJ BPU. Some of these outside stakeholders have processes for applications or permits that we can help guide NJ TRANSIT through. Others like Amtrak have their own design standards and engineering departments, which will provide feedback and approvals of the design. We are confident that our Team knows the standards and just as important the people within these organizations to help streamline the communication. Not only is coordination needed for outside reviews and approvals, but we also will need to coordinate within NJ TRANSIT including operations, engineering, the HBLR operations just naming a few. Lastly, to meet the schedule we will have multiple teams requiring site access for many facilities including 15 NJ TRANSIT HBLR Substations, Amtrak Substation 41, NJ TRANSIT Mason Substation, and NJ TRANSIT Railroad right-of-ways along M&E and HBLR. We understand the coordination this requires.

3. Clear preliminary concept of operations established early in the process

This will really drive the scope for the entire project but for the distribution system, it will be important that this is established early, so we can start to assess the equipment that will ultimately be served by the NJ TRANSITGrid.

4. Create dedicated design teams for each agency

To meet the schedule and work on all portions of the distribution system in parallel, we will assign teams to assess the connections for each transit system (M&E, HBLR, Amtrak separately, but with oversight and guidance from the task leader to make sure the design meets the intent of the overall project. The key benefit to NJ TRANSIT will be that the Jacobs Team will have clear responsibilities, be intimately familiar with their assigned systems, and have relationships and lines of communication with each organization.

Our approach in this section of the work will result in the following:

1. Create clear scope and direction for the transmission and distribution contracts.
2. Meet the 15-month schedule with the ability of the Jacobs Team to hit the ground running.
3. Focus on previously identified problem areas immediately to get solutions early.
4. NJ TRANSIT will not need to waste time on getting the Jacobs Team up to speed on their technical requirements, organization, or procurement rules.
5. Experience with Amtrak to make sure the project meets the intent of the project as well as all Amtrak standards.

DELIVERABLES

- Electric Traction Power Facilities and Power Management Design 10% and 20% – Draft and Final

Subtask 2.2.2.1 | Amtrak Electric Traction Power/Overhead Catenary System Substation 41 (Kearny Substation)

Under this task, we will provide traction power and overhead catenary engineering services to provide a new static frequency converter to provide Amtrak a new 138kV, 1 Phase, 25Hz supply to the Northeast Corridor as well as replacing Substation 41 in entirety. There are two major deliverables under this task. The first is the Conceptual Design Drawings and Report that covers multiple options and order of magnitude cost estimates for each. Once the “best” option is decided upon, the final deliverable will be the 20% (Preliminary) Design Package.

Our execution of this tTask will be driven by Amtrak’s standards and technical requirements as well as the concept of operations. The most significant risk to be mitigated during this phase of the work is not properly selecting the technology to support Amtrak’s traction power loads and hitting environmental hurdles locating the new substation.

In normal operation no adjustments will be needed to the existing Amtrak traction power operational facilities as the new generator feeds will act as additional sources to run in parallel to the existing generation. In islanded mode a detailed analysis will be conducted to determine the proper sequence of operation for the service levels determined under the Concept of Operations. This may include isolating the 138 kV and 12 kV networks through opening of switches at Substation 39 Rahway, Substation No. 42 Hackensack and Substation No. 43 PSNY 31st St. and 7th Avenue.

- Static Frequency Converter at the generation site (2 x 25 MW, 60 Hz 3 to 25 Hz 1)
- An analysis will be performed on other possible alternatives that may help support the overall system phase balancing requirements per ANSI/ NEMA MG 1-2006.
- 138kv, 25 Hz step up yard at the generator site
- 138kv, 25 Hz switching yard adjacent to Amtrak Substation No. 41 Kearny
- 138kv, 25 Hz transmission lines from the step up yard at the generation site to a switching yard adjacent to Amtrak Substation No. 41 Kearny
- Transmission connections from the switching yard to the existing Amtrak transmission network – This can be provided either east or west of rebuilt Substation No. 41 and will be driven by design constraints for the ease of construction and staging.
- Communications and SCADA equipment to tie new Amtrak facilities into CTEC, Power Director, and Load Dispatcher facilities.
- In addition to traction power, supply to other critical loads is required to enable full rail service on the NEC. For example, there are ventilation and pump loads at Weehawken that are required to be operational in order to enable passenger transportation through the Hudson tunnel. Resilient or emergency power systems will also be required for all operation and control facilities.

[redacted]

- [redacted]
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- [redacted]

[redacted]

[redacted]

DELIVERABLES

- 20% Preliminary Design Package as outlined above.

Subtask 2.2.3 | Civil, Structural, Geotechnical and Hydraulic

This task is to develop calculations and plans to support the construction of all proposed facilities. Civil drawings will incorporate aspects of structural design, the geotechnical report, hydraulic designs and permitting, and right-of-way information. Drawings prepared will include site plans, cross sections, profiles, elevations, and details. The civil plans will serve as the basis for preparing drainage and permitting plans for submittal to outside agencies.

Reports and designs from each discipline will be coordinated to provide 10% and 20% design plan deliverables. Details on the tasks are included in Subtask 2.2.4 Subsurface Investigations, with hydraulics included in this section. Structural designs will be based in part on the geotechnical recommendations and is covered in detail in Subtask 2.2.7. Survey will be performed by our subconsultant, GTS, with coordination through Jacobs and is covered under Subtask 2.3.1.

Specific information to be included in the civil drawings will be obtained from the building disciplines for structure size and support facilities, transmission towers and substations, existing and proposed utility services, drainage facilities including stormwater treatment, and right-of-way and easement lines. Temporary construction equipment access, final internal traffic circulation, parking, and maintenance needs will be combined with the above to develop the overall civil site plan. The civil plan will form the basis of the permitting plans and to identify right-of-way needs.

HYDRAULIC CONSIDERATIONS

The Civil, Structural, Geotechnical, and Hydraulic design components and identifying the impact areas and resiliency design parameters will drive some of the design options as well as permit issues.

The resiliency design efforts will include assessment of the flood elevations and desired freeboard with raising the Power Plant, Substation, and critical infrastructure facilities above the extreme flood events.

The design will include assessment based on the NJ TRANSIT Resiliency Program Design Criteria Document as well the new Executive Order 13690, which includes additional guidance on Resiliency Design including:

- Freeboard value approach, based on 100 year + 2 feet freeboard or 3 feet for critical actions/facilities
- 500 year elevation approach
- Climate informed science approach

Thedesign will also be required to meet criteria outlined in ASCE 24-14.

The Team has dealt with these issues extensively on the NJ TRANSIT MMC project and we know in detail the FEMA flood elevations of the project area. A design memorandum will be prepared to summarize the design elevations and criteria for the proposed Power Plant and Substation.

It is anticipated that the proposed project improvements will result in a disturbance area greater than one acre so the project will be considered a “major development” under NJ’s Stormwater Management (SWM) Rule (N.J.A.C. 7:8). A SWM facility is anticipated to be required for the proposed Power Station Site and access roadway. The scope of work is based on a 20 % design level effort for one extended detention facility and one Manufactured Treatment Device (MTD). A free discharge to a local drainage ditch is assumed for the basin outflow pipe. A drainage report will be prepared to summarize the proposed basin design effort.

Refer to Task 5 for additional discussion on SWM and advancement of certain design elements for the permit support.

DELIVERABLES

- Reports as detailed above.
- 10% Plans and Specifications and in conformance with Project General Plan and Specification Requirements as well as General Notes as detailed in Task 2 – Engineering above.
- 20% Plans and Specifications and in conformance with Project General Plan and Specification Requirements as well as General Notes as detailed in Task 2 – Engineering above.

The key geotechnical actions include interpreting the geotechnical data collected during the subsurface investigation, determine the most appropriate foundation options, and performing the necessary foundation design calculations for the power plant, substations, and all the associated support structures.

The successful execution of this work requires an accurate interpretation of the field and laboratory testing data, and design experience combined with a practical approach to the construction of different foundation types in order to determine feasible foundation alternatives, supported by the appropriate design methodologies and analyses.

The main geotechnical design elements of the proposed project include supporting the new power plant and the associated substation, and the reconstruction of the Kearny Substation (Sub 41). A variety of other design elements, the details and upgrades of which will be decided after the contract is awarded and following consultation with NJ TRANSIT, include a 138kv frequency converter, associated substations, power distribution systems, culverts, retaining walls, overhead and underground transmission line, etc. as discussed in the RFP. The full scope of this work and the related effort for these latter items cannot be determined at this time, but will be addressed and designed accordingly after consultation with NJ TRANSIT.

Jacobs has been intimately involved in the geotechnical engineering design for several projects in the immediate vicinity of the proposed NJ TRANSITGrid project. Our experience includes geotechnical design work performed for the Wittpenn Bridge project for NJDOT, and the following NJ TRANSIT projects: Portal Bridge project, Superstorm Sandy Improvements at the MMC, and just to the north for the Secaucus Transfer Station and the Main-Bergen Connection projects.

Jacobs was part of the design team for the Portal Bridge Project, which included embankment widening, retaining walls, and access roads in the vicinity of Substation 41 (Kearny Substation). The current RFP proposes full reconstruction of the Kearny Substation. New fill is required to be placed to raise the new substation above the anticipated 500-year flood elevation. Two alternatives for the fill pad will be performed; one using traditional fill, the second using lightweight fill materials. The use of retaining walls will also be evaluated to determine a cost efficient design.

Slope stability and settlement of the existing railroad embankment are the main concerns associated with placing fill for the new substation along the existing embankment. Our past experience at this exact location and having performed similar geotechnical analyses gives Jacobs an advantage since we have the existing data, the previous design calculations, and data reports to be able to help expedite analyzing the proposed work.

Jacobs will evaluate the subsurface conditions and laboratory test results presented in the Geotechnical Data Report that was prepared and submitted as part of Subtask 2.2.4. A Preliminary Geotechnical Engineering Report will be prepared, which summarizes the analysis of the data, compare and evaluate foundation design alternatives, discuss the constructability for the proposed structures and the impacts to adjacent facilities and systems, provide the preliminary design recommendations for the 20% plan set based on our geotechnical design calculations, and identify measures necessary for the installation of temporary or permanent sheetpiling, dewatering, and/or excavation support systems.

The Geotechnical Data Report will be part of the Preliminary Geotechnical Engineering Report. This combined report will form the basis of the geotechnical and foundation design approach for the future design-build team. The report will be submitted to NJ TRANSIT for review and comments. The baseline design criteria for the foundations will be specified and performance specifications will be developed.

The Jacobs Team has proven experience designing rail projects and foundation systems in this part of the state. We are familiar with the properties of the geotechnically challenging soils at the proposed site, and know how to appropriately design and ultimately support the proposed project elements safely.

Jacobs Geotechnical group will review the geotechnical and foundation Final Design submissions, and provide construction assistance as needed.

Subtask 2.2.4 | Subsurface Investigations

The key geotechnical actions include developing and executing a comprehensive subsurface exploration program, followed by a laboratory testing schedule tailored to deliver the necessary results to enable our Team to perform the necessary foundation design analyses for the power plant, substations, and all the associated support structures.

The successful execution of this work requires a complete understanding of the project elements and the anticipated subsurface conditions, and a thorough planning process to initiate the subsurface investigation including soil boring plans, program notes, and Site Specific Work Plans.

As mentioned in Subtask 2.2.3, there are a variety of design elements, which will be decided after the contract is awarded and following consultation with NJ TRANSIT. Therefore, the full scope of the subsurface investigation for these items cannot be determined at this time. Based on the estimated schedule and the critical work flow path, the subsurface exploration program can either be awarded then modified after these items are decided upon, or if time allows we will wait for the results of the discussions to modify the soil boring program to address the various elements.

Jacobs has been intimately involved in the subsurface exploration program for several projects in the immediate vicinity of the proposed NJ TRANSITGrid project. Our experience includes work performed for the Wittpenn Bridge project for NJDOT, and the Portal Bridge project, which included work in the vicinity of Substation 41 (Kearny Substation), Superstorm Sandy improvements at the MMC, and just to the north for the Secaucus Transfer Station and the Main-Bergen Connection projects, all for NJ TRANSIT.

Geologically the project site is located within the Piedmont physiographic province. A review of the Rutgers University Engineering Soil Survey report and the available geotechnical data from the NJDOT database indicates that the site is underlain by Triassic Shale and/or Sandstone bedrock.

It is anticipated that bedrock will be encountered at depths ranging from 85 to 100 feet below exist grade. The surficial soils are man-made fill material, ranging in thickness from 5 to 20 feet. Typically, a soft organic layer exists below the fill and above the stratified, highly compressible Silt & Clay layer. The organic layer was found to be up to 15 feet thick. A till layer is often encountered at the bottom of the Silt & Clay layer, above the bedrock.

Based on the existing information, a comprehensive, project specific subsurface investigation and laboratory-testing program will be planned and conducted by our Team in support of the design for the power plant, Kearny Substation, and all of the associated structures of this project. The subsurface investigation program will be prepared by Jacobs and executed by our geotechnical subconsultant, Matrix New World Engineering, Inc. (Matrix). The investigation program will define the underlying soil conditions as they relate to the proposed project, and define the top of rock elevation throughout the project site. The field work is anticipated to include Standard Penetration Test (SPT) soil borings and test pits. A summary of the investigation program, with boring plans, notes, and anticipated work schedule will be submitted to NJ TRANSIT for approval prior to beginning field work. At this time, a total of 123 borings are anticipated.

Concurrently, a Site Specific Work Plan (SSWP), including railroad flagging requirements as needed, will be prepared and submitted to NJ TRANSIT and Amtrak for review and approval, prior to commencement of the subsurface investigation. Every effort will be made to allow the proposed work to occur without disrupting the daily rail passenger service.

Soil borings will be located and staked in the field by our surveyors. We anticipate subcontracting Jersey Boring and Drilling Co., Inc., a qualified SBE/DBE firm with vast experience accessing difficult locations in areas of soft ground and adjacent to railroads. Matrix will provide full-time onsite inspection of the soil boring activities, and describe the soil and rock in the field. The field work will also be coordinated with our archeological subconsultant (Richard Grubb) to facilitate their needs.

The Standard Penetration Test will be utilized to obtain soil samples and blow counts. Soil samples will be taken continuously to the bottom of the organic layer to appropriately define the thickness and consistency of this problematic layer, and continued at five-foot intervals thereafter to the top of bedrock. Undisturbed soil samples will be collected of the organic and soft Silt & Clay layers to determine their strength, compressibility, and engineering indices. The location of the soil borings will be based on the proposed location and footprint of the structures, and the expected geotechnical design concerns such as settlement, slope stability, type of anticipated foundation systems, etc.

Although the subsurface investigation cannot be fully developed at this stage, the total number and depth of soil borings will be planned to appropriately cover the project elements. As an example, the anticipated foundations for the power plant are deep foundations, such as driven piles.

Section 5

Therefore, the power plant borings will be advanced to top of bedrock and drilled into the bedrock to account for other foundation types such as drilled shafts. Depending on the location and anticipated loads of the smaller ancillary structures, spread footing foundations may be possible. This will need to be confirmed based on the soil data collected. The Team will also study the use of drilled shafts for areas in close proximity to active rail tracks.

Percolation tests will be performed at the proposed stormwater basins and observation wells will be installed to establish the depth to the ground water table. The observation wells will be read over the course of six months, preferably through the wet season, to establish the seasonal high water table for the stormwater management design. It is assumed the site soils and/or groundwater is not contaminated, or will be remediated prior to beginning the subsurface investigation.

Upon completion of the subsurface investigation program, select jar and rock samples, and the undisturbed soil samples will be sent to a geotechnical laboratory to be tested for strength, consolidation, classification, dynamic shear modulus, and damping properties for the resonant vibration analysis, and general engineering indices to assist in the geotechnical assessment and engineering design.

Our subconsultant, Matrix will prepare a Geotechnical Data Report. The Data Report will include a summary of all the data collected in the field and the results of laboratory testing performed. The report will include the boring location plans, soil boring logs and soil profiles, and any field testing data. The data will be analyzed, soil properties determined, and design recommendations will be presented in the report for each geologically discrete area of the project. The report will be submitted to NJ TRANSIT for approval.

The need for temporary or permanent sheetpiling, dewatering, and/or excavation support systems will be more clearly identified as the geotechnical design is progressed toward 20%. Therefore, the need and issues involved with these elements will be identified and addressed as part of Subtask 2.2.3.

DELIVERABLES

- Geotechnical Investigation Plan and Boring Program
- Boring Plan and Profiles
- Geotechnical Report, with boring logs and analysis for each geologically discrete project element
- Section 1(A) Report of Archeological Resources and Effects as necessary

Subtask 2.2.5 | Topographical Survey Reference NJDOT Survey Standards

GTS Consultants brings recent and on-going experience with the subject property to this Team. Our involvement with the project vicinity includes the following:

Current project for NJ TRANSIT at MMC

- Includes aerial topographic mapping of MMC facility
- Includes aerial topographic mapping of Mason Substation area
- Includes aerial topographic mapping of Morris & Essex Line from Route 7 to NJ Turnpike

Prior project for NJ TRANSIT ARC/Gateway Tunnel:

- Included aerial topographic mapping of proposed power plant area
- Included existing right-of-way research and deed/map plotting of proposed power plant area
- Included survey support for geotechnical soil settlement investigation

GTS continues to provide a broad array of survey support services for the various disciplines working together on complex projects. These include:

- Primary, secondary, and aerial control survey points
- Topographic survey and mapping
- Research and recovery of existing right-of-wsay/property boundary lines
- Location of surface and subsurface utility features
- Stakeout and location of geotechnical soil borings and utility probes/test pits
- Location of wetlands and other environmentally constrained areas

GTS will coordinate the development of aerial topographic mapping for the project site and extended limits along rail lines. New aerial photography will be obtained. Ground survey control points/locations will be identified. The ground control points will then be surveyed for horizontal and vertical position (coordinates and elevations) in the project datum. Upon completion of the ground control, production of aerial topographic mapping will begin to NAD83 horizontal and NGVD29 vertical. Once the aerial mapping is complete, it will be field edited for identification and annotation of various surface features. Supplemental ground survey will be performed to address other project needs, such as surface and subsurface utility locations, bridge clearances, rail profiles, soil boring and utility test pit/probe locations, permitting, and other appropriate tasks.

Conventional ground survey data will be incorporated into the project topographic base map, which will be prepared at a scale of 1”=40’. Information from other sources such as utilities, environmental features, and railroad provided plans will be incorporated as required.

DELIVERABLES

- Topographical Survey as detailed above.
- Topographic Survey (Supplement to NJ TRANSIT’s baseline mapping as necessary).

Subtask 2.2.6 | Utility Engineering

The focus of the Utility Engineering task will be to obtain an accurate representation of the existing utilities in the project area. The utility investigations will consist of both subsurface utilities and overhead utilities. Investigations will begin with a review of the utility companies having jurisdiction within the project area and reaching out to each utility to request information such as records, future plans, and any potential capacity issues in the area. Utility companies include the following: PSE&G Electric, PSE&G Gas, Verizon, Verizon Business, Passaic Valley Sewerage Commission, AT&T, Comcast Jersey City, New Jersey Turnpike Authority, Jersey City Municipal Utilities Authority, and United Water Jersey City. In conjunction with the initial utility request, a site visit will be conducted to identify utility information that can be observed such as utility services, pole lines, and other visual features such as manholes and valves. This utility investigation will be limited to where access is permitted. This information will be used to produce the existing utility base plans.

The quality of the utility base plans sets the stage for all future utility impact analysis and ultimately utility relocations. Without an accurate utility base plan, the location of existing utilities may not be known until construction occurs and frequently field changes must occur during construction in order to alleviate utility conflicts. With an accurate utility base plan, there is reduced risk of damage to utilities. Construction cost savings are realized due to reduced change orders. Therefore, the utility base mapping is enhanced through additional geophysical investigations as defined in a Subsurface Utility Engineering (S.U.E.) Plan. This S.U.E. Plan will define the S.U.E. Approach, Utility Designating and Conflict Process, Data Management, and Conflict Analysis.

A large part of the S.U.E. process will be to accurately designate and locate utilities using various techniques such as electromagnetic pipe locators, geophysical methods, vacuum excavation test holes, and ground penetrating radar. Jacobs will team with InfraMap to conduct these S.U.E. investigations to locate the critical underground utilities potentially affected by the footprint of this project and plot all findings on the base map. Jacobs will follow the ASCE standard CI/ASCE 38-02 for depicting utilities.

Jacobs will coordinate with all affected utility owners to make certain that methods of detection and location are acceptable to owners prior to and during implementation and can be conducted safely.

Jacobs will perform a conflict analysis by preparing a Utility Conflict Matrix. This matrix identifies all possible utility conflicts throughout the project. Each conflict is looked at to determine whether more information is needed to confirm whether a conflict does or does not exist, and whether the overall design can and should be modified to eliminate the conflict. This is an iterative process that continues throughout design. In many cases, this is where air-vacuum excavation test holes are performed to verify the exact positioning of a subsurface utility. The purpose of the test hole investigations will be to confirm whether a conflict does or does not exist. Once the Utility Conflict Matrix identifies confirmed or probable impacts, the utility relocation design can be discussed and refined with each owning utility agency. This close coordination with the utility agencies is critically important in order to get their review, buy-in, and feedback relating to their efforts and available resources.

The early preparation and execution of Master Utility Agreements is important to maintain the design schedule. The key to verifying that these agreements are executed in an expeditious manner is to maintain frequent contact with the utility representative throughout the process. Often, the agreements may change hands within various departments of the utility agency and weeks go by prior to execution. This translates to critical lost time in design since many utility companies are reluctant to provide design assistance prior to the execution of this agreement. Jacobs will make it a priority to track the status of the agreements, communicate effectively with the utility agency, and work with the utility agency to provide appropriate engineering costs within the Utility Agreements.

Included within the Utility Engineering task is the support of the NJ TRANSITGrid with new utility services including water, sewer, communication, electric, and gas. Jacobs will coordinate with each respective utility company to provide the appropriate services. In regards to the gas service, Jacobs will investigate several options. There are at least two known gas utilities/pipeliners in the project area: PSE&G and Williams. Jacobs will reach out to all potential suppliers in order to provide NJ TRANSIT with the most favorable gas service option. Information that will be critical to determine the best option will be the peak hour gas demand, annual demand, and system pressure. The proximity of the supplying pipeline to the project site will also be critical. A meter and regulator station will be required, which can be designed and installed on the project site. Jacobs will investigate any easement and permitting requirements needed for the gas service feed. Jacobs will work hand-in-hand with NJ TRANSIT in gas supply negotiations. It is important to take gas at high pressure. The parasitic loads and maintenance costs of gas compression are very large and should be avoided if possible.

DELIVERABLES

- Subsurface Utility Engineering Plan
- Existing Utility Drawings
- Proposed Utility Relocation Drawings
- Utility Cost Estimates
- Utility Agreements – drafts and final for reimbursement of engineering cost
- Utility Catalog and Files
- Draft and Final Physical Facilities 20% Construction Plans as detailed above

Subtask 2.2.7 | Structures

This was discussed in detail in previous task in Section 2.2.

Subtask 2.2.8 | Communications Systems and Power Management

Communications

Due to the critical nature of the NJ TRANSITGrid, the design criteria for the EMS/SCADA system will be that of an industrial control system (ICS). The ICS must be a high reliability system making certain that the NJ TRANSITGrid can supply power to the NJ TRANSIT Rail system during an emergency situation. All major pieces of the control system will be redundant. The design will conform to the following standards:

- C37.1-2007 – IEEE Standard for SCADA and Automation Systems
- P1711.3 – Standard for Secure SCADA Communications Protocol (SSCP) (Part of the Approved & Proposed IEEE Smart Grid Standards)
- ANSI/ISA-99 – Standards for SCADA Security
- NIST SP 800-82 Rev 2 – Cybersecurity Policy Planning and Preparation

The ISC will be segmented to reduce the risk of wide spread control systems failure. The design will call for an Energy Management System (EMS) to control the power plant. The power plant will be capable of running connected to the existing power grid or in island mode (isolated from the utility grid). The design of the SCADA system will call for tools to allow the operator to switch between these modes.

The design will also include a new Static Frequency Converter (SFC) facility to convert 60Hz utility power to the 25Hz traction power required for trains operating along Amtrak's NEC. Amtrak's current Load Dispatch System (LDS) located at 30th Street in Philadelphia was installed by Advanced Control Systems (ACS) approximately 15 years ago.

The ACS equipment at the Amtrak Sunnyside Yard SFC site currently operates as a remote LDS workstation that enables the SFC operators to view all of the LDS data and displays. The Sunnyside ACS System was intended to be operated as an independent SCADA System in the event of a LDS or communications outage, but it is not currently operated in this mode. Amtrak is currently in the middle of a phased upgrade of the LDS. The new design will include the ability for Amtrak's existing LDS to interface to the new SFC control system.

Both systems will be capable of running in full automatic mode or in manual mode. The criteria for a "black start" will also be included in the design.

A SCADA system will then be designed to allow for remote monitoring and control of the power plant, the signal system, the radio system, emergency alarm stations, and fire systems. A new fiber optic based communications backbone will be specified to connect the individual systems. Coordination of the segmented control systems into one uniform SCADA system will be done by Robert Rosa, our SCADA design lead. Robert is a control systems PE and has more than 25 years experience in the design and implementation of industrial control systems.

DELIVERABLES

- Performance Specification for Communications Backbone Power Management Infrastructure, Radio Systems, Emergency Alarm Stations, Fire Alarm Systems – draft and final

Subtask 2.2.9 | Signals/Train Control Architecture

To provide the resilient operation of transit facilities as intended by the NJ TRANSITGrid project, safe and reliable signal systems are required that will be operable during emergency conditions, and will provide operational flexibility under normally and in emergency conditions. To accomplish these goals, there may be additional signal infrastructure and functional control improvements required to support the NJ TRANSITGrid integrated power generation plant providing continued operation of NJ TRANSIT and Amtrak service during both non-islanded and islanded operation. We will evaluate the existing signal system considering the planned normal operation and contingency operation to identify any modifications that will be required to support the NJ TRANSITGrid concept of operations. The results of this evaluation will be formalized into a Signaling/Train Control System Definition report that defines the signal modifications required to support the NJ TRANSITGrid operation.

The modifications to the signal system may include

- Signal power supply and signal power sectionalizing modifications
- Modifications to the track circuits to be compatible with the power supply

- Relocation of signal equipment (we will strive to minimize physical changes)
- Reconfiguration of the track circuits to provide alternative control scenarios

The signal engineers will also be involved in the required coordination of the signal power requirements at the new Kearny Substation, including two 60Hz to 91-2/3 Hz Signal Power Motor-Generator sets and associated switchgear, relay and control apparatus, auxiliary equipment and a control building.

Any signal designs will consider the rail operations plan, operating headway and throughput performance for the NJ TRANSIT M&E line, Amtrak NEC, and Hudson Bergen alignments.

The Signaling/Train Control System Definition will include an evaluation of the following:

- Concept of operations
- Existing track circuits
- Existing signal power distribution
- Existing signal power sectionalizing locations
- Existing cab signal power
- Any 60Hz power used at signal locations as backup to 96.6Hz power
- Signaling design criteria
- System architecture
- Train Control philosophy – levels of control, locations of control, jurisdiction of each agencies
- New train control technology
- Wayside Supervisory train control subsystems
- Existing signal control system power indications
- Safety assurance and hazard mitigation
- System Availability and Maintainability

A cost estimate and a schedule of the proposed signaling/ train control system modifications will also be developed and provided to NJ TRANSIT with the Definition Report. The cost estimate will include the level of effort required to advance the designs to 10% and then to Preliminary Engineering (20%) in accordance with NJ TRANSIT's CAD standards, and Amtrak's standards (as applicable).

DELIVERABLES

- Modified Signaling/ Train Control System Definition – draft and final
- Preliminary Engineering Cost Estimate for Signaling/Train Control Procurement and Modifications – draft and final
- Proposed Schedule for Procurement, Implementation of Signaling/ Train Control System – draft and final
- Reports, diagrams, drawings as detailed above

Subtask 2.2.10 | Concept of Operations

The priority of this project is making certain NJ TRANSIT resiliency by being able to operate key portions of NJ TRANSIT and Amtrak in the event of a blackout, i.e. island mode, by installing a generator and associated distribution lines in a microgrid configuration. The NJ TRANSITGrid project has significant commercial implications, including that the project may or may not have a positive ROI. Improving reliability beyond the PJM standard has costs, e.g. generator and duplicate feeders/distribution system. However, Jacobs can assure NJ TRANSIT that we will optimize and define the most cost-effective facility from a total cost (development, construction, and operations) and benefit perspective.

The objective of this subtask is developing an outline for the overall sequence of operations of the NJ TRANSITGrid. Under normal conditions, when the grid is fully available, the microgrid will be electrically connected to the grid.

Under a scenario including a regional or local blackout condition, the microgrid would become the primary source of power for interconnected traction power facilities. This would require switching coordinated with the utility after it has been determined that utility power will not be restored for an extended time period. After a regional outage, the NJ TRANSITGrid generation may initially trip offline for grid protection. For this reason, the NJ TRANSITGrid plant is required to have blackstart capability.

Given the contemplated plant size and the grid connection, NJ TRANSIT will have to undertake an interconnection and registration process with PJM. NJ TRANSIT will be required to be compliant with all applicable Federal standards that govern transmission grid connected generation. Jacobs will assist NJ TRANSIT in developing and submitting necessary registrations/certifications with appropriate energy regulatory agencies or bodies. NJ TRANSIT would be considered among many possible combinations of entities including but not limited to Distribution Provider (DP), Load Servicing Entity (LSE), and Transmission Owner (TO) in the process of complying with PJM interconnection requirements. Jacobs' team, along with Levitan, will assist NJ TRANSIT in navigating these processes. Additionally; we will provide assistance to NJ TRANSIT in evaluating compliance requirements to Currently Enforceable Standards including but not limited to: FAC-002-1 Coordination of Plans for New Generation, Transmission, and End-User Facilities; FAC-008-3·Facility Ratings; PER-005-2. Operations Personnel Training; and PRC-005-2 Protection System Maintenance. Any required applications and permits will be developed by Jacobs for submission to the regulatory agency NJ TRANSIT.

The baseline concept contemplated by the Sandia Report would allow the generation facility to deliver energy to NJ TRANSIT facilities as well as Amtrak via the microgrid's proposed frequency converter and direct transmission connections to Amtrak's 138kV system, and the Hudson Bergen Light Rail (HBLR) System. Jacobs believes there is likely a more straightforward and potentially more financially lucrative operational mode than that considered by the Sandia Report. This concept is discussed below.

ISLAND & GRID OPERATIONS

The project is to make sure NJ TRANSIT's operations in the event of a PJM blackout or similar emergency by designing the new power plant in a microgrid configuration so it can operate in island mode. By interconnecting to the PJM grid (PSE&G is the local transmission owner for that grid), NJ TRANSIT will be able to participate in the PJM power market. The two most common and most valuable power products are energy and capacity, and interconnecting into PJM will permit NJ TRANSIT to make profitable energy sales during hours in which the revenues exceed NJ TRANSIT's fuel, variable O&M, and other generation costs. Interconnecting into PJM will also make NJ TRANSIT's power plant eligible for capacity revenues. At current PJM capacity prices, capacity revenues would amount to about $8 million per year provided the plant is available to generate power when needed, which should be easy since the plant will be designed and operated to have high availability for islanding operations.

Jacobs will evaluate the cost-effectiveness of the following four operating options. The first three of which require the plant to be interconnected to the PJM grid.

- Plant operation according to PJM economic dispatch: When the plant is dispatched, its power would be utilized by NJ TRANSIT with surplus sold into the PJM wholesale market. Surplus sales would, by virtue of economic dispatch, be profitable. If the plant is not dispatched, NJ TRANSIT would buy power from the PJM market.

- Plant self-schedules operation based on peak NJ TRANSIT demand: NJ TRANSIT would determine a set schedule in advance based on NJ TRANSIT load and expected profitable operations; surplus power would be sold into the PJM wholesale market. This would simplify plant operations by scheduling plant operations in advance, e.g. to match NJ TRANSIT maximum loads provided plant operating costs are cost-effective in light of PJM wholesale energy costs. Given the anticipated plant efficiencies, this is a reasonable operating mode.

- Plant self-schedules operation based on NJ TRANSIT demand only (load-following): Operations would be limited by NJ TRANSIT loads, so there would be no surplus

Elements for Successful Regulatory Interface

- *Understanding of the procedural steps*
- *Knowledgeable in the fundamentals*
- *Identification of key regulatory staff*
- *Establish a cooperative relationship*
- *Leverage existing relations*

sold into the PJM wholesale market. This operating mode would result in missing opportunities to purchase cheaper energy and to sell energy at a profit, and would be quite challenging without the inclusion of energy storage technologies as discussed in Task 2.

- Not interconnecting into the PJM grid and only operating as a microgrid: If requested, we will investigate this option that avoids going through the PJM interconnection process. However, it will almost certainly not be cost-effective because (i) PJM blackouts happen so rarely that the power plant will seldom run and (ii) not participating in the PJM energy and capacity markets NJ TRANSIT will “leave money on the table.”

ENERGY REGULATORY CONSIDERATIONS

Essential to the NJ TRANSITGrid project in the energy regulatory arena is the knowledge and understanding of the procedural and substantive steps necessary to identify all registrations and/or certifications required by regulatory agencies and bodies with jurisdiction over the project. Where necessary, we will conduct legal research as a prerequisite to the identification process.

The actual registration requires the establishment and development of personal relations with administrators and regulators. This necessitates a cooperative effort of the client (NJ TRANSIT) and the appropriate consultants. Our Team intends to utilize the process of networking, where existing relationships in other jurisdictions, provide the bridge to relationships in New Jersey, at PJM or in the federal arena, to establish and strengthen the regulatory framework to make sure the project complies with the letter and the spirit of the law.

As part of the concept of operations, we will verify key regulatory and agency oversight interfaces are identified. This will be closely integrated with our approach to driving the process to make sure these interfaces are identified and kept current with project progress or with issues are they may arise, leading to early and efficient mitigation.

We will develop and prepare for NJ TRANSIT the following regulatory related documents:

PJM Interconnect Considerations – the interconnection process is performed by PJM under the Open Access Tariff. Based on the NJ TRANSITGrid proposed power plant size, this unit will be subject to the large generator interconnection procedure. The process is initiated with an interconnection request and must satisfy the Currently Enforceable Standards. The Currently Enforceable Standards basically cover the requirements of other regulatory bodies as follows:

NERC Compliance Registry Criteria – the way the PJM interconnect rules are structured the NERC Compliance Registry criteria are addressed in the PJM process. In short, if you can meet the PJM interconnect requirements you will have satisfied the NERC Compliance Registry criteria.

Northeast Power Coordinating Council (NPCC) – similar to NERC Compliance Registry Criteria, the way the PJM interconnect rules are structured the NPCC Compliance criteria are addressed in the PJM process. So if you can meet the PJM interconnect requirements, you will have satisfied the NPCC Compliance criteria.

Power Sales Opportunities – Amtrak – The RFP anticipates that the NJ TRANSIT power plant would enter into an arrangement to provide power to Amtrak during normal operations (excluding emergencies when NJ TRANSIT would operate in island mode and provide emergency power to Amtrak). Power sales to an unrelated party ordinarily trigger utility, i.e. cost-of-service, regulation, so we will work with NJ TRANSIT, PSE&G, and the BPU to structure an acceptable arrangement to allow non-emergency sales to Amtrak while avoiding utility regulation. We will evaluate possible pricing structures for Amtrak sales to make sure NJ TRANSIT is fairly compensated for the energy and capacity it provides consistent with Amtrak's willingness to share the project costs and risks. Possible scenarios could include but are likely not limited to:

1. NJ TRANSIT would bill Amtrak at the wholesale power market costs that Amtrak normally incurs whenever it is profitable for NJ TRANSIT. Amtrak would also receive emergency power during blackouts.

2. NJ TRANSIT would bill Amtrak at its own generation cost, i.e. Amtrak would save money when PSE&G energy prices are high by paying NJ TRANSIT's cost-based rate below the market rate. In return for this savings, Amtrak would bear its pro-rata share of the facility's fixed administrative and O&M costs. Amtrak would still receive emergency power during blackouts.

3. NJ TRANSIT and Amtrak could enter into a financial arrangement that provides the energy savings benefits without requiring PSE&G to wheel NJ TRANSIT power to Amtrak. Such arrangements are becoming more common and will require educating both parties on the costs and benefits.

We will investigate any claims of "stranded costs" and advocate on NJ TRANSIT's behalf. At the present time, we anticipate that PSE&G would not be at risk of stranded costs if we adhere to basic ratemaking guidelines, including allowing PSE&G to bill NJ TRANSIT and Amtrak for its own "wires" costs, which would allow it to recover the costs of maintaining the local transmission and distribution systems. We are familiar with PSE&G's Rate Schedule for High Tension Service and similar rates under which NJ TRANSIT and Amtrak receive power and will strive to obtain the "best deal possible" for NJ TRANSIT. We will also investigate other potential opportunities for power sales that would be permitted under BPU regulations.

In order to determine BPU regulatory applicability, we will review the various New Jersey Administrative Code regulations dealing with issues such as aggregated net metering and on-site generation.

NJ Administrative Code-Title 14, Chapter 8, Subchapter 8 – Aggregated net metering, which was recently legislated in the July 2012 Solar Act allows a public entity to install a generator behind the meter (on their property) with less limitations on generator size. The act permits the public entity to aggregate the consumption of all meters that they own that are on the same tariff.

NJ Administrative Code-Title 14, Chapter 8, Subchapter 5 – On-site generation, which is somewhat of a misnomer as it is more about combining heat and power and selling thermal energy. This concept goes back to the 1990s and entails locating a generator on one property and supplying power to an adjacent property. The term has been reused in connection with net metering, but could possibly have applicability for NJ TRANSIT if heat recovery is considered.

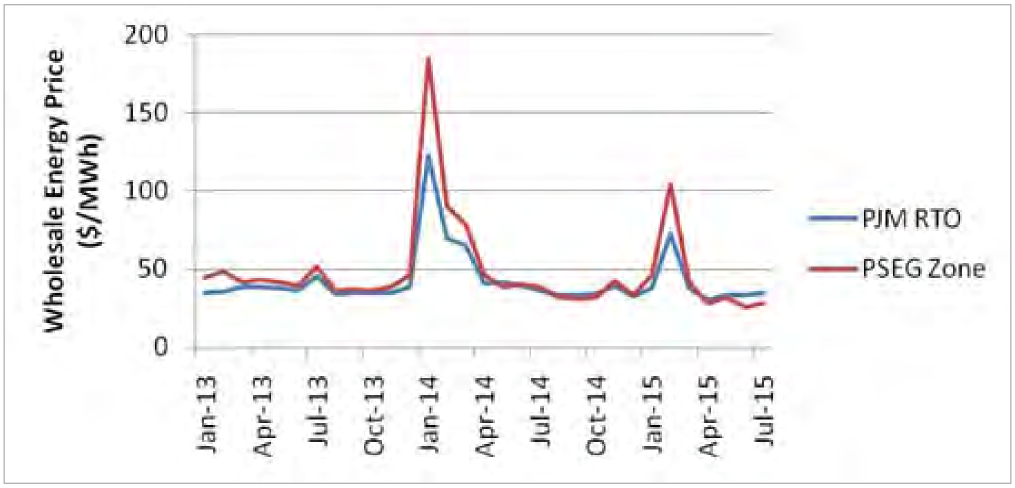
The Amtrak property may not be deemed contiguous to NJ TRANSIT's and that the power would have to be delivered through a distribution system. However, we are aware of a similar situation in New Jersey where a public entity, Six Flags, successfully petitioned the Board to waive that rule. In this instance, the power is transmitted over a distribution system located on customer property, but is owned by JCP&L. Six Flags pays a monthly rental fee to JCP&L for their equipment.

If NJ TRANSIT is prohibited by NJ state law or by BPU regulations from selling power to Amtrak and others, we are confident that NJ TRANSIT will still be able to supply Amtrak with emergency power during PJM blackouts. This arrangement should be easy for PSE&G and the BPU to accept because it strictly adheres to the priority of improving resiliency. In this situation, Amtrak might pay NJ TRANSIT (i) an annual reservation charge to cover fixed O&M and administrative costs plus (ii) payments for emergency power provided over the dedicated microgrid connection at NJ TRANSIT's generation costs.

POWER SALES OPPORTUNITIES – PJM

Regardless of the regulatory approvals required to provide power to Amtrak, NJ TRANSIT will be able to sell surplus power at wholesale prices (typically about one-half of the retail price, which includes PSE&G distribution costs) in the PJM energy and capacity markets. NJ TRANSIT is well-positioned in the PJM market because transmission constraints often cause higher wholesale energy and capacity prices in New Jersey, which is part of the Eastern Mid-Atlantic Area Council (EMAAC) Local Deliverability Area, compared to the rest of PJM. Further constraints exist from EMAAC into the PSE&G Load Zone in northern New Jersey. Since 2013, the PSE&G load zone locational marginal price (LMP) has been $5.61/MWh greater on average than the retail trade organization (RTO) LMP. PSE&G capacity prices have also cleared at a premium in PJM's annual capacity auction for the last three years.

The figure below illustrates how often PSE&G energy prices spike above the rest of PJM. NJ TRANSIT sales would be entitled to those higher energy (and capacity) prices if historical relationships persist.



PSEG versus PJM Energy Prices

FUEL SUPPLY ARRANGEMENTS

We will investigate the fuel supply, transportation, and delivery opportunities for the plant and recommend the most cost-effective arrangement given the proposed plant's operating regime and the capabilities of the local and regional gas infrastructure. This assessment will reflect current and anticipated regional gas market conditions in order to provide an informed perspective on contracting requirements, gas supply reliability, and delivered costs. Transportation and delivery analyses will focus on delivery options involving a direct lateral connection to the nearby Transco pipeline or delivery service through PSE&G. Our analysis of the delivery service would entail firm, quasi-firm, or non-firm (interruptible) transportation with an emphasis on the economic trade-offs involving different service conditions and the availability of reliable gas service during the peak load heating season.

We will review the economic and operational benefits and costs associated with the construction of a lateral to Transco, including the advantages of receiving high-pressure gas required for gas turbines and the regulatory approvals needed for a direct by-pass of PSE&G. Our assessment of the economics of a direct lateral will be based on preliminary estimates of construction and ownership costs for the economic screening analysis. Assuming that a direct connect to Transco is commercially viable; we will identify the commercial benefits that could be available under an alternative agreement for PSE&G to provide delivery services through its system. In our experience, local utility administration of tariff provisions is often shipper-specific so better utility arrangements can be obtained as an alternative to a commercially feasible direct pipeline connection.

We have evaluated and arranged fuel supplies for generators and other clients in the Northeast, and we will resolve questions of gas supply, transportation, delivery optimization, imbalance resolution, pipeline scheduling, and alternative fuel procurement strategies. We have also provided contract support for generators to help negotiate the best fuel contract terms and conditions given an expected operating regime. Our Team is well-versed in the operations and tariff conditions on Transco as well as the regulatory issues involving bypassing the local gas utility, as generators typically have done.

In order to make certain NJ TRANSIT has a reliable power supply during PJM blackouts or other emergencies, we will confirm local and state requirements to provide ultra-low sulfur distillate fuel oil in the event that interruptible gas service is curtailed. We will identify back-up fuel availability and the cost for delivery and storage on site. In making our recommendation to NJ TRANSIT, we will take into account land requirements for a gas receipt station and for distillate oil back-up storage tanks and truck or local oil pipeline deliveries, local zoning and permitting rules, and other commercial/economic/regulatory issues.

ECONOMIC SCREENING ANALYSIS AND FATAL FLAW ANALYSIS

At this point in our work, we will have developed a limited number of technically viable power plant options to meet the emergency load requirements of NJ TRANSIT and Amtrak. In order to rank these options and select a preferred option for NJ TRANSIT to review and approve, we will conduct (i) a fatal flaw analysis that will eliminate any options that may have non-technical fatal flaws e.g. not meeting local air permit standards, and (ii) an economic screening analysis that will provide NJ TRANSIT with a preliminary lifecycle cost-benefit analysis of each technical option. We strongly believe an economic screening analysis is critical in light of the crucial role this plant will play during stress conditions and the multi-hundred million dollar investment decision that NJ TRANSIT must make. The economic screening analysis will be a comprehensive, quantitative, structured evaluation of the technical options before we lock in size, technology, etc.

The screening analysis will take into account any restrictions or conditions that will be imposed by other agencies and regulatory bodies, such as the NJBPU, PJM and others. The screening analysis will determine the expected operating profile of each technology option and provide annual projections for each of the following components in a format similar to this:

NJ TRANSIT Savings

+ Revenues from Amtrak and PJM power sales

= Total value of power products

– Fuel expense

– O&M expenses

= Net Operating Revenues

– Administrative and overhead expenses

= Net income

We will also identify any material permitting, regulatory approval, or development risks that should differentiate some technology options from the others. Based on our results, we will recommend the preferred project that is the most cost-effective among the technically viable options. Once NJ TRANSIT approves the preferred project, we will continue with design and engineering to develop a power plant design that will allow us to commence procurement, permitting, PJM interconnection, and other regulatory processes. At the appropriate time, we will also lock down fuel supply and power sales arrangements based on the preferred project.

FINANCING AND ORGANIZATIONAL OPTIONS

The Jacobs Team has experts who have designed organizational structure options for microgrid operations to maximize the economic benefits while minimizing risk. We believe that developing a preferred plant design and our recommended plant operations, based on FTA and other available funding sources, will provide NJ TRANSIT with the most cost-effective plant option that will make certain NJ TRANSIT and Amtrak have reliable operations during system emergencies.

- For accounting and control purposes, the preferred corporate structure for this project would likely be the establishment of a wholly-owned operating subsidiary of NJ TRANSIT as a separate line of business. This would enable accurate management financial oversight while preserving a singular focus on power plant operations. Given NJ TRANSIT's limited authority under its enabling legislation and the conservative, risk-adverse nature of the Attorney General's Office representing NJ TRANSIT's interest in legal/contract matters, we recognize that this may not be a viable option.

- Alternatively, this project could be viewed as an extension of NJ TRANSIT's authority to provide reliable rail transportation. In this case, the generation and use of electric propulsion as an integral part of the rail service and the sale of excess power to assure reliability and reduce operating expenses could be viewed as analogous to NJ TRANSIT's current use of rail/bus advertising to offset its operating budget.

- The project could be structured as a real estate-type financing whereby NJ TRANSIT would lease the facility and related facilities to a third party owner/operator on a long-term capital lease basis who would make lease payments to NJ TRANSIT. Those lease payments could include energy provided to NJ TRANSIT at a reduced rate. The lease would include performance incentives and revenue sharing to verify high performance, low cost, and maximized value for NJ TRANSIT. This capital lease structure could be of significant benefit to NJ TRANSIT given the transfer of risk to the owner/operator, who may be able to take advantage of substantial federal tax benefits.

- If the capital lease option is not viable, NJ TRANSIT could enter into a short-term operating triple net lease in which NJ TRANSIT would retain ownership and the lessee would be responsible for O&M as well as other expenses such as insurance and taxes. This lease could include the same performance incentives and revenue sharing as the capital lease structure, while also benefiting NJ TRANSIT by providing risk transfer opportunities. NJ TRANSIT would collect “rent” which would serve to reduce operating expenses.

Additionally, we will provide assistance to NJ TRANSIT in evaluating compliance requirements to Currently Enforceable Standards including but not limited to; FAC-002-1 Coordination of Plans for New Generation, Transmission, and End-User Facilities; FAC-008-3 Facility Ratings; PER-005-2 Operations Personnel Training; and PRC-005-2 Protection System Maintenance. Any required applications and permits will be developed by Jacobs for submission to the regulatory agency by NJ TRANSIT.

ALTERNATIVE CONFIGURATION

As an alternative to the configuration prescribed in the Sandia Report, we believe there may be a generating plant solution that can reliably service the overall project intent, while also proving to be more financially viable than the base scenario. This alternative also avoids much of the regulatory hurdles anticipated with serving loads that are not owned by NJ TRANSIT or contiguous to the plant site. This concept contemplates a new gas-fired power generating facility, with storage components sized for reliable microgrid operation, but instead of merely offsetting the electricity purchased from PSE&G to NJ TRANSIT and Amtrak, this concept would sell 100% of the generated output to the wholesale market. The plant, sized correctly, with the proper mix of equipment, would result in a power plant that is much more efficient than the typical average power plant in the PJM market, resulting in a return on investment 100% of the time, on 100% of the installed generation capacity. Additionally, the storage components would be sold 100% into the frequency regulation market for additional lucrative revenues to help offset the capital cost premium associated with developing this optimized generation configuration. Also, since the plant will require blackstart capability, the power plant could realistically bid into the blackstart marketplace to provide additional revenue streams.

These items are discussed in much more detail in Task 15 of this response.

During grid emergency scenarios, NJ TRANSITGrid would be set to automatically take over the grid and frequency control after isolating from the PSE&G system. The transit load would create the noisy load profile, which would be averaged by the storage components. The generator's dispatch would be to supply this integrated load profile with a trim for frequency control. The generation plant would remain in dynamic voltage control.

The revenue stream for supplying these emergency services would come directly from third party entities via Power Purchase Agreements (PPA), but for standby power only, likely avoiding much of the regulatory challenges expected with the baseline model.

Subtask 2.3 | Existing Right-of-Way (ROW)

The project base mapping will be used for designs by various disciplines including:

- Investigation and documentation of geological conditions
- Environmental and permitting tasks
- Utility services and relocations
- Drainage structures and water treatment
- Right-of-Way plans

Subtask 2.3.1 | Right-of-Way Research and Property Acquisition Preparation

Jacobs and GTS have recent experience with acquiring Right-of-Way through the NJDOT process, which is based on the NJDOT Right-of-Way Engineering Manual. This manual will be the standard used for drafting and presentation of all Right-of-Way documents unless otherwise directed by NJ TRANSIT.

The survey components regarding Right-of-Way can be expressed in three major functions: A. definition of existing Right-of-Way; B. identification of property needs; and C. development of acquisition documents. There are many subtasks or sub components within each of the three major functions

A. Existing Right-of-Way: This task consists of research, recovery, and location of existing Right-of-Way/property boundary lines. The project areas and potential project needs are identified. Record documents are researched including deeds, tax maps, filed maps, railroad valuation maps, etc. The property lines are plotted and brought together to form a deed or property mosaic. Record document citations of physical evidence are identified for field investigation, recovery, and location. Once the physical boundary evidence is located, it is incorporated into the topographic survey base map. Then the deed mosaic is superimposed on the physical evidence to relate boundary lines to the topography.

B. Proposed Right-of-Way: During this phase, the designer identifies limits of the proposed improvements considering several project elements: proposed construction, access, utilities, environmental impacts, etc. As the various project elements are established, they in turn are superimposed on the project base mapping developed earlier. Real estate needs are identified and developed into Right-of-Way Impact plans. Once the project needs have been identified and assessed for alternatives, the proposed Right-of-Way is developed.

C. Acquisition Documents: At this point, proposed Right-of-Way acquisition documents are developed consisting of various components. These include Entire Tract Maps (ETM's), General Property Parcel Maps (GPPM's), Individual Parcel Maps (IPM's), and parcel descriptions. Acquisitions may occur in various forms including fee acquisitions, permanent easements, and temporary easements. At some point during the Right-of-Way phase of the project, a title search firm is consulted to obtain historical records for each affected property. Title searches will identify recorded title transfers, encumbrances, and public records that may impact or influence the ability to use. For critical properties, this will be initiated early to identify constraints or other issues that may require long or protracted resolutions. Peripheral properties may be searched later or at the time when they are identified as necessary. Supporting documents will be prepared as necessary per NJ TRANSIT Real Estate Procurement Procedures.

Deliverables are anticipated to include General Property Parcel Maps, Individual Property Parcel Maps, Temporary and Permanent Easements, Right-of-Way survey support, site inspection reports, and copies of all materials developed. Data input and maintenance of the PAECETRAK real estate record management system will be done.

DELIVERABLES

- General Property Parcel Maps (GPPMs), Individual Property Parcel Maps (IPPMs), Temporary and Permanent Easements, Right-Of-Way Survey/Support as detailed above and Site Inspection/Inventory Reports and Surveys (10 copies)
- Data input and maintenance of Project PAECETRAK System as noted above
- GPPMs 50% and final Preliminary Assessment Report

Subtask 2.3.2 | Screening of Parcels and PAECE Process

Jacobs and GTS will support NJ TRANSIT with property screening and clearances as part of the Right-of-Way acquisition process. We will provide property data and files in support of the PAECE process, and review current laws and regulations to verify compliance.

DELIVERABLES

- Property Files and Data containing all required information in support of NJ TRANSIT PAECE process defined above.
- Consultant to review current Federal and New Jersey laws, and local regulations as they pertain to the property acquisition process documentation prior to initiating work, to verify compliance.

Task 3 | Cost Estimating

Under this task, the Jacobs Team will provide Cost Estimating Services. We understand the major deliverables will be three Cost Estimates during the Preliminary Engineering phase:

- The first Cost Estimates will be developed during Program validation. We envision these cost estimates as iterative estimates that work to refine the right sized capital project with the best life cycle cost performance and that which provides the optimally resilient solution for the NJ TRANSITGrid. Multiple conceptual estimates will be developed during this phase, and submitted as part of the right sizing determination.
- The second Cost Estimate will be based on the completed 10% submittal and will be in more detail to reflect the option to be installed with the details available, including firms costs resulting from early procurement of certain equipment.
- Final Cost Estimates will be based on the preliminary design 20% Final submittal, and will be utilized to establish target budgets for the various issues for bid packages.

During Phase II, we will serve as adjunct to NJ TRANSIT forces providing cost estimating support deemed as appropriate by NJ TRANSIT.

The individual that will lead cost estimating is Steve Jones, who has vast experience in capital cost estimating for Jacobs. Key Staff assigned working on this task include Bill Williams and Venket Tiruchirappalli from SJH.

It is noted that estimates will be prepared as per FTA's Standard Cost Category (SCC) methodology. As per the FTA SCC this project will be covered under various Cost Categories including, 30, 40, 50, 60, and 80. However, the estimate will also be coordinated with the current estimate being prepared under the NJ TRANSIT's

Superstorm Sandy Recovery and Resiliency Program design. Under that program the estimate is being prepared as per the CSI format. Therefore, we will prepare the NJ TRANSITGrid estimates in the CSI format with cross reference to the FTA Cost Categories.

Several of the projects are currently being designed under the Superstorm Sandy program. Coordination is necessary between the Jacobs Team and the other design teams, so that the scope and capital costs are neither duplicated or missed. Our subconsultant, SJH, is part of that Superstorm Sandy Resiliency team, and we are aware of the portions of the designs and estimates being performed under that project.

Previous estimates have included a 20% Contingency. Although it is usual practice to include a contingency at Concept Level estimates, we will review and provide input on whether the 20% is reasonable or if that percentage should be adjusted. Reduction of this contingency is most effectively accomplished through experience with similar applications and can be immediately reduced drastically with the early procurement of large capital equipment lines items once it is determined that right project to pursue.

Design, Construction Management, and other costs are included as percentages of capital costs, which is normal for this application; we will review these percentages and confirm their validity for use going forward. Having performed numerous designs and have provided construction support services on several projects, our Team is very comfortable in developing reasonable design and construction support services cost estimates, recognizing the potential benefits of allocating these costs to smaller discrete components for greater resolution.

PLANT OPERATIONS AND MAINTENANCE

Operations and maintenance costs vary widely between different forms of power generation but form an important part of any power plant's business case. Estimated operation and maintenance expenses to operate the proposed facility will be based on plants of similar size, location, and chosen technology and dependent on the performance of the facility, particularly the capacity factor (or operational hours per year). Typically O&M can be broken down into three general categories: short-term maintenance, general operational, and the labor expenses as follows:

Short-Term Maintenance Expenses:

- Consumables
- Phone/Utilities
- Vehicles and grounds maintenance
- Annual preventative maintenance and spare parts
- Outside services

Operational Costs:

- Water and chemicals
- Air permit fees, including fees for criteria pollutant emissions
- Leased equipment
- Land lease
- Project support, e.g. environmental & safety training
- Plant insurance, and Property taxes

We will advise NJ TRANSIT on O&M options that will make certain the long-term performance and reliability of the power plant. For example, NJ TRANSIT could bolster its existing plant staff with trained plant operators and arrange a long-term service agreement for planned (periodic) and unplanned maintenance of the major pieces of equipment.

More likely, NJ TRANSIT could contract out the O&M responsibilities to a third party, of which there are many that would welcome this opportunity. This option is quite common for plant owners who do not want to take on unfamiliar operating risks. We are familiar with third party O&M contracts that have performance requirements, periodic tests, and a system of bonuses and penalties to enable high long-term reliability.

DESIGN DEVELOPMENT COST ESTIMATE AT 10% AND 20% LEVELS OF DESIGN COMPLETION

The development of cost estimates during this phase will rely on the various design components of the NJ TRANSITGrid Project, including the equipment being selected, the transmission and substation features, and other site features. Per our work plan, the early procurement of the power island equipment is vital to have a concept basis for design, and subsequent cost estimating purposes.

Assuming this early equipment procurement phases is acceptable, most of the equipment, site layout, and the main building features are identified at 10% design stage. The cost estimate at this stage will be broken down into, material, equipment, and labor. We will include contingency line items of reasonable percentage to allow for possible missing items in the package. The percentage contingencies for equipment will be much smaller than that for general construction or labor, reducing the overall cost uncertainty.

In this stage our cost estimating process typically begins with the review of drawings, and specifications and utilizing industry standards and knowns for our previous projects to provide cost line item values that reflect the costs of this application.

Quantity take-offs can be performed for scopes that are sufficiently developed utilizing digitizers (electronic measuring boards that calculate the areas and lengths automatically), scales (estimators must calculate the areas themselves), and in some cases field measurements. For the estimated line item quantities, cost estimates typically are based on:

- **Material Costs –** These costs are estimated based on current industry costs, taking into consideration short and long-term industry trends. Adjustments are made for current conditions such as availability of materials, transportation, geographical conditions, and other factors. For example, if ready mixed concrete needs to be supplied to a remote location where there are no nearby concrete plants suitable, an adjustment in price will be made to allow for the scarcity of local material.

  Similarly, if special items are identified in the design drawings, we will contact the specialty item supplier to obtain reasonable costs. For example, for the Long Island City Yard Project for the MTA – Long Island Rail Road, we needed to contact special Flood Gate Suppliers to obtain the costs for the specially designed Flood Gates to prevent flood waters entering the Yard. The material costs will need to be very carefully identified, and specificities such as the cost of delivery must be confirmed.

- **Equipment Costs –** It is beneficial to identify the appropriate equipment that is necessary for the production of the job, so that accurate costs can be estimated as early as possible. For instance, if erection of precast elements is involved, an appropriate crane will be identified for costing. With experience on over 50 construction inspection projects, we have the experienced staff to identify necessary equipment for specific construction activities. We are also able to estimate production rates for the equipment with reasonable accuracy.

  The largest components in the equipment category are recommended to be procured at an early date, to free up contingency for other project applications early.

- **Labor Costs –** In order to estimate labor costs accurately, we need to be able to develop production rates, and the number of workers needed for each trade. From our past experience on various projects, we are able to develop this information rather accurately. Remuneration for the various labor categories will be adjusted for geographical location, time differential, and other factors. We note that in certain instances, it is more expedient for the construction to be performed at night or during weekends to minimize interruptions to transit operations. Under warranted conditions, appropriate factors will need to be included to account for escalations and time differentials.

  Having worked on several railroad and transit projects, we understand working around railroad properties will have time restrictions and full production for a day cannot be achieved. These restrictions will be considered in our estimates and the production rates adjusted.

We are aware that labor costs vary with trades, and we will use the appropriate labor rates for various trades in the estimate of labor costs. The sources of information we use are described in further detail in the Incorporating Marketplace Fluctuations, Current Economic Factors, and Trends section below.

- Force Account Costs – We will coordinate with NJ TRANSIT to obtain their internal rates for Flagging, setting up track outages, etc. These will be used in the estimation of Force Account costs for the project.

- Specific Site Constraints – We take into account all factors that would affect the unit costs such as site accessibility, weekend/evening/ premium hours, and smaller quantities. On our Portal Bridge Project, we considered the access constraints in our pricing. Due to most of the site being soft marshy lands, similar to that of Amtrak Substation 41, we considered some equipment and pile driving operations to be performed from rail mounted rigs. All of these issues will be documented within the estimate and noted on the “Notes & Clarifications” pages.

- Hazardous Material Abatement – Estimation of hazardous material abatement can result in large impacts to costs if not estimated properly at the beginning. During the design phase hazardous materials will need to be accurately identified and the extent of their impact evaluated so that the estimate for the abatement can be accurately quantified. We have the experience in estimating such materials, on several of our projects, including the Long Island City Yard project on which we estimated the removal of Contaminated Soil. On several of our transportation projects, we have estimated the removal of asbestos containing materials, and the removal of lead paint. On the United States Merchant Marine Academy (USMMA) project, SJH developed budgetary estimates for the abatement of asbestos and lead on 48 assets throughout the campus.

- General Conditions – Upon the compilation of the various costs, we add factors for General Conditions and Fixed Fees for profit. General Conditions include cost of insurance, bonding, and other indirect costs. The profit will be adjusted based on the overall estimate of the project. Profit typically falls within a range of 8 to 10%.

  The estimates will be updated as the design progresses to 20% level of completion to serve as the basis for preliminary budgets for the various procurement packages.

- Value Engineering/ Cost Saving Strategies – Utilizing our multi-disciplinary experience, we can comment on specific design/construction items, recommend value engineering cost reductions, and participate in discussions with the design staff to make sure cost saving strategies are implemented and the project is within allocated parameters.

  If any cost items are identified as exceeding the available budget allocated by NJ TRANSIT, we will participate with the design team to:

- Review and develop alternatives to reduce the estimates of the identified items, and
- Develop other methods to mitigate the cost increases without minimizing safety and performance.

Our Team has several members who have been certified as Value Engineering Specialists, and they can provide input into mitigating cost increases. The identified items will be Value Engineered to develop cost savings. We will attend reconciliation meetings with the designers to resolve the Value Engineering proposals. Upon reaching an agreement, we will develop a revised cost estimate if necessary with the cost savings. On the currently ongoing Superstorm Sandy Resiliency Project for NJ TRANSIT, members of our Team introduced innovative means to maintain the dead load of an existing building, which was to receive additional heavy electrical equipment to eliminate the need to add more piles to support the additional load. This resulted in cost savings, from driving low headroom piles within an existing building in the water. Also, by eliminating the need for more piles, we avoided extensive DEP permitting requirements.

DELIVERABLES

- Independent Initial Cost Estimate
- 10% and 20% Cost Estimates

Task 4 | Federal Environmental Impact Statement (EIS)

Jacobs will support NJ TRANSIT and BEM in the development of an Environmental Impact Statement (EIS) in conformance with the National Environmental Policy Act (NEPA) of 1969 as amended. On an “as directed” basis, we will support the EIS effort through the generation of engineering data and plans as well as any necessary specialized studies requested during the conduct of the Draft EIS and a Final EIS. Deliverable under this task will vary depending on the specific needs and direction of NJ TRANSIT.

Jacobs is completely familiar with the requirements and methodologies related to undertaking NEPA environmental review documents having led numerous successful NEPA EIS’s, EA’s, and Categorical Exclusions. Many of these successful efforts have in fact, been undertaken for NJ TRANSIT including: the Northern Branch Light Rail Extension, the Lackawanna Cut-Off Rail Extension, and the Secaucus Transfer Station. This experience will allow us to support the overall effort over the full range of impact categories. We will do this at the highest level of technical competency and in a rapid time-saving manner.

From our perspective, a significant risk related to this project would be to advance a design that resulted in significant impacts and that did not have a high percentage chance of advancing through NEPA without schedule and mitigation complexities. This could result in significantly higher costs and possibly reduce interest by potential installation contractors/bidders.

The execution of this task will be driven by our intention to eliminate any schedule disruptions and to decrease project costs and complications by verifying that the delivered 20 percent design and specifications package results in the least impacting project with the greatest possibility of navigating the NEPA process quickly and with a minimum of complications. We will also add significant value to the project by making sure our in-house environmental team are “at the table” as we develop plans and specifications, screening our designs to make certain that no environmental thresholds are surpassed and that impacts are minimized to the greatest extent practical.

This task will be led by Jim Dowling AICP, PP, AVS of Jacobs. Jim is an environmental planner with 30 years experience related to NEPA, permitting, and design of transportation projects. He has worked on numerous NJ TRANSIT projects and is completely familiar with the physical environs and potential issues in the proposed project area. Key Staff supporting Jim include: Thomas Decker, PE; Jeepsi Patel, PE, CFPM; Steven Ricucci, Jayne Yost AICP, Kim Glinkin, AICP, PP, LEED(R) AP, and Valerie Discafani, AICP, PP.

At the outset of the project, Jacobs will coordinate closely with NJ TRANSIT and their third party consultants to better understand the level and type of support desired throughout the project. We will identify the areas of support that are initially desired.

These efforts will be programmed into our overall schedule to make sure the EIS schedule being advanced by the third party consultants will be met. We will develop outlines of methodologies and standards for review by the third party consultants to verify they are receiving materials that are consistent with accepted practice and standards for environmental review.

We will supply supporting engineering documentation as directed by NJ TRANSIT related to air emissions, hydrologic and hydraulic impacts, information necessary to support NJDEP Flood Hazard Area permitting activities, delineation of wetlands in conformance with procedures established by the USACE, tabulation of wetland impacts, and identification of wetland value, site testing, soils, etc. Depending on direction of NJ TRANSIT, we have the full capabilities and expertise to support the FEIS effort in all impact categories required for a NEPA review as noted below:

- Aesthetics
- Air Quality
- Geology and Soils
- Water Resources

- Floodplains
- Wetlands
- Terrestrial and Aquatic Resources
- Threatened and Endangered Species
- Hazardous Materials
- Cultural Resources
- Land Use
- Socioeconomics
- Environmental Justice
- Community Facilities
- Utilities
- Traffic and Transportation
- Material and Waste Management
- Safety and Health
- Noise
- Cumulative and Induced Impacts
- Mitigation
- Irreversible and Irretrievable Commitment of Resources

Additionally, Jacobs is prepared to provide support to BEM regarding the procedural aspects of NEPA. We are experienced in and fully capable of supporting the following activities:

- Drafting of the NEPA Notice of Intent (NOI)
- Development of a Scoping Document
- Planning for and Holding a Scoping Meeting
- Response to Scoping Comments
- Planning for and Holding the Public Hearing
- Cataloging and Response to Public Hearing Comments

- Preparation of the Record of Decision (ROD)
- Planning for and Assembly of the Administrative Record.

Deliverables for this task will include engineering drawings and specifications as well as engineering and environmental studies on an as directed basis by NJ TRANSIT in support of the NEPA EIS.

DELIVERABLES

- Engineering and design details to verify impacts associated with selected build alternatives as discussed above.
- Technical justification for the extent, configuration and basis of the proposed project as discussed above.

Task 5 | State and Federal Permits

As directed, the Jacobs Team will support NJ TRANSIT and the Third Party Consultant's efforts in the development of applications for all permits and approvals that may be required for the project construction and operation. Deliverables related to this effort could include engineering design details, technical studies related to hydrology and or wetlands, wetland delineations and characterizations, and support in the drafting of actual permit applications.

Given the proposed site location within the floodplain of the Hackensack River as well as the Meadowlands, it is expected that significant Federal and State environmental permitting will be required. It is likely that both the USACE and the NJDEP will have jurisdiction for permitting depending on the specific permits.

Jacobs' execution of this task will be driven by our intention to minimize schedule and budget impacts related to a potentially complex permitting situation. Environmental permits are key items on the critical path for the implementation of this project. These permits often require intensive negotiation with regulating agencies that operate on schedules inconsistent with the project schedule. Jacobs will engage in the process of permit identification and assessment from the initiation of the project and make sure that project designers are developing plans that are both permitable with a minimum of risk as well as verifying the necessary supporting design details, specifications, and studies are available to support the NJ TRANSIT effort in conformance with an expedited schedule. Our relationships with Federal and NJ Regulatory agencies have been successful and ongoing for many years. We have successfully delivered many complex permits for NJ TRANSIT including projects such as the Secaucus Transfer Station, The Lackawanna Cut-off Rail Extension, and the Meadowlands Rail and Roadway Project. In all instances, we advocate on behalf of our clients to make sure that the project can meet all permit requirements and that the permits are delivered on schedule and within budget.

This task will be led by Thomas Decker, PE, who has significant experience in advancing Flood Hazard, Wetland and other permit applications. Working closely with Tom will be Jeepsi Patel, PE, Steven Ricucci, and Kim Glinkin, AICP, PP, LEED(R) AP.

At NJ TRANSIT's direction, we will support the Third Party Consultant Team in securing permits related to the project. It is our expectation that the most significant permitting effort will be related to the NJ Flood Hazard Area Act. The proposed Power Plant, Substation, and supporting infrastructure will have an impact on existing environmental resources and regulated areas. The proposed grades, elevated structures, and access will be based on the resiliency design criteria while minimizing environmental impacts. Emergency access to the facilities will also need to be assessed.

The design effort will be at a level to support preparation of the permit applications by NJ TRANSIT and a Third Party Consultant under a separate Contract. In consultation with NJ TRANSIT, key design elements will be advanced to a level to allow for Regulatory review. The goal would be to develop a maximum project footprint or limit of disturbance for the permit applications.

It should be recognized that in order to take full advantage of the Design-Build delivery system, the design should provide the contractor with some flexibility for the final design while meeting all the design criteria and permit constraints. Therefore, permit modifications may be required to obtain full NJDEP approval of the final design and impacts.

NJDEP FLOOD HAZARD AREA

The criteria and key design issues required for compliance with the FHACAR are:

- Zero Net Fill (not applicable)
- Riparian Zone
- Regulatory Water Surface Impacts

The FHACAR provides for an exemption for the Flood Storage Displacement (A.K.A. zero-net fill rule) for projects located in Tidal Floodplains. This applies to the NJ TRANSITGrid project. Therefore, placement of fill or walls to eliminate flood storage will not be a Regulated activity as long as justification is provided.

The Riparian Zone size is 50, 150, or 300 feet based on the environmental resource of the waterway or if acid soils exist (requires a 150-foot buffer). Disturbance within the Riparian Zone must be minimized, justified, and mitigated for excess disturbance exceeding the allowable limits. The mitigated area must be protected with a deed restriction per the current rules. There is no Riparian Zone along the Atlantic Ocean, manmade lagoons, SWM Basins, or any oceanfront barrier island, spit, or peninsula. A manmade ditch less than 50 acres with no discernible has no Riparian Zone.

The extent of permit impacts and any mitigation will also be highly dependent on the amount of disturbance within the waterways associated with temporary and permanent impacts. Hydrologic/Hydraulic Modeling of any waterways is not anticipated since flood elevations have been set by the current FEMA Study. It is noted that there are new FHA Rules proposed and will be adopted during the design phase of this project. The SWM design will be reviewed as part of the FHA Permit Application.

SOIL EROSION

A Soil Erosion Certification is required if the project will disturb more than 5,000 square feet. Therefore, it is anticipated that an application for soil erosion certification will be submitted to Hudson-Essex Soil Conservation District. NJPDES Request for Authorization (RFA) for Stormwater Discharges Associated with Construction Activity (5G3-NJ0088323) is also required. This process can be performed on-line in accordance with the new procedures utilizing the NJDEP's Stormwater Construction Activity E-Permitting System.

STORMWATER MANAGEMENT

It is anticipated that the proposed project improvements will result in a disturbance area greater than one acre so the project will be considered a "major development" under NJ's Stormwater Management (SWM) Rule (N.J.A.C. 7:8). The project will thus be required to comply with the water quantity and groundwater recharge requirements in the Rule which are:

- Total Suspended Solids (TSS) removal (water quality) if proposed greater than 1/4 acre of new pavement
- Quantity Control: post-construction peak runoff rates for the 2, 10, and 100-year storms must be no more than 50%, 75%, and 80%, respectively, of the pre-construction peak runoff rates.
- Groundwater Recharge: the average annual groundwater recharge must be maintained.

Waivers are available for recharge and should be pursued. Peak flow reduction is exempt in tidally flood controlled areas but detention will be required to control volume, maintain existing conditions, and to avoid adverse impacts to any offsite local existing drainage facilities.

Any proposed SWM basin will require geotechnical information for design, such as the location of the seasonal high groundwater level.

The scope of work is based on a design level effort for one extended detention facility and one Manufactured Treatment Device (MTD).

ADDITIONAL PERMITS

Additional permits that could be applicable depending on the design include:

- NJDEP Letter of Interpretation
- NJDEP Wetlands General Permits
- NJDEP Individual Wetlands Permits and Mitigation Plan
- NJDEP Tidelands
- DSHW & Site Remediation
- NJDEP BAQM Air Quality Permit
- NJDEP No Net Loss Reforestation Assessment
- Memorandum of Agreement between the USEPA and NJDEP
- USACE Jurisdictional Determination
- USACE Section 404 Permit Individual or Nationwide
- USCG Section 10 Rivers and Harbors Act Permits

As mentioned above, the design effort will be at a level to support preparation of the permit applications by NJ TRANSIT and a Third Party Consultant under a separate Contract. In consultation with NJ TRANSIT, key design elements will be advanced to level to allow for Regulatory review. The goal would be to develop a maximum project footprint or limit of disturbance for the permit applications. The following design aspects of the project are assumed to be advanced to approximately a 75 % design level to identify the proposed footprint and in support of the permits.

- Power Point Site Layout and access
- SWM Design and Report
- Substation Site Layout and access
- Typical Sections for any Infrastructure Facilities
- Riparian and Wetland Impact Areas

Section 5

Task 6 | NJDEP Site Remediation Compliance– Jacobs

To support NJDEP Site Remediation Compliance, we have included the talent of Matrix. We understand that this scope is to support NJ TRANSIT and its Third Party Consultant's efforts in verifying compliance with the NJDEP's Technical Requirements for Site Remediation (NJAC 7:26E).

Matrix is intimately familiar with all of the NJDEP guidance documents and has decades of experience on linear construction and similar projects. Our Team of professionals, which includes six Licensed Site Remediation Professionals (LSRPs) has prepared and submitted numerous SRRA compliant workplans and reports. Through this experience, we have garnered an understanding of the requirement and value of proper data collection, assemblage and presentation to assist in workplan and report preparation. Matrix's QAPPs and Work Plans identify the data quality objectives and data format deliverables to make sure our project team is collecting data in the most efficient and compliant manner possible to support Remediation Reporting requirements. We will review the draft QAPPs and Work Plans prepared by NJ TRANSIT's Third-Party Consultant to verify the project goals and project deliverable requirements are adequately defined. This approach is consistent with our Standard Operating Practice (SOP) where our LSRPs provide comment prior to implementation of any project work. By involving our LSRPs throughout the process, not only does the project realize the benefit of our decades of experience, but we make sure there are no unexpected issues when it comes to project closure. Our multi-disciplined team of professionals work collaboratively throughout the process and have established protocols where we work with professionals outside of the SRRA regulatory environment (land-use professionals, remediation engineers, design professionals) to verify all project regulatory requirements (i.e. not just SRRA requirements) are identified and proactively addressed throughout the program.

TASKS A – REVIEW AVAILABLE DOCUMENTS/IDENTIFICATION OF STRATEGY

Prior to conducting field investigation activities associated with the potential development of a particular site, we will review available information provided by NJ TRANSIT, Third Party Consultants, and/or other readily available documents from state, federal, or local agencies related to soils and groundwater within the footprint of the project. This information, in addition to details related to the proposed design in consultation with the design team, will be used to develop an investigation strategy and a Work Plan as well as the necessary investigation to identify potential "fatal flaws" with a specific site or area based on environmental conditions. These "fatal flaws" could be related to excessive costs for remediation or potential liabilities associated with the acquisition of contaminated properties.

TASK B – FIELD INVESTIGATION AND REPORTING

We assume that the field investigations associated with the evaluation of the different sites will be conducted by the Third Party Consultant on behalf of NJ TRANSIT. As part of this task, our LSRP will be available to consult on and review, as needed, field investigation procedures and results with the Third Party Consultant and NJ TRANSIT on an as-needed basis.

Upon the completion of this task, our LSRP will review the report that is prepared by others to verify the work is compliant with all NJDEP requirements.

TASK C – DESIGN DEVELOPMENT

Based on the findings of subsurface investigation activities, we will consult with the Third Party Consultant and NJ TRANSIT as well as the project team with regard to the development of drawings and specifications in accordance with the contract requirements. These specifications will provide for implementation of appropriate remedial measures that will reduce or eliminate exposure to construction workers and the public, and will be consistent with project objectives, regulatory requirements, and special requirements of the NJ TRANSIT.

TASK D – AS NEEDED DRAWINGS

We will provide the required engineering drawings for preparation of preliminary engineering remediation plans and related information. Such information will also be utilized in the production submission and completion of LSRP approved project Soils & Ground Water Management Reports also prepared by Third Party Consultants. Said plans and related documents produced by the Jacobs Team will be included in the construction bid package.

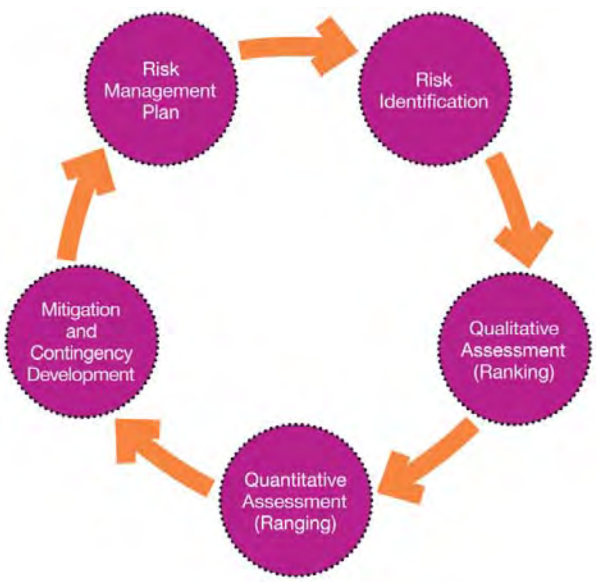
DELIVERABLES

- Engineering and design details in support of all NJ TRANSIT Regulatory Compliance
- Documentation as detailed above

Task 7 | Risk Management

Under this task, the Jacobs Team will provide risk management services. These will include the identification, evaluation, and ranking of risks through a workshop process; the prioritization, mitigation, and tracking of risks in a risk register; and ongoing risk management. Major deliverables under this task will include workshops, workshop findings reports, a regularly updated risk register, and a comprehensive risk management plan. Our risk management process will be driven by circumspect risk identification; evaluation of risks based on the knowledge of subject matter experts and the input of all impacted stakeholders; the development of clear, actionable mitigation plans; and a cyclic approach that stays ahead of risk events. The key individuals leading this task will be Michael Albergo, PE, PMP (Design & Construction Risk Manager), Dr. Richard Carlson (Commercial & Regulatory Risk Manager), and H. Charles Wedel, CPA (Financial Risk Manager). Long equipment lead time, inadequate/inaccurate load data, and discord regarding the basis of design are among the top risks for this project.

For many projects, risk management is a linear process that begins with risk identification and ends with the development of a risk register and a list of mitigations. For NJ TRANSIT's Microgrid, it is critical that risk management be approached as a cyclic process: each step must make optimal use of the preceding step and lead to a more accurate and tangible result in the following step. The first cycle, while more arduous, leads to later cycles, which address new or evolving risks and are completed more efficiently. The development of the Microgrid, a highly complex and iterative process that will take place over years, needs a cyclic process that adjusts to known risks and identifies/responds to new risks as the project unfolds. NJ TRANSIT addresses this need by requiring monthly updates to the risk register and quarterly risk review meetings.



Risk management for the Microgrid must be a cyclic process.

RISK IDENTIFICATION, WORKSHOP, AND RISK REGISTER DEVELOPMENT

Risk identification is the first step in the development of a risk register. Risks are often rooted in the assumptions and constraints of the project's scope and the requirements of stakeholders. Jacobs uses workshops and a brainstorming approach to identify risks. The workshops are led by an experienced facilitator who can elicit circumspect thinking from the participants while minimizing bias toward particular risks or mitigation solutions. The facilitator provides tools (e.g. existing risk registers and risk breakdown structures) and techniques (e.g. such as brainstorming, interviews, and questionnaires) to promote thinking and minimize bias. Our Lead Risk Manager and Facilitator, Michael Albergo, brings experience identifying and evaluating risks and mitigations on major programs such as the redevelopment of the World Trade Center and the reconstruction of NYC Transit's Canarsie Tube. Dr. Richard Carlson of Levitan has extensive risk management experience and will be assigned to track and work with others to address and mitigate all commercial and regulatory risks to enable project success. H. Charles Wedel, CPA, a former CFO of NJ TRANSIT, will lead the evaluation and mitigation of financial risks.

NJ TRANSIT's RFP calls for the consultant to develop a preliminary risk register, to be refined at a preliminary workshop with NJ TRANSIT (risks added or removed; potential risk owners and mitigations identified.) The refined draft risk register becomes the input for a full, facilitated risk workshop. This workshop is comprised of smaller working groups that are assigned specific risks to review, evaluate, assign ownership, perform qualitative analysis, and develop mitigation strategies. Following this workshop, the consultant develops a composite risk register and a risk management plan, including the schedule and cost implications of each risk.

The risk management process as outlined in the RFP offers the advantage of being highly focused, controlled, and efficient in that it limits the scope and participants at each step and directs them to work on specific, assigned risks.

This approach may limit the discovery and review of key risks if stakeholders are not engaged early on, and it limits the number of minds weighing each risk for its probability, impact, and potential mitigation.

The effect may be key risks left unidentified; inaccuracy or inconsistency in evaluating risks; and limited options for mitigation. Jacobs will guard against these effects by engaging NJ TRANSIT, workshop participants, and stakeholders to collect their concerns and harness their insights and passion as we work toward a coherent, actionable risk management plan.

Section 5

RBS Level 0	RBS Level 1	RBS Level 2
0. Project Risk	1. Technical Risk	1.1 Scope definition
		1.2 Requirements definition
		1.3 Estimates, assumptions and constraints
		1.4 Site/subsurface conditions
		1.5 Technical processes
		1.6 Technology
		1.7 Technical interface
		1.8 Design
		1.9 Construction
		1.10 Reliability and maintainability
		1.11 Safety
		1.12 Security
		1.13 Testing and acceptance
	2. Management Risk	2.1 Project management
		2.2 Program/portfolio management
		2.3 Operations management
		2.4 Organization
		2.5 Resourcing
		2.6 Communication
		2.7 Information
		2.8 Quality
		2.9 Reputation
	3. Commercial Risk	3.1 Contractual terms and conditions
		3.2 Internal procurement
		3.3 Suppliers and vendors
		3.4 Subcontracts
		3.5 Client/customer stability
		3.6 Partners and joint ventures
	4. External Risk	4.1 Legislation
		4.2 Environmental/weather
		4.3 Regulatory
		4.4 Political
		4.5 Social/democratic
		4.6 Pressure groups/special interests
		4.7 Force majeure

Jacobs used this risk breakdown structure to begin identifying and categorizing risk for the Microrgrid project

The Jacobs Team has already begun identifying potential risks and developing a preliminary risk register. Using the accompanying risk breakdown structure (RBS), we asked our Team of 24 experts to begin identifying all categories of risk relevant to the project, including:

- Risks to the project's design and construction
- Commercial and regulatory risk issues associated with the power plant, e.g. fuel costs, plant performance, air emission and water use limits, the timely receipt of regulatory approvals and permits from local, state, and federal bodies
- Overall plant economics

The team identified over 60 risks to the project. Our Draft Initial Risk Register is included with this proposal and will be refined prior to distribution to workshop participants.

QUALITATIVE ANALYSIS

Qualitative analysis is performed using a five-point scale (very low, low, moderate, high, very high) to rate probability and impact of significant risks. Jacobs discusses risk tolerances with our clients to understand their attitude toward risk and what levels of probability and impact underpin this five-point scale. We use the accompanying table, adjusted for your risk tolerances.

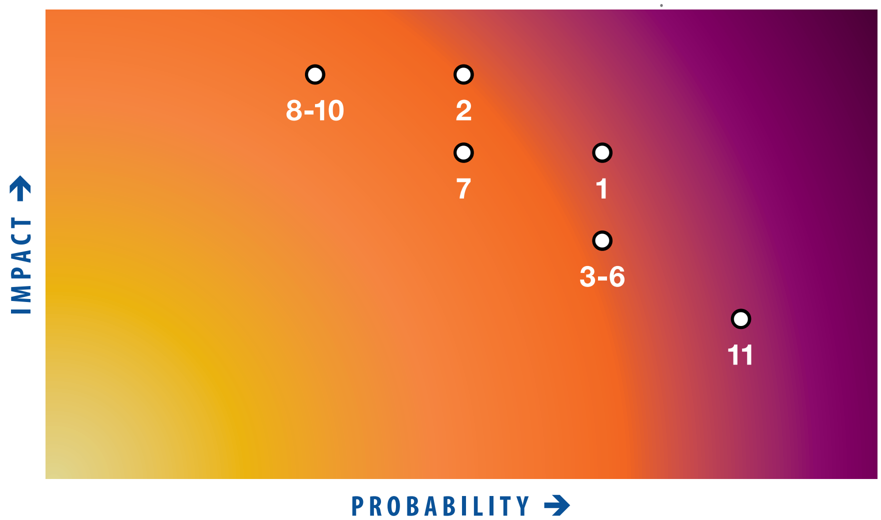
Scale	Probability	+/- Impact on Project Objectives		
		Time	Cost	Quality
Very high	71-99%	>120 days	>$1M	Very significant impact on overall functionality
High	51-70%	61-119 days	$501K-$1M	Significant impact on overall functionality
Medium	31-50%	31-60 days	$151K-$500K	Some impact in key functional areas
Low	11-30%	15-30 days	$50K-$150K	Minor impact on overall functionality
Very low	1-10%	<15 days	<$50K	Minor impact on secondary
Nil	<1%	No change	No change	No change in functionality

Multiplying the rating for probability (1 – 5) times impact (1 – 5) yields a total impact rating for each risk. The risk register is then sorted by total impact to yield the top risks. This enables us to focus our efforts on quantifying and developing contingencies for the most significant risks.

Using this method, our Team developed an initial qualitative ranking of risks for the Microgrid. The top risks are charted below.

TOP RISKS

1. Long equipment lead times
2. Inadequate load data
3. Discord on basis of design
4. Distribution along Right-of-Way
5. Funding
6. BPU regulations for Amtrak
7. Inadequate construction QA
8. Stakeholders withdraw support
9. Environmental permitting
10. BPU prohibits T&D along NJ TRANSIT ROW
11. Inadequate basis for O&M future



Top risks for the Microgrid project are plotted on a "heat" diagram, indicating the relative probability and impact of each.

RISK MITIGATION

The development of mitigations requires a separate, focused workshop with smaller working groups, as NJ TRANSIT has noted in its RFP. After an initial joint session, these workshops are held separately to focus on specific sets of risks. They are also guided by a facilitator.

Potential mitigations noted during the risk identification process serve as the starting point for mitigation development. The qualitative ranking of impacts is matched against the table of risk tolerances to serve as a starting point for schedule and cost contingency evaluation. Quantitative (Monte Carlo simulation) risk analysis of the project's budget and schedule is not identified in the scope of work, but we have the capability to provide this additional service if desired by NJ TRANSIT.

In considering the top eight risks to the Microgrid, our Team noted the following potential mitigations.

Risk	Mitigation
1. Highly specialized generator and SFC technology, limited vendor selection, and procurement requirements (e.g. Buy America) may combine to create extremely long lead times and long delays in construction.	Generator and SFC technology must be established as early as possible, and must occur in tandem with vendor outreach and procurement requirements.
2. Inadequate load data results in undersizing or oversizing of the Microgrid.	Utilize aggregated sub-hourly load data for NJ TRANSIT and for Amtrak; need to incorporate any LT expansion plans and expandability
3. Failure to reach agreement on the basis of design in a timely manner leads to extensive delays.	Engage NJ TRANSIT departments and all impacted stakeholders
4. HBLR Distribution routing: It becomes too costly to get distribution along the ROW limiting the substations that can be connected.	We have identified critical areas of concern: lift bridge, tunnels, and shared ROW with public streets. Our Team will focus on these areas early to determine options to address each.
5. Funding availability: the project may not be fully funded. Design and construction delays could occur pending funding, resulting in escalation of costs.	Identify the right project size and life cycle project; then examine funding options, including bonding.
6. Energy sales to Amtrak are in variance with existing BPU regulations; additional time to develop supporting rules will be required.	Explore this issue early in the project so that sufficient time can be allotted to work with the BPU to get the rules corrected or a waiver granted.
7. Inadequate construction quality assurance program allows poor quality construction, causes rework, and decreases service life of the project.	Establish a strong quality assurance program with defined requirements and reviews for all stages of the project.
8. Major stakeholders withdraw from project: Amtrak is a major stakeholder, but NJ TRANSIT is the funding agency and running the project. Amtrak may not be comfortable with NJ TRANSIT's DBOM approach or the final PPA contract that Amtrak has to enter into with NJ TRANSIT. Amtrak's participation is critical for the success of the project.	The Jacobs Team is experienced with Amtrak design standards and with Amtrak personnel in the engineering and utility departments; this will help make sure that we are properly coordinated. The Burns office located in Philadelphia is just down the street from Amtrak's 30th Street Station and will help facilitate communication and coordination.

We also note that NJ TRANSIT has employed the following measures to mitigate, allocate, or share risks. Each could play an important role in reducing risk for the Microgrid project.

- The purchase of appropriate insurance. From an operating perspective, NJ TRANSIT's major purchases have been for both property and general liability coverages. NJ TRANSIT established its own captive insurance company to provide an alternative to the available commercial insurance, thereby reducing premiums, or limiting premium increases.

- Risk transfer through the structure of contracts. As an example, triple net real estate contracts have been employed to transfer all risk to the lessee while providing NJ TRANSIT with a steady revenue source.

- Risk sharing through contract negotiations. As an example, NJ TRANSIT entered into a risk sharing agreement with the operator of its Hudson Bergen Light Rail system.

- Use an owner-controlled insurance program (OCIP). With regard to construction activity, NJ TRANSIT implemented a wrap up OCIP, resulting in substantial savings. The OCIP provided coverage at a lower rate than each of the contractors and subcontractors could get on its own, and increased competition since it allowed smaller contractors to compete.

We note that NJ TRANSIT generally requires payment and performance bonds from prospective contractors. Our experience has been that it is difficult to collect on such bonds, and that a letter of credit from a reputable bank is preferable.

After agreeing on the best options for mitigating each risk, we reassess the risk probability and potential schedule and budget impacts with the mitigations in place. In doing so, we gauge the effectiveness of each mitigation in reducing project risk. The results are included in the risk register. As noted above, a more detailed quantitative risk analysis can be undertaken to quantify schedule and cost impacts (both mitigated and unmitigated). An action plan and budget should be developed for each potential mitigation response. The cost of each mitigation response can then be weighed against its value in reducing project impacts to determine its overall effectiveness.

	Project Sponsor	Project Manager	Risk Manager	Risk Owner	Action Owner	Project Team Members	Other Stakeholders
Produce and maintain Risk Management Plan	C	A	R	I	I	I	I
Facilitate risk process (Workshops, interviews, risk review meetings, etc.)		A	R				
Identify risks	R	R	A	I		R	R
Assess risks		R	A	I		R	R
Develop responses		A	C	R	C	C	I
Implement responses		I	I	A	R	C	
Report progress on actions (individual risks)		I	A	R	R		
Produce and maintain Risk Register	I	A	R	C	I	I	I
Produce and maintain risk reports	I	A	R	C	I	I	I

Key: R= Responsible A = Accountable/Approve C=Consult/Contribute I=Inform

RISK MANAGEMENT PLAN

Our formal risk management plan, developed in coordination with NJ TRANSIT, will provide the framework and process for managing risk. It outlines when and how risks are identified and re-evaluated, who is involved, and what roles each person plays in the process. It identifies the level of cost and schedule contingency required on an ongoing basis, and defines the rules for the release of that contingency. It also provides an ongoing summary snapshot of the current level of risk engendered by the project.

At the heart of the risk management plan are the risk register and the individual plans for mitigating each risk. At Jacobs, we use a template for managing individual risks and mitigations. Each risk is assigned an owner, and the following information is developed and tracked:

- Anticipated date for the risk to occur (the earliest possible date)
- Current status of the risk scenario
- Trigger events that indicate the risk is occurring or about to occur
- A specific action plan for mitigating the risk
- A timetable to implement the action plan
- A budget or contingency for implementing the action plan

The accompanying risk management template is linked to each of the active risks in the risk register. Residual and secondary risks created by implementing the mitigation are also included in the risk management plan. Mitigations involving early decision-making and the basis for design are reviewed and implemented first.

Regular monitoring and reporting on risks are a core responsibility for our Team. The risk management plan becomes a living document that we routinely use to manage and report on project risks.

<table>
<tr><td colspan="3">Project Number:</td><td colspan="2">Client:</td></tr>
<tr><td colspan="3">Project Title:</td><td colspan="2">Project Manager:</td></tr>
<tr><td>Risk Reference #:</td><td>RBS ref:</td><td>WBS ref:</td><td colspan="2">Risk Owner:</td></tr>
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cause: a definite fact</td><td colspan="2"><risk> may occur,
risk: an uncertain event or set of circumstances</td><td colspan="2">which would lead to <effect on objectives>.
effect: a direct impact on a project objective(s)</td></tr>
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Nil/VLO/LO/MED/HI/VHI</td><td colspan="2">Impact Description</td></tr>
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<tr><td>Probability Rating
Nil/VLO/LO/MED/HI/VHI</td><td>Other</td><td></td><td colspan="2"></td></tr>
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Task 8 | System Safety and Security Management

Subtask 8.1 | Safety and Security Management Plan

A fundamental goal of NJ TRANSIT is to provide passengers and employees with the highest level of safety and security that is practical and consistent with its mission. This is achieved through the adoption and implementation of a comprehensive system safety and security program for the identification and elimination or control of safety hazards, security vulnerabilities, and criminal opportunities to an acceptable level of risk in transit operations. Jacobs professional Safety and Security specialists are experts in this field and national authorities in safety, security, and the development and implementation of proven safety and security plans.

The NJ TRANSITGrid Project must be designed and constructed in full compliance with the safety and security requirements established by the Federal Transit Administration (FTA), and appropriate local, State, and Federal agencies. The safety and security of employees, general public, and emergency responders is of utmost importance during the design, construction, and operation of the NJ TRANSITGrid.

In order to provide a safe physical work environment, we establish work rules and enforce them. We receive commitment from the top levels of the organization and work with our client involving them in the process. The tool utilized to verify safety throughout the project will be the Safety and Security Management Plan (SSMP). This document will make sure all facility and systems design, construction, testing, training, certification, and documentation is completed. The SSMP will serve to verifysure all project facilities and systems planning, design, and construction meet safety and security standards and will be designed and built to the satisfaction of NJ TRANSIT and third party stakeholders.

The SSMP will have bearing on all phases of the Project, including the development of the design criteria, construction and installation, hazard identification/resolution/tracking, configuration management and document control, testing and acceptance, start-up planning, the development of operations/maintenance rules and procedures, and training. Jacobs will guide the entire Project Team to enable a clear understanding of the responsibilities toward developing safe, secure, and reliable systems are demonstrated.

The design, construction, testing, and start-up of the Project will comply with applicable safety and security laws, regulations, and requirements. All facilities and systems must be designed and constructed in a manner that promotes the safety and security of persons and property. This SSMP, as part of the Project Management Plan (PMP), is the prime document describing management of safety and security for the Project. It establishes safety and security activities for each phase of the Project, and responsibility for their performance and oversight. It also describes the safety and security organizational interfaces, policies, procedures, goals, and objectives.

Section 5

Safety, accident prevention, and security breach prevention must be incorporated into the performance of every task. Through a cooperative team effort and the systematic application of safety and security principles, the NJ TRANSITGrid Project will be designed and constructed to operate safely, securely, dependably, and efficiently.

Consequently, the SSMP will be developed in accordance with Chapter IV of FTA Circular 5800.1, Safety and Security Management Guidance for Major Capital Projects. As specified by this section, NJ TRANSIT will describe its approach to safety and security activities to be carried out throughout the 11 Sections and various sub-section, including:

1. Project Management commitment and philosophy toward safety and security
2. Integration of safety and security into the project development process
3. Assignment of organizational safety and security responsibilities for the project
4. Safety and Security Analysis and hazard and vulnerability management processes
5. Development of safety and security design criteria
6. Process for verifying qualified operations and maintenance personnel
7. Safety and security verification processes (including final safety and security certification) to verify conformance with specified safety and security requirements during design, in equipment and materials procurements, and during testing/ inspection and start-up phases
8. Construction safety and security management activities
9. Requirements for 49 CFR Part 659, Rail Fixed Guideway Systems; State Safety Oversight
10. FRA coordination
11. Department of Homeland Security (DHS) coordination.

We have the professional staff and expertise to manage, coordinate, and develop the SSMP as well as working with both NJ TRANSIT and Amtrak. Our Staff is also well versed on the development of Site Specific Work Plans (SSWP) to include the local emergency services, hospitals, and site-specific safety and security related issues/ concerns for the work areas.

Our approach will be to assist and guide NJ TRANSIT personnel with the development of the above mentioned sections and progress them immediately following NTP. Building on past experience and similar projects we can progress several sections in parallel to expedite the circulation for approval.

Our understanding of NJ TRANSIT, Amtrak, and the project area gives us a significant amount of the security related criteria that has been implemented and deployed elsewhere on recent projects where we conducted the required meetings to obtain and document the applicable information. While this project will have unique challenges, it is equally important in terms of process, personnel assignments including committees, and the means to track through the life of the project. Our experience will inform the development of security criteria and understanding the current approach and plan to implement both physical and analytical security measures.

TRANSIT RELATED SAFETY

One of the major issues in working in the rail environment is underground utility strikes. Understanding as-built documents are not always updated and available, we have developed various means and methods to address this and minimize such issues. One such example is the development of a utility matrix, listing and identifying all known and potential utilities, the routing, potential conflicts, and potential relocations.

Another major concern is Railroad Resources such as adequate Flagman and other specialized trades whereby they are relied upon to cover daily duties as well as incidents and emergencies. We will monitor flagman assignments/availability and work within the guidelines to make sure we have the required resources scheduled accordingly. This becomes critical as they are typically assigned to a specific area or region based on the agency and therefore, limiting resource availability. When a request of a flagger for one or multiple days is made, they must be assigned by the road master, who has to balance this request against other activities they protect. The priority will be given to work that keeps the railroad running and safe first; if there is no one left to fill our request, our work will have to be rescheduled. Our experience with several of the Class I Railroads assists in minimizing the impact by creating work around to maximize availability

SAFETY IN DESIGN

Jacobs's Culture of Safety extends beyond the field and extends into how we plan and approach design to provide a safe environment from concept through completion and operations.

This process begins in the programming phase of the design process. Our Team will review the safety and security of the facility with NJ TRANSIT in detail and will work as a partner to determine areas of safety and security risk and how the design can be enhanced to mitigate and ultimately reduce the risk of injury, loss time, and potential damage.

During the early phases, our Team will identify how the daily activities will be conducted within the operations of the facility. The key steps in this process will be initially performed through a series of programming workshops with the necessary groups within NJ TRANSIT.

Ultimately, we will work together to:

- Jacobs Culture of Safety extends beyond the field and extends into how we plan and approach design to provide a safe environment from concept through completion and operations.
- This process begins in the programming phase of the design process. Our Team will review the safety and security of the facility with NJ TRANSIT in detail and will work as a partner to determine areas of safety and security risk and how the design can be enhanced to mitigate and ultimately reduce the risk of injury, loss time, and potential damage.
- During the early phases, our Team will identify how the daily activities will be conducted within the operations of the facility. The key steps in this process will be initially performed through a series of programming workshops with the necessary groups within NJ TRANSIT. Ultimately, we will work together to:

During the early design phases, we will work with your stakeholders to create an operations plan. This document will be part of the overall design program and will outline in detail how each system is to be integrated, how communications will work, and where controls are to be implemented both on and if required off site.

As the design and construction phases are advanced, our safety and security experts will continue to work with NJ TRANSIT to validate the design concepts.

Design workshops will be implemented to review with each group and allow for periodic feedback of the design so that refinements can be made. The ultimate goal is to achieve a design that has been detailed, so that the facility can function as intended and planned.

Our safety and security team will also work with NJ TRANSIT to determine what credentials are to be implemented by operations group, personal and areas of the facility to control access to secure sections of the facility. This control plan will be part of the overall safety and security plan, so that only authorized individuals can gain access to sensitive areas of the facility.

DELIVERABLE

Safety and Security Management Plan as detailed above.

Task 9 | Public Involvement and Agency Coordination

A key component of the successful implementation of this project will be the ability to inform, collect pertinent information, and answer questions from the multiple stakeholders who will have an interest in or jurisdictional responsibility regarding this project. Our execution of this task will be driven by our intent to present a unified and singular public face to this project. Often, overly complex and confused or contradictory messaging can result in miscommunication or worse yet, misstatement of facts. Our Team will work to assist NJ TRANSIT in creating a comprehensive communications program that is focused on building relationships and the steady advancement of the project through design, permitting, and implementation in accordance with the project schedule.

The potential location of the proposed generation facility is in a Heavy Industrial Zone District along the Hackensack River in the Town of Kearny. Given the geography of this portion of Hudson County, the site is exceptionally isolated from any residential development. The closest residential area is more than ¾'s of a mile away in Jersey City. This area is separated from the project site by the Hackensack River, the Hack PATH Lift Bridge, the Lower Hack Lift Bridge, and the Pulaski Skyway as well as numerous elevated roadways. As a result of this relative isolation, it is not anticipated that there will be significant impacts to nearby residential communities.

An area that could result in community concern would be related to the air emissions and operating noise of the facility. Again, presuming that the facility will operate within Federal and State laws as well as meeting local Town of Kearny Industrial Performance Standards, we do not expect this to be a significant issue.

Most likely, issues related to the natural environment will be the primary drivers of community concern. The site is located within the NJ Meadowlands under the jurisdiction of the New Jersey Sports & Exposition Authority and the NJ Meadowlands Commission (NJMC). The NJMC provides oversight of zoning, site plan, and environmental permitting within the district. They will be concerned about the potential effect of the facility on the natural environment including the placement of any fill on the site, impacts to wetlands and natural vegetative communities as well as effects to water quality, and the marine ecology. Special efforts will be made to reach out to the staff of the NJMC as well as the NJDEP, the USACE, the Hackensack River Keeper, etc. to make sure that their concerns are noted early, and that the design acknowledges their concerns and eliminates or minimizes any impacts to the maximum extent practicable. If mitigation is actually required, we will also apply the same proactive approach of early vetting and inclusion into the design and cost estimates to make sure that the project remains on schedule and within construction and operating cost parameters.

Major deliverables related to this task include the development of a master communications plan that will guide activities, establish protocols, templates, and chains of command that will enable consistency and timeliness of our message;

PowerPoint presentations, brochures, and other graphic materials identifying the purpose and need for the project as well as related to specific design and engineering components of the project; meeting minutes, invitations, advertisements, and other records of communication; and other assorted materials related to the planning for and results of communication efforts.

Our efforts will have three primary areas of focus: Public Involvement related to communicating with the larger public, businesses, organizations, and municipalities for the purpose of informing them and collecting information from them; second Public Involvement related to the statutorily required Federal processes such as NEPA; and finally, agency coordination related to the various negotiations and ongoing permit applications necessary to implement and gain approval for the project.

The larger encompassing Public Involvement program will seek to provide a coordinated and comprehensive approach to communicating directly with stakeholders. These stakeholders could include: the Town of Kearny, adjacent municipalities such as Jersey City and Secaucus, Hudson County, the Hudson County Economic Development Authority, the NJMC, Adjacent property owners, the Hackensack Riverkeeper, Chambers of Commerce, and other business groups, etc. Working closely with NJ TRANSIT, we will develop a Master Communications Plan that clearly identifies the pertinent stakeholders, the potential interests and/or concerns of those stakeholders and actions, and methods necessary to communicate with these stakeholders. We will develop a specific schedule of meetings with these groups. The types of meeting could range from small informal face-to-face meetings with individual stakeholders to larger open house or information sessions for the general public. We will prepare necessary materials including presentations, display graphics, fact sheets, brochures, email blasts, and other forms of communication to reach out to these groups, respond to their questions, and assist NJ TRANSIT in building advocacy for the project.

We will document and log all communications as part of the project record. We will maintain a database of individuals and groups available for the entire team. We have assumed that we will provide assistance to NJ TRANSIT for 10 meetings. All communication will occur with close coordination and the advance permission of NJ TRANSIT.

A second focus of our Public Involvement efforts will be to assist NJ TRANSIT and their Third Party Consultants in the conduct of the NEPA Public Involvement program, which is statutorily required as part of the EIS process. As directed by NJ TRANSIT, we are prepared assist in the following tasks: drafting and publish of the NEPA NOI; preparing and revising the NEPA Scoping Document; conducting the NEPA Public Scoping Meeting; conducting the NEPA Public Hearing and related notices and advertising; responding to comments and developing a comment tracking database for Responses to Comments; drafting and publishing of the NEPA Record of Decision; and other activities related to these required actions.

Finally, the third area of focus for our Public Involvement Program is related to the coordination of involved and interested agencies. Many of these agencies will be involved from a permitting jurisdiction perspective. Other agencies will have interests related to ongoing projects and adjacencies to our project. Finally, other agencies will be involved due to shared responsibilities and the need for negotiations due to their involvement and interface. Jacobs will coordinate communication between the project team and the various agencies throughout the length of the project. A record of all communications will be maintained including email, letters, phone conversations, and meeting minutes. A strategic schedule of planned communications (informed by the project's needs for permits and negotiated agreements) will be developed and adhered to.

Agency coordination is potentially anticipated with the following entities:

- NJDEP
- NJ SHPO
- PANYNJ
- Hudson County
- Hudson County Soil Conservation District
- Hudson County Economic Development Authority
- USACE
- USCG
- USEPA
- US Fish and Wildlife Agency
- FTA
- FERC
- Amtrak
- NJ BPU
- PSE&G

Under NJ TRANSIT's direction we will setup and coordinate meetings with stakeholder agencies, prepare and distribute advance information prior to meetings, and develop agendas, presentation materials and meeting minutes. We will develop and maintain a register of key issues and actions necessary to resolve or mediate these issues.

Subtask 9.1 | Open Houses and Meetings

As noted above in Task 9, we will host a series of open house meetings for the purposes of public engagement and involvement in coordination with NJ TRANSIT and other critical stakeholders. Our efforts will have three primary areas of focus: Public Involvement related to communicating with the larger public, businesses, organizations, and municipalities for the purpose of informing them and collecting information from them; second Public Involvement related to the statutorily required federal processes such as NEPA; and finally, agency coordination related to the various negotiations and ongoing permit applications necessary to implement and gain approval for the project. All meetings will be thoroughly documented and conducted in an open book fashion. For further details, see the Task 9 above.

Task 10 | Integration and Interface

By definition from the Construction Industry Institute (CII), Interface Management is the management of communications, relationships, and deliverables among two or more interface stakeholders. Jacobs, as a leading firm in Interface Management, aided in the research and development of Interface Management and its practices with CII. We recognize four key anchors that drive the implementation of Interface Management:

- High Technologies
- Multiple/Interdependent Stakeholders
- Geographically dispersed
- Iterative Schedules

Each of these key anchors represents a potential risk to a project. With new technologies, you often have higher design criteria. Likewise, with multiple project stakeholders, you will have multiple interests and agendas. Clear and concise planning must be done in order to achieve today's normal, fast-tracked schedule. Interface Management is the practice of identifying and managing these inherent risks. NJ TRANSITGrid is an ideal project candidate for employing Interface Management as a distinct discipline, as it captures all of the four key anchors.

As NJ TRANSIT'S consultant, we will lead the collective charge in integrating the project stakeholders and all the interfaces, hard and soft, and verifying all interfaces are managed accordingly and effectively. We have proven success developing and administering Integration Management Plans on projects across the globe; including mass transit. Our differentiator is that for applicable projects Jacobs deploys a stand-alone practice for Interface Management utilizing Interface Managers as key project team members. We have managed projects with elemental programs such as Excel to packaged IM specific software. For this particular project, we recommend the utilization of Prolog Converge, a web-based data management and administration tool that will allow for easy accessibility and ease of use among the project stakeholders.

Section 5

We implement Interface Management in accordance with CII IM principles. The first step is developing our project-specific Interface Management Plan, which will identify the key stakeholders, critical interfaces, and interface management processes for the project. A key success factor in complex projects is clearly identifying who the stakeholders are and what information they are responsible to provide/receive. This enables a fluent and complete design process, which allows for project execution without reengineering or re-design further down the track.

Within the IMP, we provide Interface Agreement Forms, an Interface Register template, and customizable report templates. We begin this key deliverable with our Interactive Planning (IAP) sessions, which should occur as early as possible. The greatest value gained from our IAP is team alignment and risk mitigation on critical interfaces. The IAP is led by the project's Interface Manager. To aid our initial discussion, we have several industry tools/roadmaps specific to Interface or Integration Management. One of those tools is iCAT, which stands for Interface Complexity Assessment Tool, is an industry standard tool recommended by CII for evaluating the complexity among the stakeholders on our project.

Upon team alignment and collectively initiating the identification of critical interfaces, we will assume management for integration. Within this function, we will integrate the Interface Register or Interface Database into our Document Management System (DMS). As noted above, we recommend Prolog Converge for the overall DMS on our project. Throughout the design process, our Interface Manager is responsible for implementing the integration/interface processes for all stakeholders.

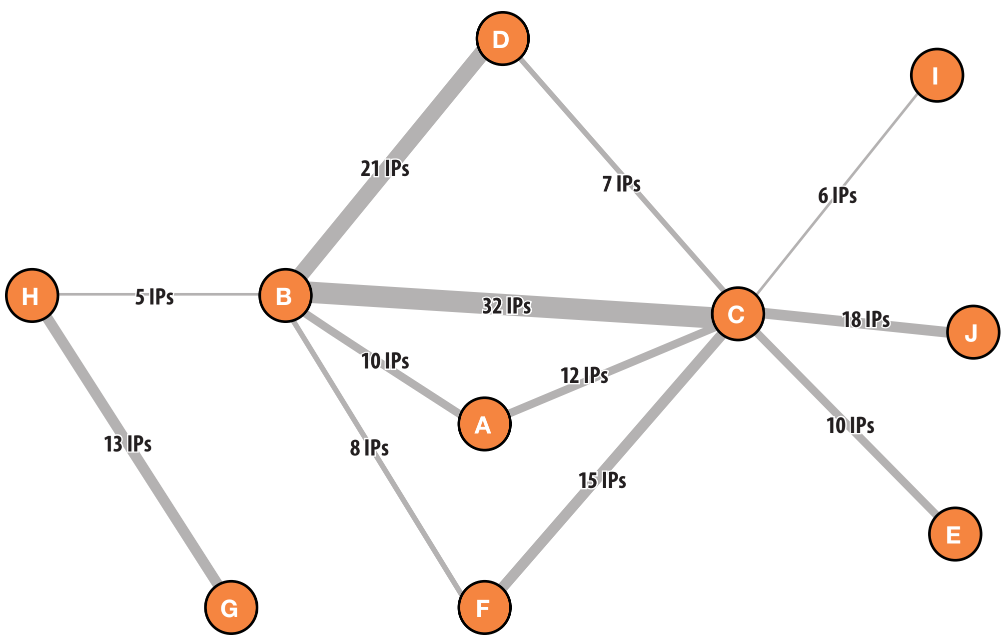
The major steps of the Interface Management, starting with the development of the IMP, are:

- Interface Identification: identify all possible stakeholders and interfaces on the project.
- Interface Documentation: document and describe all interface information, including interface characteristics, involved parties, deadlines, related documents.
- Interface Transfer: transfer identified interface information and documentation to appropriate parties.
- Interface Communication: coordinated by Mehul Gandhi, the Interface Manager, this step entails the issuance of interface agreements and on-going communication between all stakeholders to effectively manage the identified interfaces.
- Interface Implementation: perform all interface action items, providing deliverables meeting the specifications within required time parameters. Updates and changes are recorded in the interface control documents and circulated between involved stakeholders.
- Monitoring and Control: Mehul, on an on-going basis, evaluates the interface agreements and documentation with regard to timeliness and quality.

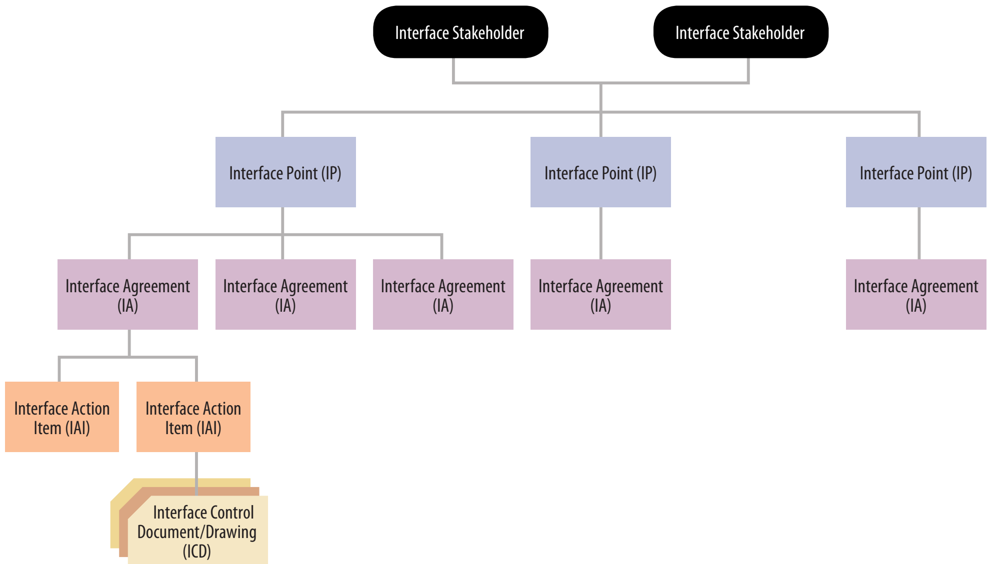
- Interface Closing: interfaces are considered closed when all involved parties agree on the accuracy and completeness of interface related deliverables.

The following diagram provides an example of an Interface Network. An outcome of the Interface Management kick-off meeting, the resulting diagram will visually identify a project's most critical interfaces based on volume of interface points. Each node represents a project stakeholder and the interconnecting lines represent the Interface relationship between two stakeholders.

The more interface points between two stakeholders, the greater the potential risk that has to be managed. The project specific diagram illustrates the Interfaces that require more or less attention within the Interface and Integration Management system.



Section 5



Each project interface can be represented, as shown above, by a hierarchy of interface points between stakeholders. The individual stakeholders are shown at the highest level (for example, an interface between a contractor and a utility company). The next level down shows the actual interface points, which can be both virtual and physical (for example, contracts between stakeholders and/or physical tie-ins between stakeholder owned equipment or infrastructure). The third level represents the interface agreements, which document arrangements for expectations and deliverables. These may include physical properties of the tie in point (flow rate, voltage, geo spatial information, etc.) or contractual obligations. The bottom level designates all of the interface documents, such as summary sheets, drawings, data sheets, scoping documents, etc.

DELIVERABLES

- Integration Management Plan – draft and final
- Interface Control Document (ICD)
- Interface Database
- Integration Report for Amtrak Sub-41

Task 11 | Value Engineering

INTRODUCTION

We have been actively involved in Value Engineering (VE) for more than 20 years, both from the designer perspective, conducting VE workshops and in providing technical expertise to consultant VE teams. Staff resources include two certified value engineers (PE, CVS Team Leaders), seven PE, AVS Assistant Team Leaders, and a background of more than 1000 VE studies, conducted worldwide.

We recognize that value engineering is growing in acceptance as a methodology to improve project performance and control project cost. We are fully staffed with experienced and knowledgeable professionals technically astute in terms of conducting and participating in formal value engineering workshops. We bring to you more than 50 years of design and hands-on construction experience.

RELEVANT EXPERIENCE

We have conducted approximately 200 VE workshops on transit projects, ranging from new routes projects to historic renovations and restorations. Project values range from several million dollars up to the $3.2 billion Second Avenue Subway project. VE experience includes track, signal, SCADA, and maintenance shops, as well as third rail and catenary substations and distribution. A study was conducted on alternatives to replace the A&W 138kv transmission lines and supporting structures from the Safe Harbor Hydro-Electric Generating Plant in Pennsylvania under Amtrak's ARRA program. Numerous studies have been conducted for NJ TRANSIT including the proposed power generating upgrades and back-up power facilities at the MMC, as well as studies on the Secaucus Transfer, Trenton, Ridgewood, and Perth Amboy station upgrades, and Portal Bridge.

THE VE TEAM

For the NJ TRANSITGrid project, VE studies are required at the initial submission (10% design) and again prior to the final 20% design submission. Richard LaRuffa, PE, CVS, Jacobs' Director of Value Engineering, is proposed as lead facilitator. Prior to each workshop, Rich will submit team member qualifications for approval. Team members will be chosen from staff not associated with the design effort, and may include consultant subject matter experts.

REPRESENTATIVE VE TEAM:

- CVS Team Leader (Certified Value Engineer)
- Assistant Task Leader/Cost Engineer
- Power Generation Engineer

- Power Transmission Engineer
- Structural Engineer
- Civil/Drainage Engineer
- Geotechnical Engineer
- Electrical/Communications Engineer
- Environmental Engineer
- Industrial Engineer
- Architect

We will conduct and manage the study from our Morristown, NJ office.

VALUE ENGINEERING METHODOLOGY

VE is a systematic approach to obtaining optimum value for dollars to be invested in a project. Through an organized system of investigation, unnecessary expenditures are avoided resulting in improved value and economy. The VE approach is a creative effort directed toward the analysis of functions. A design represents one approach to satisfy the stated program requirements (or functions). VE looks at alternate ways to meet program requirements, while validating that the proposed design satisfies those requirements in a priority sequence. Costs are identified against each function being considered. After defining the costs related specifically to given functions, alternates are proposed which:

- Achieve required functions for less cost
- Add or eliminate functions for the same or greater cost
- Eliminate unnecessary functions and/or costs
- Optimize operating costs
- Achieve any combination of the above

The VE study will address all aspects of a project. In addition to the functional aspects of the design, the team will review the construction aspects to address how construction may best proceed to minimize impact on operations, the cost of premium time construction or “windows” of construction, and the life cycle cost of alternative construction systems, materials, and operations. Life cycle cost analyses will be performed to demonstrate that the alternatives considered are truly the most cost-effective over the defined life span of the project.

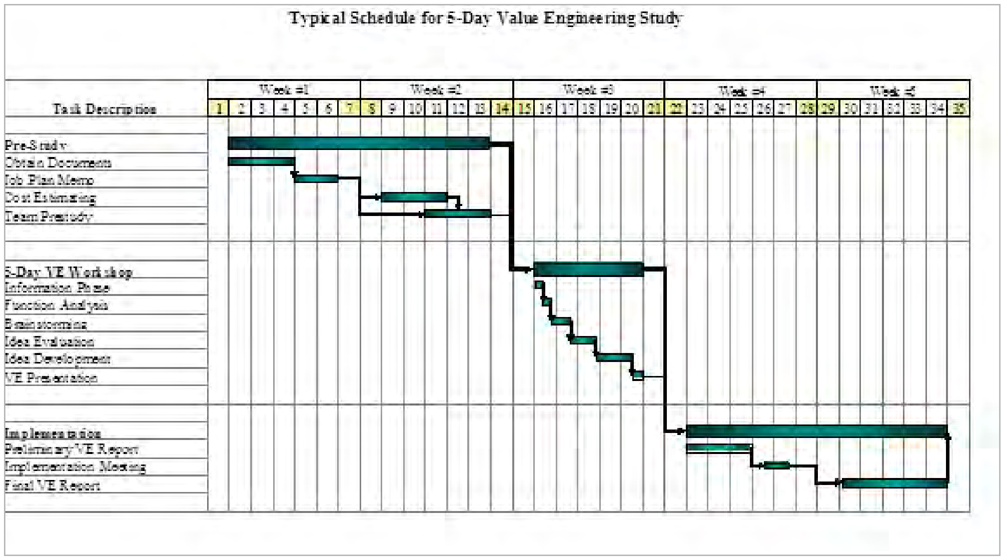
VE studies are conducted using the VE and/or Value Analysis techniques as procreated by the SAVE International, The Value Society utilizing a multi-disciplined team approach. All studies follow the five-phase job plan; Information, Speculation, Analysis, Development, and Presentation. Workshops varying in length and complexity from 3-days to 10-days duration have been conducted. In addition, Jacobs accommodates client needs for implementation services ranging from documenting responses to conducting consensus meetings with client staff and designers to resolve implementation decisions. We will prepare the specific Job Plan based on the approved schedule and authorization to proceed with the VE effort.

In accordance with the NJ TRANSIT Task 11, Value Engineering, the figure on the next page shows the typical sequence for a 40-hour VE Workshop to be completed within a five-week period. Upon selection and approval by NJ TRANSIT of the proposed team members, we will finalize the Job Plan and proceed with the Pre-Study schedule (Subtask 11.a). Pre-Study occurs in the two-weeks prior to the Workshop. We will collect project information including feasibility reports, analyses of alternatives, environmental studies, cost estimates, and the latest plans and documentation. Rich will prepare a memo of the specific Job Plan for the Team one week prior to the workshop. Team members will have an opportunity to review the conceptual plans and become generally familiar with the project during the second week (8 hours review time). Rich will submit the VE Job Plan to NJ TRANSIT detailing the specific efforts and schedule for the workshop.

During Pre-Study, the Jacobs Team will review the design cost estimate and prepare cost models. Any concerns with the design cost estimate will be resolved with the design team so that the Workshop can proceed with a reconciled estimate in place. It is very important that cost estimates are reconciled so that any VE ideas will be based on equivalent unit cost parameters, contingencies and multipliers for comparison.

The 40-hour Workshop (Subtask 11.b) will begin on Monday morning with a presentation by the design team of the current design options under consideration, and a discussion of how the project evolved to its current stage. The presentation will be followed by a site inspection. The team will then proceed with the remaining workshop phases, culminating in a presentation of the VE results to NJ TRANSIT and the design team.

In the typical Job Plan format, the VE Presentation Meeting occurs at the end of the workshop, on Friday afternoon. At the presentation, the VE Team will distribute handwritten copies of the study results. The purpose of the presentation meeting is to provide NJ TRANSIT and the design team with the rationale behind the VE ideas presented. It is intended that VE ideas will be discussed only in general clarification terms, and not for evaluation or decisions at that time.



As shown in the figure above, Jacobs will provide the Preliminary VE report within one week of the Workshop. Since NJ TRANSIT and the design team will already have copies of the Workshop results, they can begin immediately after the Workshop with their review and commentary on the VE suggestions and recommendations.

Subtask 11.d, Presentation, indicates that the VE Presentation Meeting occurs the week following the study, when the Preliminary VE Report is issued. The subtask, however, describes this meeting for presentation and implementation. We assume the typical Friday presentation meeting with all team members present will occur, while the latter meeting is for implementation. The implementation meeting should be viewed as a work session, wherein all parties discuss the merits and disadvantages of each VE proposal, and make decisions on each proposal. Following the implementation meeting, we will prepare and submit the Final Value Engineering Report, including minutes of the presentation/implementation meeting and resolution of each VE idea proposed (Subtask 11.c). Our proposed CVS, Rich, is also a NJ Professional Engineer, and he will sign the report as required in the RFP, to certify that each study was conducted using current and approved VE principles.

Task 12 | Constructability Reviews

Integrated throughout our concept design and overall system validation process is constructability and construction intent. For projects featuring challenging site logistics, tight quarters and continuous operations, an eye for constructability is a must. The Jacobs Team features construction engineers well-versed in developing means and methods for accomplishing construction on a power generating facility site while maintaining continuous operations.

Our construction specialists will perform a "cold eyes" constructability review of all elements of the concept design for safe access and ease of execution for construction, operation and maintenance in the field. This input will be collected and input to help capture and transmit this vital data for the next phase detailed design. We will focus especially on the interfaces between systems, components, and trades where the greatest potential for conflict often lies. Key focus areas include:

- Heavy equipment access & rigging requirements (especially near substations)
- Field adjustment tolerances & allowances
- ROW access and daily transit options
- Simplification of construction details
- Opportunities for subassembly and pre-erection
- Cold weather and adverse conditions construction support
- Standardized elements
- Material Laydown Areas
- Fabrication and erection considerations
- Three-dimensional (CAD) Modeling
- Number of field welds and inspection requirements
- Effects of weather/climate on construction

Also key in our analyses is the engagement of our designated Stephen Donohoe, our Design Safety Lead, who facilitates the identification and mitigation of hazards involving the design, construction, and maintenance and operation of facilities. Stephen is responsible for making sure designs meet all Safety-In-Design requirements, OSHA requirements, NFPA requirements, and applicable fire protection guidelines.

We routinely use the VE workshop format for safety reviews. SME's are assembled under the leadership of a facilitator, and the design is reviewed with a focus on coordination, clarity, and suggestions to improve the project.

Constructability Reviews

- *Constructability reviews produce more effective design solutions that result in a final construction product that is not only more efficient to bid but is of better quality, longer lasting, and easier to maintain.*

Examples of issues addressed during the constructability review include identification and suggested mitigation of:

- Conflicts where multiple services merge
- Details with a focus on difficulty
- Conflicts between contracts
- Onerous contract language
- Conflicts between phases
- Project risk reduction
- Project expediting
- MPT logistics and protection
- Optimizing project phasing
- Work better performed off-hours

The findings of the review will be discussed and agreed to with the client for implementation as part of the project contract documents. The findings usually include an itemized listing of comments on the drawings, specifications, and procurement package with priorities for addressing any of the concerns listed above. If the constructability review is conducted as part of a VE workshop, the issues are noted as being driven by the above concerns and the VE team offers alternatives to mitigate any conflicts. A sample output from the constructability review is show below:

DELIVERABLE

- Document findings of constructability reviews in a report to NJ TRANSIT.

Consultant: ________________ Sheet ______ of ______ Contract No.: ________________ Project No.: ________________ Date: ________________ Constructability Review Comments: ________________	DISPOSITION CODES: A: Incorporated B: Not incorporated (provide explanation) C: Clarification required (provide explanation) D: Will incorporate in future submission	TBTA DISPOSITION CODES: A: Incorporate comments B: Do not incorporate comments

COMMENT NO.	DWG. NO./ SPEC. PAGE	CONSTRUCTABILITY REVIEW COMMENTS	DISPOSITION CODE	DESIGN CONSULTANT'S RESPONSE	TBTA DISPOSITION CODE	TBTA'S RESOLUTION
1	General	There should be a property layout sheet giving the construction limits and property owners and if any agreements and or restrictions have been agreed prior to award for purposes of bidding and compliance. For example: the Landscaping drawings show Parks Department properties (see comments on work restrictions below).				
2	Spec. TB-114-1.03D	No work permitted on or above any NYC Department of Parks between Memorial Day and Labor Day. This may pose a serious problem unless better defined.				
3	General	There appears to be inadequate room to efficiently demolish and reconstruct the on and off ramps as currently shown in the plans. Suggest that access be afforded through where the current and new abutments are to be placed to allow the contractors a reasonable means of planning and executing their work to comply with both the schedule and the bridge as currently allocated. Various comments below address this issue.				
4	G-4	General Note 8 – construction load information needs to be completed				
5	G-4	General Note 10 – the Contractor's Staging Area will be indicated on one of the G drawings. This information should be shown on G-8 or a separate drawing.				

Task 13 | Contract Packaging

We have significant past experience designing and packaging large complex projects and developing contract packaging and procurement strategy plans that are aimed at eliciting a highly competitive response from the market.

Stan Grill and his team have significant past experience managing varied methods of procurement, as well as administering a wide variety of contract types, including lump sum (LS); design build (DB); design-build-operate-maintain (DBOM): CM at Risk (CMAR); and other alternative project delivery methods – from solicitation through contract close out. The NJ TRANSITGrid Project is a unique application – it is part power plant project and part rail traction power project. As such, applying an optimal contract delivery structure likely varies from the typical delivery of either a power project or a classic rail project. Items that impact this delivery structure are numerous and include:

- Design: To effectively design and account for the construction costs for the power generation scope of this project, the equipment needs to be selected. This is driven largely by the variability of the equipment design characteristics from one vendor to the next, as well as the associated foundation loadings, waste heat, and emissions profiles. Some units are axial exhaust; some are in a tee configuration. If a combined cycle power generation option is to be considered, pre-procurement of the generation equipment is vital to the selection of the heat recovery steam generator. Similarly, selection of the heat recovery unit, dictates the layout of the building and site. Some units are short and fat while others are tall and skinny.
- PJM Interconnection: The interconnection process with PJM requires extensive technical data that is dependent on the equipment selection. The process is regimented and requires extensive technical data for the analyses. The process has definite time allotments with expiration dates, so once the process is started, completion needs to be the goal, otherwise the schedule will be delayed significantly and additional costs incurred.
- Environmental Air Permit: Similar to the item above, the air permit will be driven wholly by the selection of the equipment for the application. The permit is a long lead schedule driver and should therefore be considered on the critical path and necessitate early equipment procurement.

In addition to the distinct advantages of the early equipment procurement as discussed above, the selection of the construction phase and operations/maintenance phase delivery methods can have a drastic impact on project success. For this unique project we will consider multiple factors, including the components and activities associated with the project, the capabilities and capacity of key providers in the marketplace, the results of the project financial and market revenue analysis, the concept of operations and technology alternatives analysis, as well as regulatory constraints, to develop an effective packaging and procurement strategy plan.

As discussed throughout this document, it is incumbent to select the equipment for the power island to effectively design the solution and have cost and operational certainty.

Selection of a contracting methodology ultimately is a function of risk allocation and pricing. It is important for NJ TRANSIT to select a contracting methodology that matches the actual project risks with the available project funding. Potential delivery methodologies include:

- Design-Bid-Build (DBB)
- Design-Build (DB)
- Design-Build-Operate-Maintain (DBOM)
- Construction Manager at Risk (CMAR)
- Engineer Procure Construct (EPC)
- Engineering Procure Construction Management (EPCm)

DESIGN BID BUILD

DBB Contract & Compensation Structure

Often referred to as the traditional contracting method, this is the approach with which most public project Owners are familiar. In the DBB approach, the Owner contracts the design and construction efforts separately. This is a linear process in which one task follows another with no overlap. Plans are developed to 100 percent completion and the project is advertised for bid. Contractors bid the project exactly as designed and the work is awarded to the lowest bidder. The design professional is typically compensated on a percentage of construction cost.

Benefits of DBB Approach

- Traditional, well-known delivery method
- Simple procurement process to manage
- Defined scope
- Lowest initial price typically accepted (prequalification can control respondent field)
- Good for simple, uncomplicated projects that are not schedule-driven
- Design professional protects the interests of the Owner
- Owner gets to select the perceived best design professional and installing contractor independently

Risks of DBB Approach

- Linear process equates to a longer schedule
- Design and construction teams have competing interests which may lead to disputes and possible delays
- No Owner control over subcontractor selection
- No input from contractor on cost or constructability during design
- Lack of flexibility for change during construction
- Not well suited for complicated projects that are sequence, schedule, or change-sensitive

DESIGN-BUILD

DB Contract & Compensation Structure

Under the DB method, a single entity provides for both the design and construction of the project. The Owner contracts with a contractor and architectural/engineering (A/E) firm simultaneously as a single team. This usually requires a design criteria package or bridging documents (usually about 25 to 30 percent design) to be prepared by a separate design consultant to communicate project intent to the DB team. It is a non-linear process in which design and construction overlap. This usually employs a two-phase qualifications based procurement (RFQ/RFP). The design-builder usually provides a lump sum bid based on the bridging documents.

Benefits of DB Approach

- Single point of accountability for design and construction
- Enables fast-track delivery with construction beginning before design is complete
- Project cost defined early in the process

Risks of DB Approach

- Design-build firm controls contingency
- Does not take full advantage of competitive bidding for materials and services
- Not suited for small projects
- Requires a separate design consultant for bridging documents
- Little control or flexibility of design after contracting design-builder

- Change management may be expensive – Owner carries this risk, any uncertainty in bridging documents will be exploited by design-builder
- Can create adversarial relationships
- Design professional works for the design-builder and has profit motivation on the project instead of advocating for the Owner in all cases

DESIGN-BUILD-OPERATE-MAINTAIN

An extension to the Design-Build delivery model, the DBOM offering includes provisions for long-term operations and maintenance of the facility to be provided. This method of project delivery is typical in the transit marketplace, but has seen little to no development in the power generation space. The selection of the team will likely prove to be challenging for this application given that there are large and highly qualified design-builders or EPC partners, and there are firms that look for long-term operations and maintenance engagements. However, there lacks a stable competition of highly qualified firms that are both premier design-builders that also want to enter into long-term operations contracts.

Benefits of DBOM

- Procurement strategy familiar to the transit marketplace
- Provides a single point of contact for long-term design through operations
- Allows for construction input during design

Risks of DBOM approach

- Lack of depth in the marketplace for DBOM competition
- Owner gives up most control of the offering after bridging documents
- Long-term contracts for operations and maintenance likely dwarf the value of the construction, which can lead to higher capital costs

CONSTRUCTION MANAGER AT RISK

CMAR Contract & Compensation Structure

Construction manager at risk is usually selected by the Owner based on qualifications prior to completion of the design. The CMAR works with the Owner's previously contracted A/E to provide cost estimates and constructability input and is paid a fee for its services during the design phase of the project.

Near the completion of design, the CMAR provides the Owner with a Guaranteed Maximum Price (GMP) and schedule. During the construction phase, the CMAR functions as the general contractor and holds all subcontracts. Savings on the GMP are usually shared between the Owner and CMAR. The A/E is typically compensated on a percentage of construction.

Benefits of CMAR Approach

- CMAR is selected on qualifications
- Allows construction input during design
- Collaborative approach during design phase
- GMP established prior to construction
- Enables fast-track delivery, early equipment procurement, integrated design, and phased construction
- Suited for large, complex, schedule-driven projects

Risks of CMAR Approach

- Not suited for small projects
- No single point of responsibility for design and construction
- Requires active participation by Owner's representative in project especially in change management
- Many CMARs are general contractors receiving extra fee during design phases and struggle to function in this role
- Tension routinely exists between design professional and CMAR

ENGINEER PROCURE CONSTRUCT

EPC Contract & Compensation Structure

EPC is a turnkey delivery model. The EPC firm is selected on a first costs basis to provide the project scope as identified in a high-level performance specification. The EPC provides design, procurement, construction, and commissioning services on a lump sum, all in basis. The EPC firm has full control of equipment and vendor selection as long as it maintains compliance with the performance specification.

Benefits of EPC Approach

- Single point of responsibility for design and construction
- EPC contractor carries firm price risk for the installed scope
- EPC contractor carries performance risks of the installed system
- EPC contractor carries schedule for completion on contract date
- Establishes fast-track delivery

Risks of EPC Approach

- EPC firm prices significant contingency to cover risks of firm fixed price work, performance risks, and schedule risks, typically around 20 percent of the contract value
- Owner has little control of quality or equipment selection after contract execution without significant change order pricing
- Life cycle cost factors not a driving factor in decision matrix
- EPC controls and keeps all contingency instead of applying to the project value
- High cost/low risk delivery model
- Does not afford transparency of costing
- Can lead to adversarial relationships and Owner dissatisfaction – 19.7 percent satisfaction per Power Engineering magazine

ENGINEERING PROCURE CONSTRUCTION MANAGEMENT

EPCm Contract & Compensation Structure

EPCm is a hybrid of the design-build model. The EPCm firm is selected on a qualifications basis to provide a collaborative team-oriented project delivery approach. The EPCm firm provides design, procurement, construction, and commissioning services and works closely with the Owner to optimize project cost, time, value and operational efficiency with the focus on total cost of ownership. The EPCm firm and Owner capitalize on the benefits of early construction involvement which may include specialized design-assist subcontractors for expertise on critical systems.

Professional services are handled as fixed fees for:

- Design & engineering services
- Procurement & preconstruction support services

- Construction management services
- EPCm/construction fixed fee (as a mark-up on subcontracted costs and direct expenses)

It is important to prequalify all bidders with input from the Owner on any preferred vendors. Construction subcontracts and equipment purchases should be competitively bid on a lump sum basis to prequalified respondents and contracted on standard subcontract and purchase order forms. All significant subcontracts should be bonded. Where appropriate and beneficial to the project, early subcontractor and vendor involvement during design may be utilized on a negotiated basis subject to Owner approval. All construction costs should be billed and handled on an open book basis with full disclosure and access to Owner. General conditions costs related to site office, temporary services, and support are billed at cost.

Incentive fees are based on mutually agreed upon performance measures, referred to as Key Performance Indicators (KPI). Since the EPCm supplier is acting in the interest of the Owner, they should maintain a cash flow neutral position throughout the project through mutually agreed billing and payment schedules and procedures. Financing of the project through delayed payments should never occur.

Benefits of EPCm Approach

- Single point of responsibility for design and construction
- Enables fast track delivery and minimizes total time to market
- Maximizes Owner flexibility and input throughout design
- Minimizes the impact of changes during construction
- Allows best value options and systems analysis throughout
- Allows Owner & EPCm firm to share contingency
- Low cost/low risk delivery model
- Provides total cost transparency
- Prevents adversarial relationships with Owner
- Owner's project goals and interest are shared and protected by all parties

Risks of EPCm Approach

- Requires risk sharing by Owner – Owner carries certain risks instead of paying another party to carry it

- All funding goes to project capital, not to EPCm profit for risk sharing
- Requires teamwork to reach potential

OVERALL PROJECT RISKS

Contractors enter into a multitude of financial arrangements that carry various levels of risk. These command different levels of compensation and fees. They include:

- Reimbursable plus fee for profit*
- Cost plus fee *
- Target price
- Guaranteed maximum price (GMP)
- Escalation Clause
- Unit rate
- Negotiated fixed price
- Lump sum

* Subcontracts can be on either Owner's or supplier's paper

There are various factors impacting project risks; some are within the contractor's control and some are not. Similar to project uniqueness, Owner desires or requirements, project needs, and external factors play a role in affecting project risks. These include:

- Extent of scope and schedule definition
- Change management
- Price guarantees required by Owner, including total project cost, direct cost, or professional services only
- Estimate accuracy and confidence
- Commodity pricing
- Escalation and market conditions
- Fixed price subcontracts
- Incentives based on performance
- Claims

A fixed price lump sum project places financial risks on the contractor, but provides certainty to the Owners. Contractors must cover this risk, and do so with additional contingency and profit, taking away from the real property value of the project.

A few key terms for a successful contract include a mutual waiver of consequential damages, balanced indemnity, and a mutually agreed contract liability cap, which are generally defined below. It is imperative to have a contract whereby all parties seek the best interests of the Owner and successful project completion instead of self-protection.

Mutual Waiver of Consequential Damages – is meant to limit the parties' liability to one another to direct damages. Limiting or eliminating the availability of consequential damages reduces the monetary incentive to escalate a claim and eliminates some uncertainty as to what risks the parties are reasonably undertaking when they enter into a construction project together. The waiver can be extremely important because the direct damages flowing from a breach can be dwarfed by those associated with the consequential damages a creative attorney can come up with.

For instance, the defects in the construction of a project may result in direct damages in the form of added costs to the Owner for repairs. However, consequential damages can spiral to include loss of expected profits and damage to the Owner's business reputation.

Balanced Indemnity – serves to protect both parties from litigation associated with third party claims. In other words, a third party cannot sue an Owner and name the contractor as an associated party in hopes of finding a depth of resources, and vice versa.

Limitation of Liability – permits contracting parties to reduce the potential for direct, consequential, special, incidental, and indirect damages. The cap on damages is typically set at the fee for the services provided.

A successful EPCm contractor must deliver these elements of strategy, controls, and people to translate into project success. Using a cost plus EPCm approach can provide potential savings or increased project scope value for the same budget. By comparing the potential cost impacts of increased contingencies related to verifying lump sum or GMP price risk with possible reinvestment of those savings, the cost plus EPCm approach can yield a 2.5 to 5 percent savings.

Benefits of Cost Plus EPCm Approach

- Provides streamlined communications and decision making by having a single point of contact
- Reduces the number and cost of Owner resources needed
- Eliminates duplicate project controls and reporting from separate design and construction firms, improving operating efficiency and saving redundant management/support personnel costs
- Eliminates finger pointing between design and construction and reduces reaction time for decision making by holding accountable a single responsible party
- Greater input, support, and coordination from the full project team (design, construction, procurement, maintenance) from pre-planning through construction and startup, all looking out for the Owner's interest
- Higher potential for innovative and mixed contracting strategies – time and materials, unit price and lump sum pricing options to engage critical subcontractors earlier
- Greater flexibility to respond to and incorporate Owner requested changes while minimizing the cost impacts often associated with extended general conditions
- Reduces total project delivery time/schedule through greater fast-track "overlapping" of design and construction
- Increases transparency through "open book" estimating, pricing, bidding, and change control
- Improves consistency in reporting and quality standards
- Improves communication and management of customer operations and needs via a single entity integrated project team
- Enforces a project based on the "end in mind" – commissioning and turnover
- Supports better Owner decision making and response time due to cost reporting on an open book real time basis
- Better manages and minimizes escalated costs of key commodities such as steel, concrete, fuel, transportation, and labor through subcontract price indexing or allowances if needed
- Achieves better value by promoting effectively tailored and sequenced procurement packages
- Improves detailing and coordination in final design since key equipment can be pre-purchased earlier to provide critical vendor data/input

- Keeps the project on schedule due to rapid response to field coordination issues
- Maximizes efficiency in the field through increased quality management, resulting in shared design and construction resources for administration, communication, quality control, and schedule control
- Better supports the implementation of lean principles such as integrated project teams, early subcontractor involvement, and treating craft as customers
- Allows team to hit the ground running and be immediately productive by integrating procedures and controls systems for design and field operations
- Enhances start-up by detailing early commissioning plans and schedules with maximum involvement of client operations and maintenance staff and equipment vendors

ALTERNATIVE PRICING STRUCTURES

There are also alternative pricing structures available under this model that are attractive to some Owners.

Cost Plus Fixed Fee with Target Price & Performance Incentives

The Target Price is set at the beginning of the project as Owner's budget funding limitation. EPCm Contractor works to design and build to that budget with incentives and a portion of fee at risk tied to achieving those targets.

Advantages include:

- Full alignment of EPCm & Owner interests to maximize project value rather than protect GMP
- All unused contingency and budget underruns accrue to Owner
- Reduced EPCm risk fee and contingency allows more scope for budget
- Achieves reasonable price security with 95% + of all costs locked down as lump sum subcontracts and fees at the beginning of construction
- Minimizes potential for adverse positions on changes, contingencies, schedule impacts, etc.

Disadvantages include:

- Owner does not have total price guarantee (GMP) for entire project.

COST PLUS FIXED FEE WITH GMP & SHARED SAVINGS

The GMP is set near the end of design based on bids received from subcontractors. All construction costs are still billed to and paid by Owner on a cost plus basis subject to the GMP threshold.

Advantages include:

- Owner has total price guarantee for entire project from EPCm Contractor

Disadvantages include:

- Overall price guarantee drives higher fee for risk and contingency in GMP
- Reduced percentage of total project budget is available for “bricks and mortar” project scope
- Creates potential for Owner and EPCm Contractor interests to diverge on issues such as changes, contingency use, schedule impacts, etc.
- Increases required documentation to define and protect GMP

DELIVERABLES

- Contract Packaging and Procurement Strategies’ Plan

Task 14 | Preparation and Subsequent Support of Contract Bid Documents and Bidding Process

Dependent on the outcome of the Contract Packaging and Procurement Strategies Plan, we will develop appropriate solicitation documents. Our Team has extensive experience managing FTA Best Procurement Practices and is intimately familiar with procurement requirements for projects funded with federal assistance. We also have thorough understanding of NJ TRANSIT's procurement regulatory environment and a good working relationship with NJ TRANSIT's senior procurement management team, which will allow us to work as a true extension of your daily team.

Our procurement team, with our experience handling a wide variety of procurement methods, can provide whatever level of assistance is required by NJ TRANSIT's procurement officer for the project. We expect to assemble comprehensive solicitation packages that are compliant with federal, state, and NJ TRANSIT regulations and requirements, and provide for a competitive bidding environment. Given the unique nature and proposed contracting strategy, we will evaluate NJ TRANSIT's boilerplate bid and contract documents, and make recommendations, as may be necessary to maximize competition and protect NJ TRANSIT's interests.

Our Team has decades of experience managing solicitations, from cradle to grave. As a construction contractor with construction experience in this marketplace, we are used to dealing with the equipment manufacturers and can help guide NJ TRANSIT through the appropriate terms and conditions negotiations. We will provide assistance to NJ TRANSIT's procurement staff as needed at every step of the process. We will prepare solicitation documents, coordinate market outreach and conduct market analysis, incorporate all necessary provisions, forms and certifications into the solicitation packages, draft advertisements, manage bidder lists and communications, manage responses to RFIs, draft addenda, and provide support in evaluating bids and/or proposals.

If a best value process is employed for this project, our procurement team can provide support to develop appropriate RFP packages, including development of project specific evaluation criteria, a detailed evaluation plan, assist in the assessment of technical and cost proposals, provide support during negotiations, assist in drafting award recommendations, and preparing conformed contract documents prior to execution of the contracts.

We will work hand-in-hand with NJ TRANSIT Procurement throughout the solicitation process to make sure they are provided with the necessary support at every step, and also to provide advice gained from our years of experience to verify the procurement process goes smoothly. We are sensitive to issues that could lead to protests and will take the necessary steps to mitigate that possibility.

Task 15 | Analysis of Ancillary Services Market Revenue Opportunities

We will review all power market opportunities for sales from NJ TRANSIT's plant. Wholesale energy and capacity sales, previously described in section 2.10 of this proposal, will constitute a major portion of project power revenues. If we consider only PJM's generation costs and ignore transmission and administrative costs, those two power products account for over 95% of PJM's costs. Naturally, those two power products account for over 95% of generator revenues as well. Ancillary services provide critical support for the safe and reliable of the PJM bulk power system, but make up less than 5% of generation revenues and therefore will not be as large of a value driver for NJ TRANSIT. However, certain offerings in the ancillary market have incredible market opportunities currently based on scarcity of offerers

PJM ANCILLARY SERVICES

As a PJM resource interconnected to the bulk power system, the NJ TRANSIT plant will have opportunities to sell some ancillary services, and we will make sure we include the associated revenues in the economic screening analysis as well as in the final cost-benefit analysis we prepare for NJ TRANSIT. We will investigate all feasible options for the NJ TRANSIT plant to earn additional revenues through the opportunities to provide ancillary services as well as energy and capacity.

FERC Order 888 defined six ancillary services that apply to PJM and other wholesale power markets:

- Scheduling, System Control and Dispatch
- Reactive Supply/Voltage Control
- Regulation and Frequency Response Service
- Energy Imbalance Service
- Operating Reserve – Synchronized Reserve Service
- Operating Reserve – Supplemental Reserve Service

PJM provides Scheduling, System Control and Dispatch and Reactive Supply/Voltage Control on a cost basis. PJM provides Regulation, Energy Imbalance, Synchronized Reserve, and Supplemental Reserve services through market mechanisms in which generators submit bids and PJM selects the lowest-priced bids. Although not defined by FERC as an ancillary service, Black Start plays a comparable role. PJM provides Black Start service on the basis of incentive rates or cost. The largest of PJM's ancillary services is operating reserves, i.e. plants that can provide additional energy on short (10 minute or 30 minute) notice.

Given the intermittent load profile expected, it is highly likely that some form of energy storage will prove to be a valuable asset for island operation. FERC Order 755 sets out the structure of the "pay for performance" frequency regulation market in PJM. If robust, fast-response, short duration energy storage is included on site as part of the project to stabilize NJ TRANSIT's load when operating as a microgrid, NJ TRANSIT would have a valuable power management tool that would enable it to participate in PJM's frequency regulation market while grid connected.

As a consumer on the PJM grid, NJ TRANSIT will have real time obligations for frequency regulation costs that cannot easily be managed or hedged, except through the ownership or control of a fast-acting frequency regulation resource such as energy storage. Short duration energy storage could also be used to manage and reduce the "spikey" loads associated with multiple train departures – effectively flattening the load profile, easing generator operations, and reducing demand charges.

To be effective in both roles, it would be important to select equipment that includes high cycle applications. Subject to our preliminary design work and economic screening analysis, we feel that this requirement may be best served by flywheel energy storage technology. We have experience with Beacon Power Flywheel technologies, having designed two 20MW frequency regulation plants for them, one in PJM and one in NYISO. Essentially a mechanical battery, flywheels have significantly greater cycling ability, no operating constraints, and virtually zero degradation compared to electrochemical batteries. In the relatively new energy storage field, this is well proven technology with, over 10 million flywheel operating hours and 370 GWH of grid energy injected and absorbed while providing frequency regulation service from these two facilities.

Section 5

Task 16 | As Directed by NJ TRANSIT

Under this task, we will provide NJ TRANSIT supplemental Design and Engineering Consultant services, not currently covered in the contract. The cost of these additional services will be paid for under an Allowance Item and in accordance with the established Change Order procedures. Work will be authorized by a Directive Letter that will be issued by the NJ TRANSIT Contracting Officer. This approach will expedite mobilizing supplemental support and specialty services. We are pleased to offer additional support in the following areas:

CIVIL/STRUCTURAL ENGINEERING

- Viaducts and Bridges
- Catenary Structures
- Building Structures
- Transmission Structures
- Underground Utility Relocation
- Geotechnical Engineering
- Hydrology and Hydraulics

TRANSPORTATION PLANNING/ENVIRONMENTAL ANALYSIS

- Major Investment Studies
- Environmental Impact Statements (NEPA/SEQRA)
- Feasibility Studies
- Rail Operations Analysis
- Environmental Permitting
- Noise/Air Quality Analysis
- Hazardous Materials
- Cultural Resources
- Natural Resources/Wetlands

FACILITIES

- Maintenance Shops
- Storage Facilities
- Locomotive Fueling Facilities
- Passenger Stations
- Park-and-Ride Facilities
- ADA Compliance
- Parking Lots and Garage Structures
- LEED – Compliant Architectural Design

COMMUNICATIONS SYSTEMS

- Fiber Optic Systems
- Telecommunications
- SCADA Systems
- Public Address/Public Information Systems
- Radio Systems
- Audio/Visual Systems – CCTV

SIGNAL SYSTEMS/TRAIN CONTROL

- Automatic Block Signal Systems
- Cab Signaling
- Centralized Traffic Control
- Control Centers
- Highway Grade Crossings
- Block Layouts
- Factory and Field Testing

Section 5

TRACK ENGINEERING

- Alignment and Drainage
- Special Trackwork/Interlockings
- Main Line Track
- Yards

TRACTION POWER ENGINEERING

- Substation Engineering
- DC Power System Studies
- Third Rail Distribution
- Catenary Design

ELECTRICAL DESIGN

- Transmission Systems
- Electric Distribution Services
- Interior and Site Lighting
- Current Testing and Control
- Cathodic Protection

CONSTRUCTION AND PROJECT MANAGEMENT

- Cost Estimating
- Specifications
- CPM Scheduling
- Construction Staging
- Value Engineering
- Constructability Review
- Field Inspection/Supervision

Phase II | Construction Assistance/ Engineering Support

During Phase II, the Jacobs Team will provide Construction Phase Support to NJ TRANSIT and its Construction Manager. The major areas of work are defined and detailed in Tasks and details listed below:

Task 1: Shop Drawing Review

Task 2: Technical Meetings and Workshops

Task 3: CPM Schedule Review

Task 4: Participation in Construction Progress Meetings

Task 5: Risk Management

Task 6: Systems Coordination and Testing

Task 7: Support NJ TRANSIT in Dispute Resolutions

Task 8: Change Order Analysis Support

Task 9: NJ TRANSITGRID Start-Up Support

Task 10: Project Closeout Support

Task 11: Alternate Designs

Task 12: As-Directed by NJ TRANSIT

Our approach is to become seamlessly integrated into the Construction Delivery Team. As a supporting member, we will provide the services described below and act as a NJ TRANSIT advocate throughout Phase II.

We make sure that our key technical staff are made available throughout the Construction Phase to support the Project.

Section 5

Task 1 | Shop Drawing Review

Under this task, we will provide shop drawing reviews and coordination. The major deliverable under this task is a high quality and timely review of all required submittals. We will document, track, coordinate, and distribute review comments through the Project Controls Management System. The most significant risk associated with this task is the untimely review of critical components that could delay the release of long lead items for fabrication or work from being performed. This will be managed through the PCMS Submittal log that notes all open submittals and the days that they have been in for review. The Submittal Log will be published and reviewed at all construction progress meetings.

Typical Submittals that will need to be coordinated and reviewed for conformance to the plans and specifications:

- DB Submittals Register and Plan
- Manufacture's Drawings
- Catalog Cuts
- Data Sheets and Calculations
- Fabrication, Assembly, and Erection Drawings
- Commissioning Plans
- Safety, Environmental, and Fire Protection Programs
- Working Drawings
- Quality and Safety Plans
- Inspection and Test Plans
- Quality Control Program
- Operating & Maintenance Manuals
- Site-Specific Work Plans (SSWP)
- Samples

As part of our Project Execution Plan we will provide a Construction Document Control Submittal Procedure that includes a naming convention and file structure. The Design-Builder will be responsible for loading their documents for review into the PCMS.

A submittal matrix will be developed and contain detail of all required submittals, scheduled submittal dates, responsible design reviewer and responsible NJ TRANSIT coordinator/reviewer. We will also develop a document distribution matrix to make sure that the proper people receive copies of submittals.

Once the submittal has been reviewed and all comments consolidated, the submittal will be assigned on of the following statuses:

1. Approved – full conformity. In this case, the document control officer closes the submittal. Work can begin against the submittal.
2. Approved as Noted – approved, but the changes noted become part of the submittal. The document control officer closes the submittal, and distributes the revision accordingly. Work can begin against the submittal.
3. Approved as Noted Resubmit – indicates comments. The contractor is allowed to order, ship, and install this equipment on the condition that the comments are addressed. Resubmittal for record purposes is required.
4. Revise and Resubmit – In this case, the required revisions are extensive enough that the submittal needs to be revised before work can begin against the submittal. The review cycle would have to be restarted. The revisions requested are noted and become part of the submittal until the new version is produced. During the review of the new version, the submittal is reviewed for conformity to each revision request that was noted in the previous version.

Amtrak ASDP Documentation

Contract/Task: ______________________

Project Manager: ______________________

Revision: ______________________

Date: ______________________

DISTRIBUTION

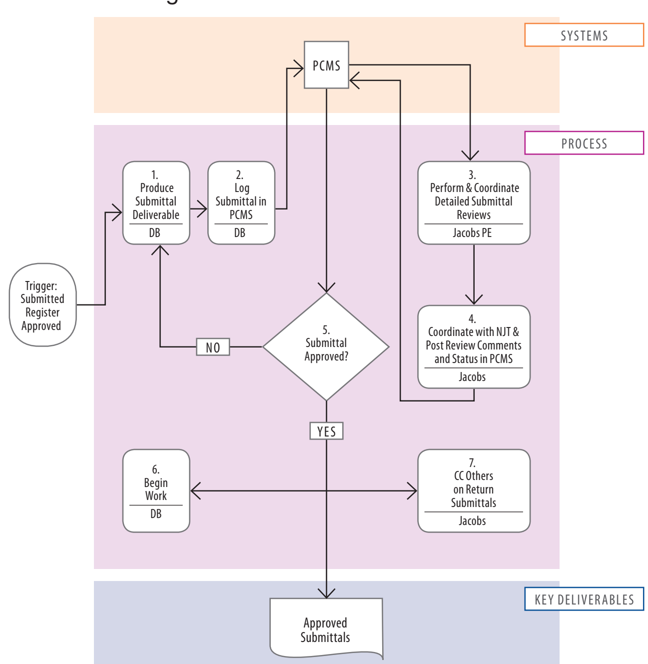
NAME	TITLE	ABBREV.	Design Submittal Documents	Procurement Submittal Documents	Construction Submittals	RFIs	General Correspondence	Meeting Minutes	Daily Reports	Monthly Reports	General Issues	Safety	QA/QC	NCNs	GC Invoice	Change Management Documents	Cost Information	Schedule Information	Punch List Information	As-Built	Documents	Other	COMMENTS
	Amtrak Project Manager	APM																					
	Amtrak Contracting Officer	CO																					
	Amtrak Contracting Officer's Tech Rep	COTE																					
	Amtrak Resident Engineer	ARE																					
	Jacobs Project Manager	JPM																					
	Jacobs Project Engineer	PE																					
	Jacobs Design Professional	DP																					
	Jacobs Resident Engineer	RE																					
	Jacobs Inspector	IN																					
	Jacobs Contract Administrator	CA																					
	Jacobs Document Control Admin.	DCA																					
	Jacobs Project Controls	JPC																					
	General Contractor Project Manager	GC																					
	General Contractor Field Rep	GCRE																					
	Ancillary Contractors	AC																					

5. **Rejected –** In this case, the submittal has deficiencies so serious that a list of revision requests cannot be coherently documented and still maintain the integrity of the submittal. The document control officer closes the submittal and makes a note that it needs to be entirely re-done. When the replacement submittal is received, it is processed as the next review cycle for that submittal.

6. **Not Applicable –** Indicates the submittal was returned un-reviewed or cancelled.

Our experience has shown that sometimes the traditional approach to reviews needs to be approached from an out of the box mindset. When special conditions arise and an expedited review is required on critical or highly technical subjects, we have successfully performed "over the shoulder" design and submittal reviews with the DB designer of record at a meeting location.

Submittal Management



Section 5

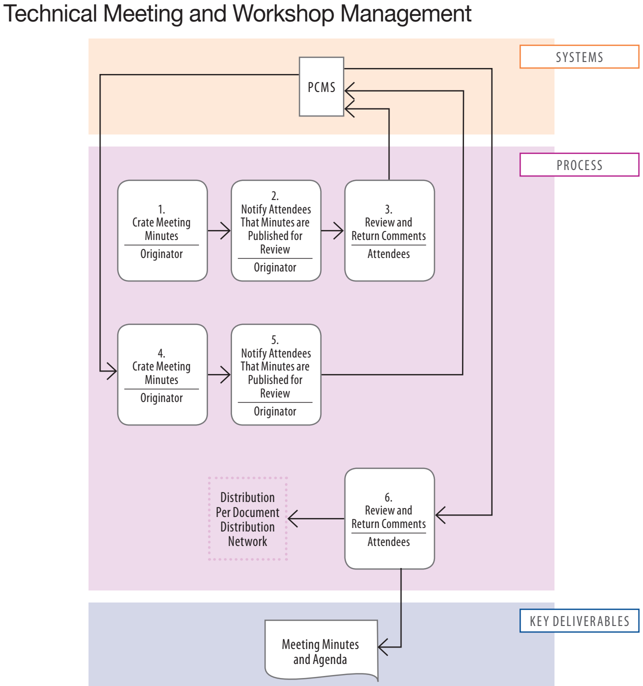
Task 2 | Technical Meetings and Workshops

Under this task, the Jacobs Team will attend pre-bid and pre-construction meetings and workshops, and answer design related technical questions during the construction and procurement phases of the project. The most significant risk associated with this task is the lack of detailed documentation on items that were discussed and agreed to during technical meetings and workshops.

We will provide detailed Meeting Minutes of all technical meetings and workshops hosted by Jacobs. The Meeting Minutes will be filed in the PCMS and distributed to all attendees.

To maximize documentation and minimize confusion, we recommend audio recording all technical meetings and workshops and filing the sound file in the PCMS system where they can be reviewed if any clarification is required. We recorded all Weekly Project Meetings during the Amtrak ARRA Program and this procedure proved to be a real time saver when issues were questioned down the road.

Technical Meeting and Workshop Management



Task 3 | CPM Schedule Reviews

Under this task, we will assist NJ TRANSIT's Construction Manager with the review of the initial baseline project schedules as well as monthly project schedule updates. The most significant risk associated with this task is the lack of detailed activities, improper logic (sequences and durations) on the baseline schedule, and overstated progress on schedule updates supplied by the Design-Builder. If these issues are not corrected in the initial schedule submittal, the schedule will not reflect the correct status throughout the life of the project. It could also complicate the Time Impact Analysis process if claims are encountered in the future.

We will provide a timely written response to the Construction Manager for all schedule reviews that detail our areas of concerns and observations. We will also request supporting information from the Design-Builder(s) when observations are made that require supporting data.

We recommend that we use a Torch Light Report to highlight how all critical deliverables and activities are trending on a project. We developed the Torch Light Report on the Amtrak ASDP Program to get a snapshot of how critical activities were trending on a month-to-month basis. The Torch Light Report tracks selected activities that are exported out of Primavera P-6 and tracks their completion status as well as variance of Total Float for the week, over the last 3 months and from a designated milestone. A pink color designates a total variance up to 10 days while a red variance indicates a variance over 10 days. Additional variance ranges/parameters can be set up based on project needs.

We would recommend setting up a custom Torch Light for this Project to be used as a weekly or monthly executive schedule overview.

Task 4 | Construction Progress Meetings

Under this task, we will attend and participate in all Construction Progress Meetings and support NJ TRANSIT's Construction Manager. The most significant deliverable for the Progress Meeting is the reporting out on the status of all submittals, RFIs and resolving all design technical support issues.

We will come prepared to report on all of our deliverables and distribute an RFI, Submittal, and Issue Reports that show the status of all outstanding deliverables similar to the one on this page.

Jacobs Engineering Group **Demo Test Station**

Submittal Log

Job No: PC **Date: 2/8/2011**

Project No: 101 **Page: 1 of 1**

					Required		Latest Dates				
Package	Submittal	Rev.	Title	Status	Start	Finish	Rcvd.	Sent	Return	Forward	BIC
	1. ADA ASSESSME	001	ADA Assessment	AAN	11/2/2010	11/16/2010	11/2/2010	11/10/2010	11/18/2010	11/16/2010	
	2. SCHEMATIC	001	Schematic Design	APP	11/22/2010	12/6/2010	11/22/2010	11/26/2010	11/29/2010	12/6/2010	
	3. 65% DESIGN	001	65% Design Submittal	APP	12/13/2010	12/27/2010	12/13/2010			12/27/2010	
	4. 95% Design	001	95% Design Submittal	NEW	12/28/2010	1/10/2011					JEG
	5. IFB DOCS	001	Issued for Bid Documents	AAN	1/25/2011	2/8/2011	1/25/2011	1/25/2011	1/25/2011		JEG
02700	02700-001	001	15" RCP Culvert Pipe	NEW	1/3/2011	2/3/2011	1/4/2011	1/17/2011			WDCO
02700	02700-002	001	18" RCP Culvert Pipe	AAN	1/17/2011	2/28/2011	1/17/2011	2/16/2011	2/22/2011	2/23/2011	
02700	02700-003	001	24" RCP Culvert Pipe	NEW			1/20/2011				ACMEGC
02700	02700-004	001	34" X 22" HF-3	NEW			1/17/2011				ACMEGC
02700	02700-005		Storm Drain Type A								ACMEGC
02700	02700-006		Storm Drain Type B								ACMEGC
03100	03100-004		Formwork shop drawing II								JEG
03100	03100-005		Formwork calculations								JEG
03200	03200-001		Wall footings rebar								JEG
03200	03200-002		Column rebar								JEG
03200	03200-004		Foundation wall rebar								JEG
03300	03300-001		Cement Certificate for Grout								JEG
03300	03300-002		Concrete Mix - 3000 PSI								JEG
04210	04210-001		Facing Tile Sample "Stark"								JEG
04210	04210-002		Facing Tile Base								JEG
04210	12000000		test								JEG
04400	04400-001		Mortar Type N								JEG
04400	04400-002		Mortar Type S								JEG
05300	05300-001		Roof Panels								JEG
05300	05300-002		Roof Panel								JEG
08000	08000-001		Custom Frames								JEG
08000	08000-002		Custom Doors								JEG
09000	09000-001		Acoustical Ceiling - Type A								JEG
09000	09000-002		Acoustical Ceiling - Type B								JEG
09000	09000-004		Acoustical Grid								ACMEGC
15300	15300-003		Piping / Fitting								ACMEGC
15300	15300-004		Pipe Rollers								ACMEGC
15400	15400-001		Plumbing Fixtures								ACMEGC
15400	15400-002		Water Heater								ACMEGC
15400	15400-003		Plumbing Fixtures								ACMEGC
16500	16500-003		Light Fixtures								ACMEGC
16500	16500-004		Switchboards								ACMEGC
16700	16700-001		Security System								ACMEGC
16700	16700-002		Alarm System								ACMEGC

Primavera ® Report R_SB_01

Task 5 | Risk Management

Under this task, we will develop and maintain the Risk Matrix and Risk Management Plan through Final Design and the Construction. The Risk Matrix and Risk Management Plan will be developed and maintained as described under Phase I, Task 7 – Risk Management of the Proposal.

To make sure the Risk Register is an integral part of the Construction Phase, we will make it a standing agenda item at each Construction Progress Meeting. The Risk Register will be updated after each monthly construction progress meeting to include actions and discussion from the meeting and to also reflect the progress of the project.

Design, procurement, and construction based risks are listed on the Risk Register that is located in Phase I, Task 7- Risk Management of this Proposal.

Task 6 | Systems Coordination and Testing

An important risk for new microgrid/power generation projects is accepting systems prior to complete and thorough checkout and commissioning. Each system must be individually and thoroughly checked out to verify that each and every component is installed, calibrated, tested, and operating correctly. Failure to do so can result in an inability for the system to operate, reliability issues, equipment damage, and potential impact to human life. As such, we take this task very seriously. Once the equipment is selected and a path forward, during the design and shop drawing phases of the project, we will collect data for each and every piece of equipment and subsystem. These documents will include the individual start-up, installation, and commissioning procedures for these systems. However, the interoperability of the systems will not be thoroughly documented. The Jacobs Team will work with NJ TRANSIT, the installation contractors, the equipment suppliers, etc. to make sure a valid and comprehensive testing and start-up procedure will be developed well in advance of system readiness.

We will coordinate the establishment of a comprehensive calibration plan for all instruments whether factory-installed by manufacturers or field-installed by contractors. This coordinated plan and the resulting documentation and verification will be critical to verifying the accuracy and correct operations of the utility systems and control. We will coordinate reviews of control systems in conjunction with NJ TRANSIT, Amtrak, and HBLR Operations staff, as well as representatives from PSE&G, and the equipment vendors, including coordination of instrumentation and graphics. Specific emphasis will be placed on understanding and planning for the integration of the control systems between demand and supply for both real and reactive power dispatch both in island and grid connected modes. Coordination and integration of the control systems and instrumentation will be a key component to the success of this project and will remain a prime focus of the team throughout all phases.

Testing activities will focus initially on functional performance testing for individual pieces of equipment within the systems, and individual systems. This portion of the commissioning effort will be designed to determine whether or not the equipment and systems will work as pursuant to the design intent and basis of design. When this commissioning effort has been completed and any required equipment and system changes, modifications, and repairs that the commissioning effort exposed have been completed, the integrated testing of the systems will commence.

Integrated system testing will focus on the operation of all equipment and systems together and whether their integrated operation will provide the services detailed in the design intent and basis of design under different operating conditions. The operating conditions typically tested are operating and failure sequences, with interruption and/or loss of exterior utility power, and with all systems available emphasizing the interconnections between the systems. Testing relating to isolation or loss of one component or the other will also be conducted to enable resiliency through a single failure. Other operating conditions that might become apparent during the development of the commissioning effort will be included as necessary.

Any issues identified during the individual systems and equipment functional performance testing and the integrated systems testing will be tracked by the Team through the Commissioning Corrective Issues Report. Resolutions to all items within the Corrective Issues Report will be tracked and coordinated with the construction and design teams. Retesting will be performed as necessary on the systems based on resolution identified for the individual items.

The testing plan must require careful testing procedures for the protection and control systems, as well as the basic ASME PTC code tests for any of the power island equipment. The systems that can really impact reliability are the protection and control systems. We will work from the protection oneline diagrams, fully developed P&IDs, and control loop drawings to develop in-depth testing procedures for each and every component. A vital component that will be thoroughly scrutinized is the electrical protection coordination and relay settings. Roger Copeland, who also is the project manager, will have a keen interest in this scope. Roger began his career as a protection and control engineer and continues to be the Jacobs authority on protection and control systems for device coordination

Task 7 I Dispute Resolution Support

Under this task, our Team will provide all assistance as may be required to resolve any issue that may arise pertaining to the interpretation of the plans and specifications. The major deliverable under this task is Progress Meeting and Workshop attendance and providing assistance in the preparation of any dispute analysis, report, or other response as may be required. The most significant risk associated with this task is not providing a timely review and response, which could eventually have an adverse impact on the project schedules, budget, logistics, resources, or quality.

To make sure we do not fall into the trap of untimely responses on Issues, we manage Issues through a rigorous Issue Management Process as detailed below.

1. Identify the Issue: Project issues can usually be categorized as one of the following types:
   - Resource – equipment availability, personnel availability, material availability, contractor issues
   - Legal – Right of way, environmental, contractual etc.
   - Partnership – assignment of responsibilities, disagreements over project direction, etc.
   - Other issues that do not fall under any of the above categories (issues associated with progress, weather, etc.)

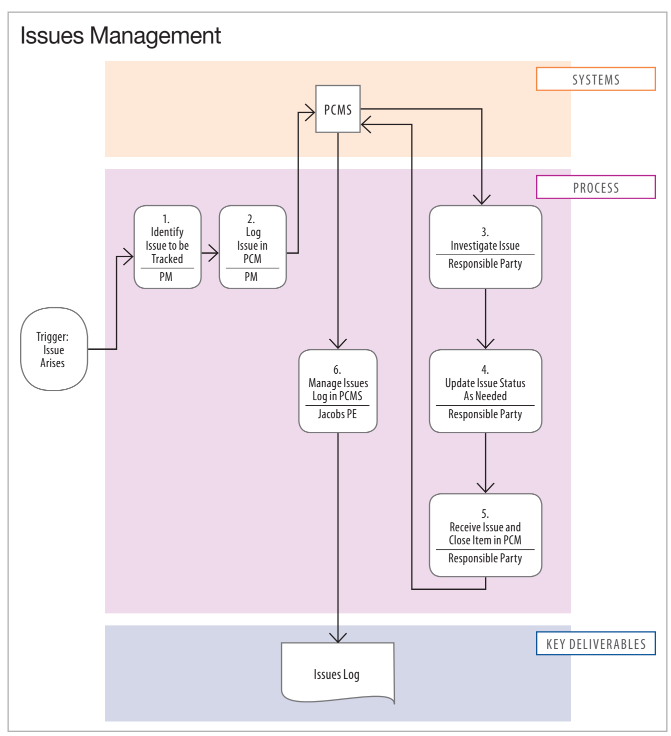
2. Log the Issue: Once the issue has been identified, the Project Engineer logs it and links all correspondence and documents associated with the issue. A person on the project team is then assigned the responsibility for the resolution of the issue.

3. & 4. Investigate and Update the Issue Status: Some issues require a number of steps or events to take place before they are resolved. These events can be meetings, agreements, or follow-up actions that have been taken. In order to clearly see how the issue has been resolved, these events are documented with an Issue entry in the PCMS.

5. Resolve and Close The Issue: Once the final decisions have been made on the issue resolution it is distributed and closed in the PCMS.

6. Manage & Produce Issues Log: We will produce and distribute an updated Issue Log for all Project Meetings to ensure that all Issues are being tracked, resolved and do not have an adverse impact on the project schedules, budget, logistics, resources or quality.

We also anticipate that as part of Task 14, we will assist NJ TRANSIT in developing appropriate dispute resolution clauses for any stand-alone contract packages. While such clauses are useful, our goal is to provide sufficient administrative support during design and construction to avoid the necessity for either party to initiate a formal dispute process or legal action.



Section 5

Potential disputes should be identified and resolved as early as possible through negotiation or through a structured change order process.

NJ TRANSITGrid, given its size, complexity and numerous interfaces, could potentially give rise to disputes on many fronts, including scope, delays caused by others, design development and approvals, issues during construction, and during commissioning and testing. Jacobs, given our past experience managing major, technically complex projects, is well positioned to support NJ TRANSIT throughout the design and construction of the project to manage and mitigate potential disputes.

Our procurement leader, Stan Grill, has an industry-wide reputation for fairly and effectively handling of disputes with contractors. He is also currently working with NJ TRANSIT staff to manage the difficult relationship with NJ TRANSIT's Statewide LMR Network contractor. With Stan's involvement, that project has been turned around, and the contractor is now working diligently towards completion of this much delayed project. Effective resolution of disputes requires careful review of contract requirements and contract records, and then taking a strategic approach to conflict resolution that is most likely to result in an acceptable outcome. Over the years, Stan has been instrumental in resolving significant disputes with contractors, both during his tenure at MTA NYC Transit, and then subsequently when managing Amtrak's national-wide ARRA funded infrastructure upgrade program.

Task 8 | Change Order Analysis Support

Under this task, we will provide assistance to NJ TRANSIT's Construction Manager in the Charge Order process. We will assist in the analysis of all changed conditions related issues and will participate in the negotiations associated with this work. The major deliverables under this task are a thorough evaluation of the validity of the change request and its associated Time Impact Analysis. It is important to provide a thorough and timely review/response so there is no adverse impact on the project schedules, budget, logistics, resources, or quality.

The Jacobs Team is well positioned to support NJ TRANSIT during design and construction to make sure changes are managed expeditiously and follow a structured process that is compliant with all Federal, state, and NJ TRANSIT regulations. It is critical for good change management to verify during the preparation of the solicitation packages under Task 14, detailed requirements for change management are included in the contract provisions.

Supported by our design managers, field engineering staff and procurement team, our Project Controls team will oversee change management during design and construction to make sure changes are tracked, documented, and fully compliant with all regulatory requirements. Project Controls will support NJ TRANSIT at every step in the change order process and maintain timely and accurate records of all changes.

Jacobs, as an experienced project management company, has detailed, well-defined change management practices, which will be adapted for and used to support NJ TRANSIT for this project. Our change management processes are designed to control and expeditiously track and process both contractor and owner initiated changes. Our processes include:

- Development of project-specific Change Management Procedures and Change Order templates;
- On-going maintenance of Change Order Control Logs;
- Clearly defined Change Order review and approval processes;

Section 5

- Management of Requests for Information (RFI); Field Change Notice (FCN); Change Order Requests (COR); Potential Change Order (PCO); Requests for Proposal (RFP); and Change Orders (CO);
- Comprehensive review of CORs to include determinations that the work is out-of-scope; the work needs to be done; the request is complete and all required COR forms have been provided by the contractor; the COR is technically and commercially acceptable;
- Preparation of comprehensive change order justifications, including:

— Procurement history;

— Narrative explanation of the change;

— Independent cost estimate;

— Impact on D/SBE goals, as applicable;

— Record of negotiations;

— Cost/Price analysis;

— Funding source;

— Recommendation

With deep experience providing change management support on numerous federally funded projects, we can make sure changes on this project will not only be carefully managed, but will be adequately documented to meet all FTA requirements. The change order files will be maintained to fully meet all requirements for FTA audit review, including FTA requirements for an independent cost estimate, cost/price analysis, and written record of procurement history. Jacobs will also verify all changes conform to applicable Federal cost principles for allowable costs and are not in conflict with any FTA prohibited procurement actions.

When a Change Request is received, we will perform an independent review and analysis of the request, develop recommendations, and evaluate the merit of the request. The primary step in our evaluation is an in-depth gathering of information. The typical sequence of events in order to prepare includes, but is not limited to:

The primary step in our evaluation is an in-depth gathering of information. The typical sequence of events in order to prepare includes, but is not limited to:

- Review progress meeting minutes/record of proceedings
- Review any key letters associated with the pending claim
- Review plans and specifications
- Interview contractor project representatives
- Interview consultant construction manager representatives, if applicable
- Interview your project staff representatives
- Interview specialized material fabricators, if applicable
- Review available change order requests
- Review project testing records, if applicable
- Analyze the construction CPM baseline schedule and corresponding updates

We will review and analyze the information furnished through the aforementioned activities to provide professional opinions on the merits of the pending request, including any payment or settlement recommendations applicable to the major topics of contention as submitted.

Section 5

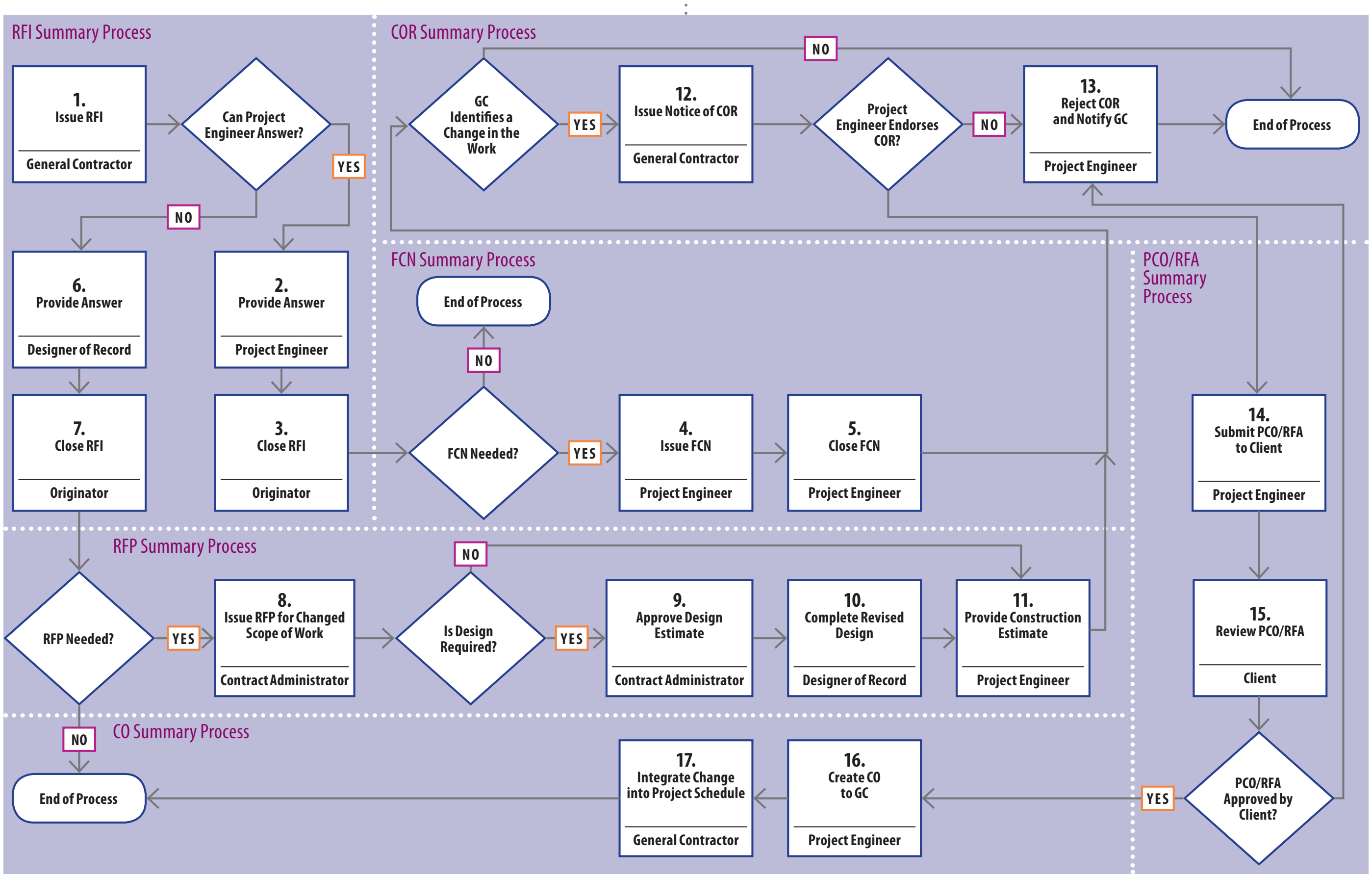
As the diagram shows, there are typically five trigger events that are associated with Change Order Requests:

1. Additional information about a particular piece of the work to be done is requested (RFI/Notice)
2. Field conditions that had not been anticipated (FCN)
3. There has been a requested change in scope (RFP)
4. There has been a delay that is outside of the contractor's control (COR)
5. An unsolicited GC change order request (COR)

A Request for Information (RFI) is issued when there is a project-related question that requires documented clarification. An RFI is initiated by the Design-Builder/ General Contractor. Based on the Answer to the RFI, a Field Change Notice (FCN) or Request for Proposal (RFP) may be required to be issued and the RFI can be closed out. An RFI should not be used a Change Order Request.

A Field Change Notification (FCN) is issued when there is a deviation from the contract scope due to site/field conditions. If the FCN results in additional cost or time then the DB/GC is required to submit a Change Order Request.

A Request for Proposal (RFP) would be generated if NJ TRANSIT wanted additional work performed that is outside of the DB/GC contract scope. If design is necessary, then Jacobs would provide a design estimate to NJ TRANSIT for approval, complete the design, and provide the design to DB/GC so they can submit a COR based on the design. If design is not needed or is simple enough to be red-lined, then the DB/GC, in response to the RFP, will submit a COR. We will provide assistance in evaluating the COR to validate the pricing. If the CM

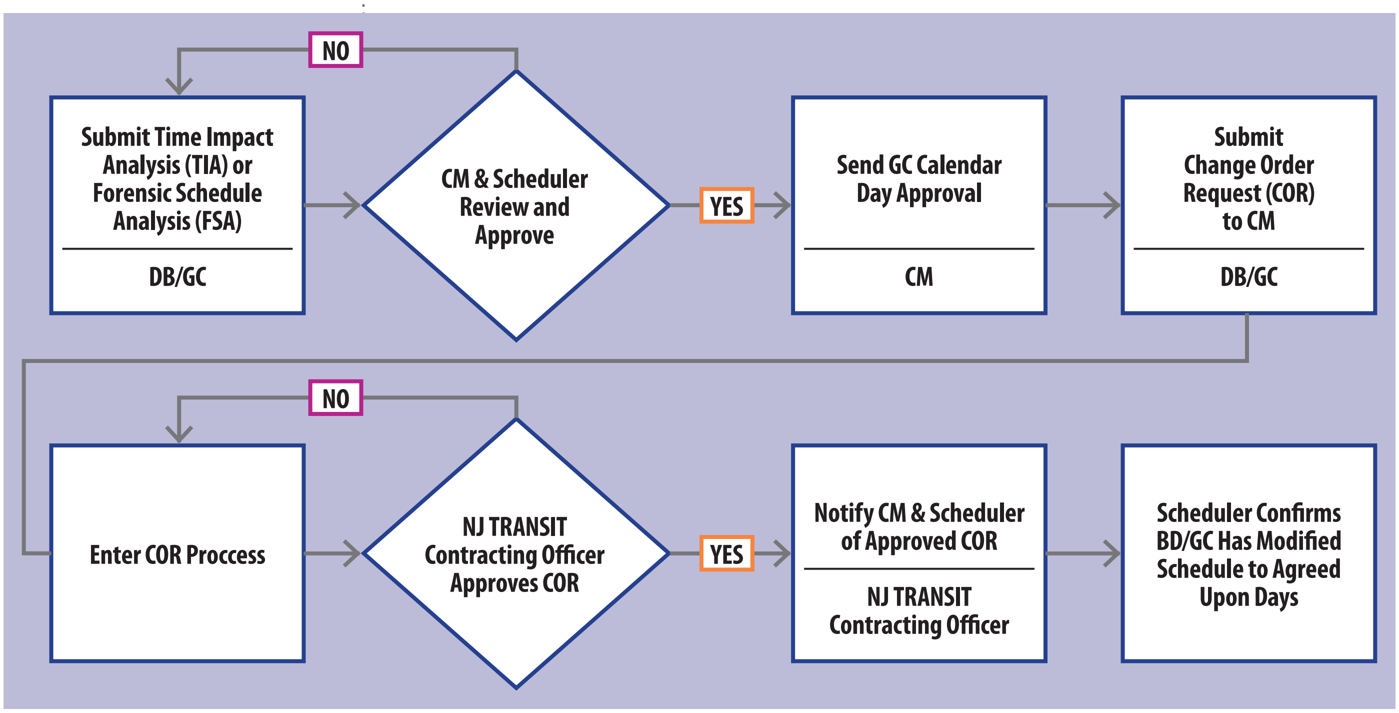


supports the COR document it is moved into the PCO/ RFA work process for approval on each. If the COR is determined to be inadequate or not justified, then it is either sent back for revision or rejected and closed out.

The COR process is the vehicle used by the DB/GC to forward pricing of a change to the CM so the CM can determine if it is justified. If the COR is determined by the CM to be inadequate or not justified, then it is sent back to the DB/GC for revision or rejection. If the COR is determined by the CM to be justified, then the CM enters the COR information into the appropriate area of the PCO document, and concurrently attaches all supporting documents to the PCO to be forwarded to the Client. A Change Order Request can be triggered by a request from Client (RFP) or Jacobs (FCN) for unanticipated field conditions, or by DB/GC (COR) for a change in conditions that are outside the GC's control.

Once the CM has validated that the COR is justified and supports a COR from the DB/GC, it is forwarded to Client as a PCO for approval.

An additional tool we have used to great success associated with Change Order Requests and Claims Analysis is to use a Forensic Schedule Analysis, where the design-builder will submit a 'backward-looking' or 'retrospective analysis' method of evaluating impacts to the schedule that is performed after a delay event has occurred.



Time Impact Analysis (TIA)/ Forensic Schedule Analysis (FSA) Process

The DB/GC will refer to AACE's International Recommended Practice No. 29R-03 Forensic Schedule Analysis, Section 3.7 (Modeled/Additive/Multiple Base) through Section 4.2 (Identification and quantification of concurrent delay) for this method. The submitted FSA would include:

1. CPM calculations
2. Concept of data date used
3. Consideration of project floats
4. Consideration of critical path
5. Consideration of all available project schedules

Upon receipt of the documents, the Scheduler will perform a technical review. Once the analysis is done, the scheduler will present his findings to the Construction Manager for concurrence.

This process focuses on the time delay aspect of the claim first. If time is substantiated and can be justified we would review the cost component of the claim.

Task 9 | NJ TRANSITGrid Start-Up Support

A detailed step-wise start-up plan will be required for this complex system of power generation and distribution. It is important that the testing and start-up are sequenced on the schedule and that systems are functional when they are needed to allow the next system to come on line. Depending on the nature of the power generation that is eventually selected, the testing of gas turbines is both a prerequisite as well as a precursor to the testing of the heat recovery components. Each of these is dependent on the timely start-up of the electrical systems to run the auxiliary systems as well as to allow for the power to be taken from the generation systems for testing. Since we regularly provide the actual construction, testing and start-up ourselves, we are well versed these requirements, and will make sure the installation teams, construction managers, and equipment suppliers are fulfilling the necessary requirements for this to be a success. The Jacobs Team routinely provides on-site, full-time, start-up support for these types of projects and will provide the technical guidance during the start-up phase.

Reference verification for this scope is likely the most effective way to convey our level of service. We encourage you to call Mark Schmidt (513) 673-6907 (mobile) who was the client project manager for the confidential blackstart/macrogrid project we recently completed. He will be happy to speak to our level of commitment during construction, testing, start-up, and commissioning.

Task 10 | Project Closeout Support

Under this task, we will provide assistance to NJ TRANSIT's Construction Manager by checking all As-Built drawings provided by the Contractor(s) for compliance with the contract plans and specifications, approved shop drawings, and approved deviations. The major deliverables under this task is a thorough review to verify the completeness of the As-Built drawings and verification that all changes and modifications encountered during the project duration have been incorporated into the As-Bulits.

We have found that periodic audits of the Design-Builder's As-Built Drawings have helped reinforce the importance of having up-to-date As-Builts. We recommend that this be an agenda item at each Progress Meeting and also found it to be a Best Practice to assign a dollar value to the drawings on the monthly pay estimate.

We will also provide the engineering and design review oversight support to assist NJ TRANSIT staff in determining that all Project related permit and regulatory approval conditions are satisfied as well as any other Project Closeout work requested.

Task 11 | Alternate Designs

Following direction by NJ TRANSIT, we will perform reviews of all alternate designs proposed to be used or implemented by the contractors, equipment manufacturers, and other business enterprises performing services for the Project including the review of contractor VE proposals.

Recommendations will be made as to the validity and appropriateness of utilizing any proposed design, which deviates from the original plans and specifications.

Task 12 | As Directed by NJ TRANSIT

Under this task, we will provide NJ TRANSIT supplemental Design and Engineering Consultant services, not currently covered in the contract. The cost of these additional services will be paid for under an Allowance Item and in accordance with the established Change Order procedures. Work will be authorized by a Directive Letter that will be issued by the NJ TRANSIT Contracting Officer. This approach will expedite mobilizing supplemental support and specialty services.

We are pleased to offer the following additional services:

- Archeological
- Architecture
- Civil Engineering
- Communications
- Configuration Management
- Constructability
- Construction Inspection
- Construction Management
- Cost Estimating
- Document Controls
- Economic Screening Analysis
- Environmental Permitting Support
- Financial Pro Forma
- Force Account Coordination
- FTA Reporting Compliance
- Gas Supply & Transportation
- Generation Plant Engineering
- Geotechnical

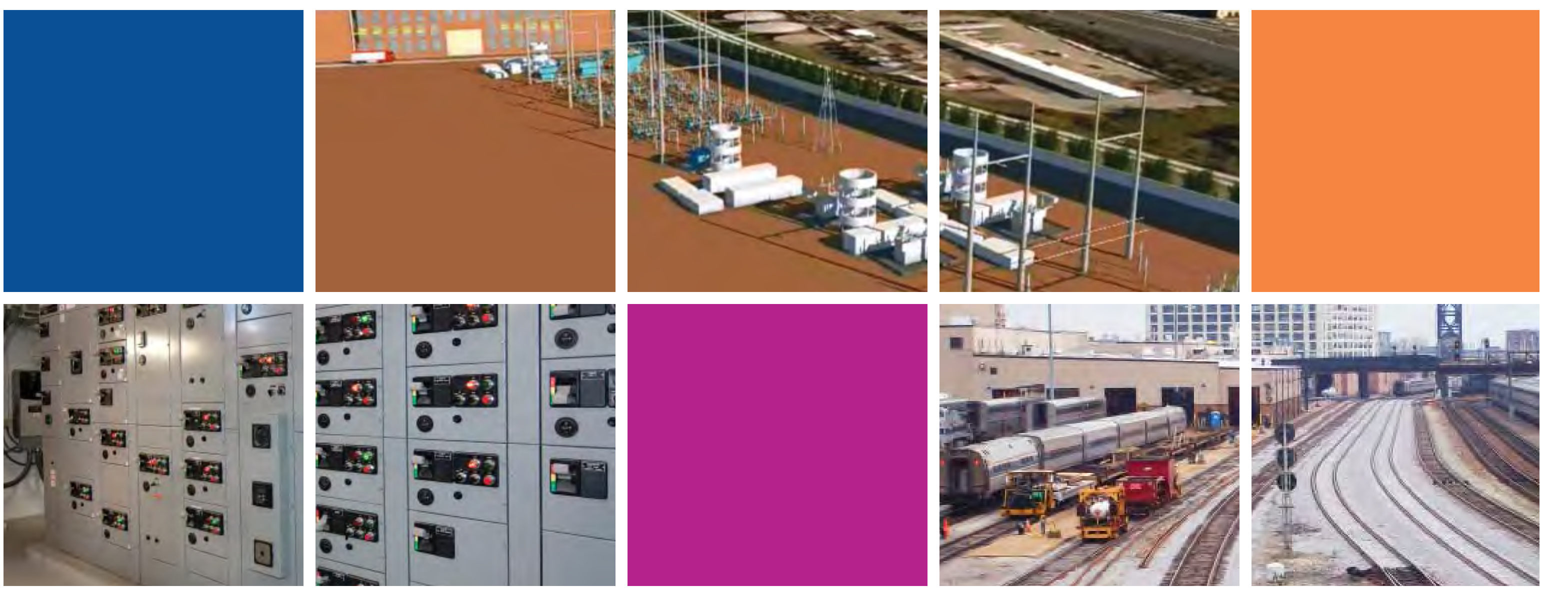
Section 5

- Grant Management
- HBLR Distribution
- Hydraulics/Drainage
- Interagency Coordination
- Landscape Architecture
- Microgrid Design
- Microgrid Planning & Engineering
- Negotiation for Power Sales
- Overhead Catenary System
- Peer Review
- PJM Regulations &Interconnection
- Power Transmission/Interconnection
- Procurement
- Program Management
- Project Controls
- Project Management
- Public Outreach
- Quality Assurance & Quality Control
- Quality Control
- Rail Operation Analysis
- Rail Power Analysis
- Rail Power Study
- Rail Substation Design
- Railroad Engineering
- Regulatory/PJM Interconnectivity
- Risk Management
- ROW Mapping
- Safety Compliance
- SCADA Coordination
- Signals
- Stakeholder Coordination
- Structural Design
- Substation Design
- Surveying
- Transmission and Interconnectivity Design
- Utility Engineering/Relocation
- Value Engineering

Section 5

Fully charged. Ready to go. Jacobs NJ TRANSITGrid Team

6 Team Organization/Resource Allocation



Section 6 | Team Organization/Resource Allocation

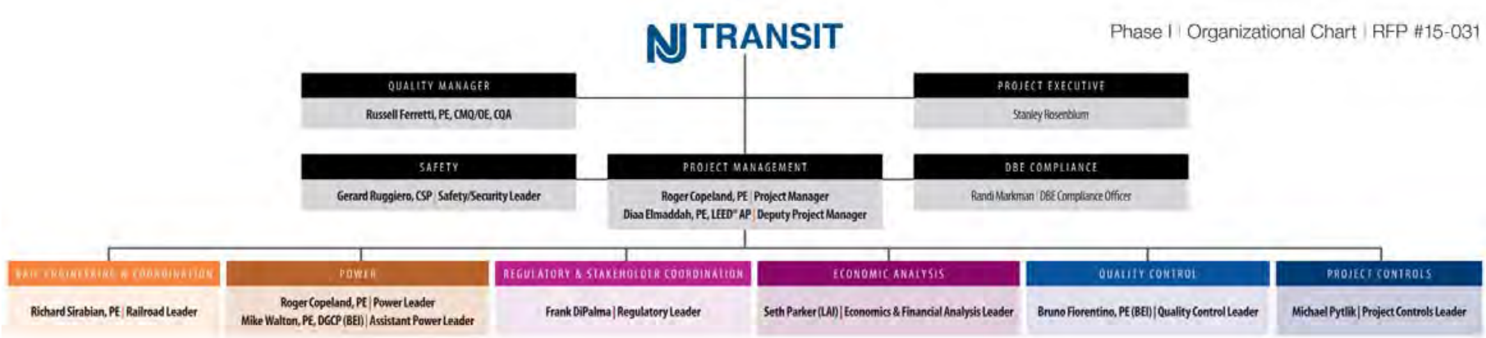
Organization Structure

Our organization is structured to have a strong Project Manager (Roger Copeland) with power and regulatory experience and a Deputy Project Manager (Diaa Elmaddah) with strong railroad engineering and operations expertise. Roger and Diaa provide the overall management for the project (The Management Team). Reporting directly to Roger are the Assistant Power Task Leader (Mike Walton); Regulatory & Stakeholder Coordination Task Leader (Frank DiPalma); Economic & Financial Analysis Task Leader (Seth Parker); Safety/Security Leader (Gerry Ruggiero), and DBE Compliance Officer (Randi Markman). Reporting to Diaa are the Rail Engineering & Coordination Task Leader (Rich Sirabian); Quality Controls Task Leader (Bruno Fiorentino); and Project Controls Task Leader (Mike Pytlik). In addition, Diaa is responsible for coordinating all support engineering services required by the Engineering Task Leaders.

The Quality Manager (Russell Ferretti) will be responsible for quality audits and quality assurance and reports directly to our Project Executive (Stanley Rosenblum). Roger also reports directly to Stanley. Roger meets monthly with Stanley to review overall performance of the project, while Stanley makes sure Roger has the resources needed and the availability of staff committed to the project.

Our Project Management Team is structured to maximize productivity, provide strong project management control, encourage collaboration and coordination, and equip each person with well-defined roles and responsibilities for each task identified in the RFP.

- *We are the team with the "right stuff" and structure you need to power up this microgrid and keep NJ TRANSIT and Amtrak constantly fired up and moving patrons from here to there!*



EMPOWERED PROJECT MANAGER: ROGER COPELAND

As Project Manager, Roger is responsible for making certain the project is delivered on budget, on schedule, and to your satisfaction. He is your single point of contact regarding the delivery and execution of the project. In addition, Roger is the liaison between all parties implementing this project. He serves as the ultimate decision maker on the resolution of issues regarding project administration and engineering issues related to the design of the power plant and transmission and distribution lines.

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- *The benefit to you under this organizational structure is that Roger can address, resolve, and commit to decisions, directly with you. This builds trust between your Project Manager and Roger; resolves issues before they begin to fester; and avoids unnecessary delays caused by the failure to act quickly.*

- *The benefit to you from the creation of our "two in the box management" is it enables total integration of all aspects of the project. Roger's focus on the strategic execution of the project and the power design, and Diaa's focus on the tactical execution of the work and the rail design provides a comprehensive management approach to the project.*

Roger is empowered to make decisions for Jacobs and has full and immediate access to Stanley Rosenblum (Project Executive).

THE PROJECT MANAGEMENT TEAM: ROGER COPELAND AND DIAA ELMADDAH

Our organization chart shows Roger and Diaa as "two people in one management box". This two in the box reinforces the partnership and interconnectivity of the responsibilities and work to be performed by Roger and Diaa (The Project Management Team). Roger's focus is on driving the overall direction of the project, interaction, and communications with your Project Manager, regulatory third parties, external stakeholders (except Amtrak), and the power engineering scope. As mentioned above, reporting directly to Roger is Diaa Elmaddah, Frank DiPalma, Seth Parker, and Michael Walton. Diaa's focus is on day-to-day management of the project; oversight of the work effort by the Rail Engineering & Coordination Task Leader (Richard Sirabian), the Project Controls Task Leader (Michael Pytlik), and the Quality Control Task Leader (Bruno Fiorentino). Roger is the strategic driver of the project, and Diaa is the tactician. Together, they review the budget, the earned value, schedule, and quality of the work performed. They also focus on design integration and seamless coordination between the power scope and the rail scope.

With Roger's expertise in microgrids and the regulatory environment, and Diaa's expertise in rail engineering and operations, you will have a high level of confidence that our Project Management Team creates a project culture that is focused on the full integration of design, quality execution, timeliness of work product, and adherence to schedules. As part of their duties, Roger and Diaa have weekly meeting with a set schedule to review: 1) Deliverables for the upcoming week; 2) Open work items; 3) Schedule; 4) Budget; 5) Quality; and 6) Safety. At these meetings, Roger and Diaa review areas requiring additional management or support and decide who will take ownership on resolving and mitigating any risk to the project. Afterwards, Diaa provides Roger with an update on the budget and schedule.

Experienced Technical Task Leaders

The six Task leaders are responsible for a specific scope of work as indicated in our organizational chart. Task Leaders have the appropriate discipline leaders reporting directly to them. For example, the Rail Engineering and Coordination Task Leader, Rich Sirabian, has rail power modeling, electric traction, communications/signals, railroad operations liaison and the site/civil/structural staff (except for the microgrid platform) report directly to him. Each Task Leader is directly accountable for the schedule, budget, and quality of work they are managing. The Task Leaders make sure their direct reports are properly safety qualified and trained. Furthermore, the Task Leaders report to either Roger or Diaa, as previously indicated. The Technical Task Leaders, their reporting relationship, and task responsibilities are as follows:

Section 6

The Power Task Leader, Roger Copeland, supported by Michael Walton, have management over all of the power plant planning and engineering work including the design of the microgrid, the transmission and distribution systems and the communications, SCADA, and cybersecurity elements of the microgrid. Roger and Mike are responsible for making sure safety in design is a key element of the power plant. In addition, they have the structural engineering responsibility for power station platform/foundation. Michael Walton reports to Roger Copeland.

The Rail Engineering Task Leader, Richard Sirabian, has management of the non-power design elements of the project (except for the platform for the power station) including rail traction power/OCS, signals/communications, civil, overall site preparation including drainage and utilities, and traffic mitigation. Reporting to Rich are the discipline leaders for traction power, overhead catenary systems, signals, communications, structures (except for the power station foundation/platform). Richard Sirabian reports to Diaa Elmaddah.

The Regulatory & Stakeholder Coordination Task Leader, Frank DiPalma, is responsible for the overall utility regulatory strategy and plan. Reporting to Frank are the PJM Interconnection, PSE&G, NERC, FERC, NJBPU, and third-party coordinators (except for Amtrak). Frank and his team's scope of service includes all matters related to regulatory requirements and interface. Frank reports directly to Roger Copeland.

The Economic & Financial Analysis Task Leader, Seth Parker, is responsible for developing the economic and financial analysis required to understand the financial viability of the power plant and provide the economic analysis required by PJM. Reporting to Seth are individuals responsible for power price forecasting, fuel price forecasting, cost-benefit analysis, economic screening analysis, and cost estimating. In addition, Charles Wedel reports to Seth, and serves as Financial Advisor developing organizational concepts. Seth reports to Roger Copeland.

The Quality Control Task Leader, Bruno Fiorentino, is responsible for the execution of the quality on the project and the preparation of all plans and documents required to guide or track quality performance. Bruno is the lynchpin for developing all the policies and procedures required to achieve a high standard of quality within each discipline and the integration of design disciplines to assure project success. Bruno will be responsible for the development of the Quality Management Plan, DCP, Interface and Integration Management Plan, constructability reviews, Value Engineering, and other quality control procedures. Bruno works closely with the Russell Ferretti (Quality Manager - Assurance Officer) to address all issues identified in quality audits. For each issue identified, Bruno develops a Project Improvement Notice that establishes specific actions to be taken. Furthermore, Bruno implements quality procedures for all subconsultants. Bruno reports to Diaa Elmaddah.

The Project Controls Task Leader, Mike Pytlik, is responsible for all scheduling, cost reports, documentation control reports, and other reports needed to assess the progress and execution of the project. Mike's direct reports include the scheduler, cost engineer, and document control staff. Mike reports to Diaa Elmaddah.

- *The designation of six Technical Task Leaders benefits you by centralizing and clearly identifying the responsibility and accountability for each discrete set of deliverables. Therefore, you know all tasks, subtasks, and deliverables are assigned, and if necessary can have a meeting with any individual Task Leader to review progress on the project.*

The Team

As Project Manager, Roger holds regularly scheduled meetings with the Leadership Team. This Team consists of Roger Copeland, Diaa Elmaddah, Rich Sirabian, Mike Walton, Frank DiPalma, Seth Parker, Bruno Fiorentino, Mike Pytlik, Gerry Ruggiero, and Randi Markman. Also invited to the management meeting is Russell Ferretti, the Quality Manager. However, to avoid a conflict of authority, the Quality Manager is not considered a member of the Leadership Team, since his role involves independent oversight over the execution of the quality plan and quality performance of the Team. Russell attends these meetings to provide input and guidance on quality issues that have arisen during the quality audit process.

Relationship between Project Management Team and Top Management of the Firm

Stanley Rosenblum, the Project Executive assigned to this project, is a Vice President of Jacobs with full authority to conduct business on behalf of Jacobs. Stanley also has direct authority over the project. As mentioned earlier, the Project Manager (Roger Copeland) reports directly to Stanley. Stanley is the project advocate within Jacobs and received assurances from other Jacobs executives with staff assigned to this project that they are fully dedicated to this project until released by the Roger with concurrence from Stanley.

As for non-Jacobs employees assigned to this project, we have received commitments from the executives from each firm that those individual mentioned on the organization chart are available to work on this project for the full duration.

Project Office, Project Staffing, Hardware, and Support to Successfully Manage and Complete the Work

Jacobs and or subconsultants certify that a full-time office will be maintained during the entire project period. We are using the Jacobs Morristown, NJ office as the location of the Project Office. The Morristown office is a full-service engineering office that has been the location used for every major project performed by us on behalf of NJ TRANSIT. The Morristown office is located within 30 minutes of your headquarters in Newark, NJ, and has the space to accommodate the consolidation of designated project staff.

For each new project, we require the Project Manager to develop a Technology Assessment to identify all the software, hardware, connections, and other IT support needed to properly manage and communicate among the team members. This includes the establishment of the project website, and the resolution of any firewall issues that may arise within the Team or between the Team and you.

Section 6

Prior to the Notice to Proceed, Stanley invites the executives from our subconsultants to attend an “Executive Meeting”, whereby Roger and Diaa review the schedule, staff resources, expectations, and deliverables for the project with them. This meeting provides Roger the opportunity to define the staffing and other resources required to manage and complete the plan; thus, providing you with a high-level of confidence that the project team is properly aligned and ready to go! In addition, on a monthly basis, Stanley reviews the ability of the Jacobs Team to meet the requirements of the project, and if necessary will take internal or external actions to address support issues in a timely manner.

Management Structure and Assigned Personnel Fit Into Scope of Services & How Staff Assignments Vary Over the Project Time Frame

Roger and Diaa are assigned to the project through both Phase 1 and Phase 2. Their hours are concentrated in the Project Management Task 1, but their involvement in the project extends throughout the project and includes a level of engagement at each task and subtask level. The Technical Task Leaders’ (Rich Sirabian, Roger Copeland, Mike Walton, Frank DiPalma, Seth Parker, Bruno Fiorentino, and Mike Pytlik) involvement ebbs and flows dependent on their engagement in particular tasks and subtasks. Our approach focuses the Technical Task Leaders on areas where they have a direct responsibility or a significant integration role. Russell Ferretti, Gerry Ruggiero, and Randi Markman also remain throughout the project, but their hours ebb and flow too depending on the task or subtask being undertaken. Similar to Roger and Diaa, the hours for Russell, Gerry, and Randi are primarily assigned in Task 1 of Phase 1, but their involvement extends to the entire project.

Individual Staff

Individual staff assignments are targeted to the specific work they perform. These individuals have discrete hours to deliver discrete tasks. Once their limited scope is completed, they will no longer be engaged in the project. However, should questions arise or additional work required, these individuals will remain available to support these efforts.

Subconsultants

Most of the subconsultants’ work is limited to Phase 1 of the project. Upon completion of their scope of work, they will no longer be engaged with the project. The major exception to this is Burns and LKG. Burns is involved in both Phase 1 and Phase 2. Their hours are aligned to match their level of responsibility. LKG provides document support services and remains with the job until it is closed out.

Section 6

- *We believe our nest staffing plan assigns the right people to the right tasks at the right level of involvement.*

Maximizing Your Resources by Focusing Our Effort

We have developed our staffing plan based on the scope of services provided, our understanding or assumption of your expectations, and our experience in managing projects of a similar nature. On several occasions, this philosophy of "right-sizing" effort has resulted in Jacobs not using the fully allocated budget to accomplish the job. At the same time, with a project of this complexity and uniqueness, we do not want to understaff the assignment. Jacobs will mobilize the necessary resources, but have the bench strength to ramp up if necessary. When a task or assignment is completed, we will assess roles and ramp down to avoid unnecessary effort on the project.

Changes in Key Staff

As per the RFP requirements, if any changes in key staff need to occur, we will seek written approval from you prior to making any changes.

Manpower Allocation, Man-Hour Allocation, and Assigned Individuals Performing Scope

See the attached matrices.

NJ TRANSIT

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LEGEND

Jacobs Engineering Group Inc.
Burns Engineering, Inc. (BEI)
Levitan & Associates, Inc. (LAI)
LTK Engineering Services (LTK)
InfraMap Corp. (IMC)
exida Consulting LLC (EXC)
Resume included **indicated by bold type.**
*All staff is Jacobs, unless otherwise indicated.

DBE SUBCONSULTANTS:
GTS Consultants, Inc. (GTS)
Jersey Boring & Drilling (JBD)
LKG-CMC, Inc. (LKG)
Matrix New World Engineering, Inc. (MNW)
Richard Grubb & Associates, Inc. (RGA)
SJH Engineering, PC (SJH)
Sowinski Sullivan Architects, PC (SSA)
Sullivan Cove Consultants, LLC (SCC)

QUALITY MANAGER
Russell Ferretti, PE, CMQ/OE, CQA

PROJECT EXECUTIVE
Stanley Rosenblum

SAFETY
Gerard Ruggiero, CSP | Safety/Security Leader

PROJECT MANAGEMENT
Roger Copeland, PE | Project Manager
Diaa Elmaddah, PE, LEED® AP | Deputy Project Manager

DBE COMPLIANCE
Randi Markman | DBE Compliance Officer

RAIL ENGINEERING & COORDINATION
Richard Sirabian, PE | Railroad Leader

MODELING
William Lipfert (LTK) | Rail Power Analysis/Operations Modeling

ELECTRIC/TRACTION
Daren Petroski, PE (BEI) | Sr. Traction Power Leader
Robert McPherson, PE | Sr. Traction Power
Kalaivanan Uthirapathy, B.Eng, C.Eng, MIET | Static Frequency Converter

COMMUNICATIONS/SIGNALS
William Wiedmann, MIRSE (BEI) | Signals Leader
Frank Velazquez | Signals
William George | Communications
Robert Rosa, PE | Energy Management
Robert Rosa, PE | SCADA Coordination

RAILROAD OPERATIONS
Manuel Cabrera | Rail Coordination/Force Account

SITE/CIVIL
James Homoki, PE | Site/Civil Leader
Kenneth Bienkowski, PE, AVS | Utilities Engineering/Relocation
Thomas Decker, PE | Hydraulics/Drainage Engineer
Michael Kaminski, PE | Sr. Structural Engineer
Gerard Ruggiero, CSP | Construction Safety (Railroad)

POWER
Roger Copeland, PE | Power Leader
Mike Walton, PE, DGCP (BEI) | Assistant Power Leader

POWER PROCESS
Kent McAnally, PE | Lead Power Process Engineer
Herbert Tull, PE | Lead Mechanical Engineer
Joseph Saltarelli, PE | Mechanical Engineer

POWER ELECTRICAL
Darrell Widner, PE | Lead Electrical Engineer
Michael Lewis, PE | Electrical Engineer
Kalaivanan Uthirapathy, B.Eng, C.Eng, MIET | Substation Engineer
Anthony Marsh, PE | Relay and Coordination Engineer
Robert Rosa, PE | Power SCADA
John Beaudry, PE | Lead I&C Engineering
Morgan Sutton, PE | Electrical Engineer

CYBERSECURITY
Eric Persson, CompTIA Network+, CISSP, CACE (EXC) | Cybersecurity

TRANSMISSION / DISTRIBUTION
Asif Bhangor, CPEng, RPEQ | Transmission Engineer
Daryl Scott, MIE, CPEng, RPEQ | Distribution Engineer
Randy Winks, PE (BEI) | RR Coordination/Integration (Wires)
Anthony Zeloyle, PE | RR Coordination/Integration (Structures)

STRUCTURES
Gabriel Serna, PE | Structural Engineer
Cesar Vallenilla, PE, PhD | Structural Engineer
Robert Witte, Jr., LEED® AP (SSA) | Architecture
Stephen Donohoe, PMP | Construction Safety (Facility)

REGULATORY & STAKEHOLDER COORDINATION
Frank DiPalma | Regulatory Leader

PJM INTERCONNECTION
Edward Tsikirayi (LAI) | PJM Regulations & Interconnection
William (Michael) Williams | PJM Coordination/Administration

REGULATORY INTERFACE
Frank DiPalma | BPU Interface & Coordination
Michael Rafferty | PSE&G Interface, NERC, & NPCC
John Graham, Esq. (SCC) | FERC

GAS SUPPLY
John Bitler (LAI) | Gas Supply

THIRD PARTY COORDINATION
Jonathan Livingston | Agency Liaison
Michael Rafferty | Utility Liaison
Jayne Yost, AICP | FTA Reporting Compliance
Jeffrey Stiles, PP, AICP | Public Involvement

ECONOMIC ANALYSIS
Seth Parker (LAI) | Economics & Financial Analysis Leader

FINANCIAL STRUCTURE
Charles Wedel, CPA | Financial Structure

ECONOMIC ANALYSIS
Seth Parker (LAI) | Negotiations for Power Sales
Alex Mattfolk (LAI) | Power Price Forecasts, Plant Operational Modeling
Matthew DeCourcey (LAI) | Fuel Price Forecasts
Michael Rafferty | Cost-Benefit Analysis

ECONOMIC SCREENING
Philip Curlett, PE (LAI) | Economics Screening Analysis

COST ESTIMATING
Venket Tiruchirappalli, PE (SJH) | Costing Estimating
William (Steve) Jones | Capital Cost Estimating
William (Michael) Williams | O&M Cost Estimates

QUALITY CONTROL
Bruno Fiorentino, PE (BEI) | Quality Control Leader

Kevin Fox, PE | Quality Control - Power
Dale Legg, PE | Quality Control - Rail

CONSTRUCTABILITY
Dale Legg, PE | Constructability Leader
Steven Eichinger, PE, LEED® AP | Electrical
Randy Winks, PE (BEI) | Transmission Lines
Philip Semler | Rail
Rodney Carpenter | Cogeneration Construction Specialist

RISK MANAGEMENT
Michael Albergo, PE, PMP, LEED® AP | Risk Mgt. Facilitator/Leader
Richard LaRuffa, PE, CVS | Rail
Richard Carlson, PhD (LAI) | Regulatory / Economics

PEER REVIEW (20% DESIGN)
Peter Rasmus | Peer Review Leader

VALUE ENGINEERING
Richard LaRuffa, PE, CVS | Value Engineering

PROJECT CONTROLS
Michael Pytlik | Project Controls Leader

SCHEDULING
David Morgan, CPE, CPM | Scheduling

DOCUMENT CONTROLS
Alla Kudravitsky (LKG) | Document Control
Veronica Hollis (LKG) | Configuration Management

INTERFACE AND INTEGRATION MANAGEMENT
Mehul Gandhi, PE, PMP, PSP | Interface and Integration Coordinator

PROCUREMENT
Stanley Grill | Procurement
David Cimino | Bid Support
Roderick Schwass, LEED® AP | Grant Management

TECHNICAL & SUPPORT RESOURCES

ENVIRONMENTAL SUPPORT
James Dowling, PP, AICP, AVS | Federal/State Environmental Review
Thomas DeMichele, LSRP (MNW) | Environmental Remediation
Steve Ricucci | Environmental Permitting
Kimberly Glinkin, LEED® AP, PP, AICP | Air/Noise
Paul McEachen (RGA) | Archaeological Resources
Miles Cheang | GIS Mapping

SURVEYING / LAND SUPPORT
Rick Voss, PLS (GTS) | Surveying & ROW
James Homoki, PE | Acquisition Identification
Tammy Schlagbaum, ASLA | Landscape Architecture

CORROSION PREVENTION
Michael Shelton, PE | Corrosion Prevention

SAFETY IN DESIGN
Stephen Donohoe, PMP | Safety Design Coordinator

GEOTECHNICAL & SUBSURFACE
Christopher Ellis, PE | Geotechnical Engineering
Frank Carrozza (JBD) | Soils Borings
Donald Heck, PE (MNW) | Subsurface Investigation Support
Kenneth Kerr, PE (IMC) | Subsurface Utility Engineering

Team Organization

NJ TRANSIT

JACOBS ENGINEERING GROUP INC. (PRIME FIRM)

- Project Management
- Railroad Engineering
- HBLRT Substation Design
- Power Plant Design
- Microgrid Design
- Quality Assurance
- Safety Compliance
- FTA Reporting Compliance
- Force Account Coordination
- Procurement
- Financial Structuring
- Transmission and Interconnectivity Design
- Power Plant Engineering
- Public Involvement
- Geotechnical
- Site / Civil Engineering
- Utility Engineering / Relocation
- Hydraulics / Drainage
- SCADA Coordination
- Communications
- Project Controls
- Scheduling
- Static Frequency Converter
- Mechanical Engineering
- I&C Engineering
- Energy Management
- Risk Management
- PSE&G Interface, NJBPU, NERC, & NPCC
- DBE Compliance
- Third Party Coordination
- Regulatory & Stakeholder Coordination
- Federal/State Environmental Review & Permitting Support
- Acquisition Identification
- Corrosion Prevention
- Landscape Architecture
- Constructability
- Peer Review
- Value Engineering
- Structural Design
- Interface & Integration Management
- Cost-Benefit Analysis
- Traction Power - NJT Rail

SHARED RESPONSIBILITIES:

- Signal
- Cost Estimating

BURNS ENGINEERING, INC.

- Medium Voltage Distribution from Power Plant to Hudson-Bergen Substation
- Connection Back to Mason Substation
- Quality Control
- Traction Power – Amtrak
- Signals
- OCS
- Power Design & Engineering Support

LEVITAN & ASSOCIATES, INC.

- Economic Screening Analysis
- PJM Regulations & Interconnection
- Gas Supply & Transportation
- Plant Operational Modeling
- Negotiation for Power Sales
- Financial Pro Forma
- Power & Fuel Price Forecasting

LTK ENGINEERING SERVICES

- Load Profile Development
- Operations Modeling
- Vehicle Interface

INFRAMAP CORP.

- Subsurface Utility Engineering

EXIDA CONSULTING, LLC

- Cybersecurity

* Every member of the team and every firm is contractually responsible for the quality of their work and the safety of their people.

SOWINSKI SULLIVAN ARCHITECTS, PC (DBE)

- Architecture

GTS CONSULTING, INC. (DBE)

- Surveying
- ROW Mapping
- Deed/Title Research Coordination

LKG-CMC, INC. (DBE)

- Document Controls
- Configuration Management

SULLIVAN COVE CONSULTANTS, LLC (DBE)

- Federal Energy Regulatory Commission (FERC)

SJH ENGINEERING, PC (DBE)

- Cost Estimating

RICHARD GRUBB AND ASSOCIATES, INC. (DBE)

- Archaeological Resources

MATRIX NEW WORLD ENGINEERING CO., INC. (DBE)

- Site Specific Plan
- Subsurface Investigation & Lab Testing
- Environmental Site Remediation Support
- Preparation of Geotechnical Data Report

JERSEY BORING & DRILLING (DBE)

- Geotechnical Soil Borings

Jacobs
NJ TRANSITGrid
Team | Running on all cylinders!

Phase	Task No. and Task Description
Phase 1	**1 - Project Management & Administration**
	1.1 - Project Management Plan
	1.2 - Project Control
	1.2.1 - Final Scoping / Preliminary Engineering (PE) Schedule
	1.2.2 - Records Management Control System
	1.2.3 - Monthly Progress Reporting
	1.3 - Quality Control
	1.3.1 - Quality Management Plan (QMP)
	1.3.2 - Quality Management Plan Requirements
	1.3.3 - ISO 9001 Requirements
	1.3.4 - Quality Manager and Other Resources
	1.3.5 - Design Control
	1.3.6 - Control of Quality Records
	0.0
	1.3.7 - Internal Quality Audits
	1.4 - Peer Review of Design
	1.5 - Configuration Management
	1.6 - Project Meetings
	1.7 - Payment Procedures
	2 - Engineering
	2.1 - Verification of Concept
	2.2 - Engineering and Design
	2.2.1 - Power Plant Design
	2.2.2 - Electric Traction Power Facilities and Power Management Design
	2.2.2.1 - Amtrak Electric Traction Power / Overhead Catenary System Sub 41 (Kearny Substation)
	2.2.3 - Civil, Structural, Geotechnical, & Hydraulic
	2.2.4 - Subsurface Investigation
	2.2.5 - Topographical Survey Reference NJDOT Survey Standards
	2.2.6 - Utility Engineering
	2.2.7 - Structures
	2.2.8 - Communications Systems and Power Management Communications
	2.2.9 - Signals / Train Control Architecture
	2.2.10 - Concept of Operations
	2.3 - Existing Right-of-Way (ROW)
	2.3.1 - Right-of-Way Research and Property Acquisition Preparation
	20700.0
	2.3.2 - Screening of Parcels and PAECE Process
	3 - Cost Estimating
	4 - Federal Environmental Impact Statement (EIS)
	5 - State and Federal Permits
	6 - NJDEP Site Remediation Compliance
	7 - Risk Management

Preliminary and Final Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project
RFP No. 15-031

	Task No. and Task Description
	8 - System Safety and Security Management
	8.1 - Safety and Security Management Plan
	9 - Public Involvement and Agency Coordination
	9.1 - Open Houses and Meetings
	10 - Integration and Interface
	11 - Value Engineering
	12 - Constructability Reviews
	13 - Contract Packaging
	14 - Preparation of Subsequent Support of Contract Bid Documents and Bidding Process
	15 - Analysis of Ancillary Services Market Revenue Opportunities
	16 - As Directed by NJ TRANSIT
Phase 2	**1 - Shop Drawing Review**
	2 - Technical Meetings and Workshops
	3 - CPM Schedule Review
	4 - Participation in Construction Progress Meetings
	5 - Risk Management
	6 - Systems Coordination and Testing
	7 - Support NJ TRANSIT in Dispute Resolutions
	8 - Change Order Analysis Support
	9 - NJ TRANSITGrid Start-Up Support
	10 - Project Closeout Support
	11 - Alternate Designs
	12 - As-Directed by NJ TRANSIT

TEAM HOURS BY TASK

PHASE 1 - CONCEPTUAL AND PRELIMINARY DESIGN (0%-20%)

TASK 1 - PROJECT MANAGEMENT & ADMINISTRATION (Subtasks)

Company	1.1	1.2	1.2.1	1.2.2	1.2.3	1.3	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.4	1.5	1.6	1.7
Jacobs Engineering Group Inc.	374	1,568	1,040	348	1,105	1,240	152	8	23	145	906	171	284	850	140	2,580	228
Burns Engineering, Inc. (BEI)	0	0	0	0	0	75	75	75	75	75	75	75	75	0	0	0	0
Levitan & Associates, Inc. (LAI)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	0
LTK Engineering Services (LTK)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
InfraMap Corp. (IMC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GTS Consultants, Inc. (GTS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jersey Boring & Drilling Co., Inc. (JBD)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LKG-CMC, Inc. (LKG)	0	0	200	1,400	1,600	0	0	0	0	0	0	0	0	0	1,200	0	400
Matrix New World Engineering, Inc. (MNW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Richard Grubb & Associates, Inc. (RGA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SJH Engineering, P.C. (SJH)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sowinski-Sullivan Architects, P.C. (SSA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sullivan Cove Consultants, LLC (SCC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
exida Consulting, LLC	24	16	24	4	16	16	0	16	0	0	4	0	16	40	16	40	16
Total Hours	**398**	**1,584**	**1,264**	**1,752**	**2,721**	**1,331**	**227**	**99**	**98**	**220**	**985**	**246**	**375**	**890**	**1,356**	**2,920**	**644**

TASK 2 - ENGINEERING (Subtasks)

Company	2.1	2.2	2.2.1	2.2.2	2.2.2.1	2.2.3	2.2.4	2.2.5	2.2.6	2.2.7	2.2.8	2.2.9	2.2.10	2.3	2.3.1	2.3.2
Jacobs Engineering Group Inc.	1,728	6,985	8,210	3,308	589	6,160	38	210	1,210	1,570	698	228	1,420	64	400	192
Burns Engineering, Inc. (BEI)	700	0	0	6,600	9,750	0	0	0	0	0	2,800	800	700	0	0	0
Levitan & Associates, Inc. (LAI)	1,582	0	0	0	0	0	0	0	0	0	0	0	300	0	0	0
LTK Engineering Services (LTK)	2,452	0	0	0	600	0	0	0	0	0	0	0	0	0	0	0
InfraMap Corp. (IMC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GTS Consultants, Inc. (GTS)	0	0	0	2,500	0	0	208	880	304	0	0	0	0	520	504	20
Jersey Boring & Drilling Co., Inc. (JBD)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LKG-CMC, Inc. (LKG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Matrix New World Engineering, Inc. (MNW)	0	0	0	0	0	3,156	0	0	0	0	0	0	0	0	0	0
Richard Grubb & Associates, Inc. (RGA)	0	0	0	0	0	0	245	0	0	0	0	0	0	0	0	0
SJH Engineering, P.C. (SJH)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sowinski-Sullivan Architects, P.C. (SSA)	120	0	1,450	0	500	0	0	0	0	0	0	0	0	0	0	0
Sullivan Cove Consultants, LLC (SCC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
exida Consulting, LLC	40	16	80	80	110	0	0	0	0	32	120	110	32	0	0	0
Total Hours	**6,622**	**7,001**	**9,740**	**12,488**	**11,549**	**9,316**	**491**	**1,090**	**1,514**	**1,602**	**3,618**	**1,138**	**2,452**	**584**	**904**	**212**

TASKS 3–16

Company	TASK 3	TASK 4	TASK 5	TASK 6	TASK 7	TASK 8	Subtask 8.1	TASK 9	Subtask 9.1	TASK 10	TASK 11	TASK 12	TASK 13	TASK 14	TASK 15	TASK 16	Subtotal Phase I
Jacobs Engineering Group Inc.	1,760	980	1,130	40	838	784	137	680	315	664	882	1,320	652	1,208	370	0	55,932
Burns Engineering, Inc. (BEI)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21,950
Levitan & Associates, Inc. (LAI)	0	0	0	0	180	0	0	0	0	0	0	0	0	0	224	0	2,586
LTK Engineering Services (LTK)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,052
InfraMap Corp. (IMC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GTS Consultants, Inc. (GTS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,936
Jersey Boring & Drilling Co., Inc. (JBD)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LKG-CMC, Inc. (LKG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,800
Matrix New World Engineering, Inc. (MNW)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,156
Richard Grubb & Associates, Inc. (RGA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245
SJH Engineering, P.C. (SJH)	1,280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,280
Sowinski-Sullivan Architects, P.C. (SSA)	0	0	0	0	0	0	0	80	80	0	40	40	0	0	0	0	2,310
Sullivan Cove Consultants, LLC (SCC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	80	160
exida Consulting, LLC	80	0	0	0	24	0	40	32	32	16	0	32	0	32	32	0	1,188
Total Hours	**3,120**	**980**	**1,130**	**40**	**1,042**	**784**	**177**	**792**	**427**	**680**	**922**	**1,392**	**652**	**1,240**	**706**	**80**	**101,595**

PHASE II - CONSTRUCTION ASSISTANCE / ENGINEERING SUPPORT

Company	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10	Task 11	Task 12	Subtotal Phase II		GRAND TOTAL
Jacobs Engineering Group Inc.	5,320	3,688	3,342	4,770	864	2,314	1,948	2,684	3,002	760	1,268	0	29,960		85,892
Burns Engineering, Inc. (BEI)	3,580	2,300	800	1,440	960	1,440	1,020	2,440	2,240	2,440	1,640	0	20,300		42,250
Levitan & Associates, Inc. (LAI)	0	0	0	0	0	0	0	0	0	0	0	0	0		2,586
LTK Engineering Services (LTK)	0	0	0	0	0	0	0	0	0	0	0	0	0		3,052
InfraMap Corp. (IMC)	0	0	0	0	0	0	0	0	0	0	0	0	0		0
GTS Consultants, Inc. (GTS)	0	0	0	0	0	0	0	0	0	0	0	0	0		4,936
Jersey Boring & Drilling Co., Inc. (JBD)	0	0	0	0	0	0	0	0	0	0	0	0	0		0
LKG-CMC, Inc. (LKG)	20,700	0	0	0	0	0	0	0	0	0	0	0	20,700		25,500
Matrix New World Engineering, Inc. (MNW)	0	0	0	0	0	0	0	0	0	0	0	0	0		3,156
Richard Grubb & Associates, Inc. (RGA)	5	5	5	5	5	5	5	5	5	5	5	0	55		300
SJH Engineering, P.C. (SJH)	0	0	320	0	0	0	0	0	0	0	0	0	320		1,600
Sowinski-Sullivan Architects, P.C. (SSA)	400	80	0	80	0	0	40	40	0	24	40	0	704		3,014
Sullivan Cove Consultants, LLC (SCC)	0	0	0	0	0	0	0	0	0	0	0	0	0		160
exida Consulting, LLC	112	64	16	64	32	160	16	16	120	80	24	0	704		1,892
Total Hours	**30,117**	**6,137**	**4,483**	**6,359**	**1,861**	**3,919**	**3,029**	**5,185**	**5,367**	**3,309**	**2,977**	**0**	**72,743**		**174,338**

Preliminary and Final Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project
RFP No. 15-031
Matrix of Person-Hours by Firm

TASK 1 - PROJECT MANAGEMENT AND ADMINISTRATION

Staff Person/ Classification	Title	Discipline	1.1	1.2	1.2.1	1.2.2	1.2.3	1.3	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.4	1.5	1.6	1.7	Subtotal Task 1
Firm Name	Jacobs Engineering Group, Inc.																			
S. Rosenblum	Project Executive	Management																		0
R. Copeland	Project Manager	Power	40	100	60	40	120	80				20	120	40	60	30	24	400	60	1,194
K. McAnally	Lead Power Process Engineer	Power					30	80								16		40		166
B. Romero	Mechanical Engineer	Power																		0
H. Tull	Lead Mechanical Engineer	Mechanical Engineering					30	80								16		80		206
J. Saltarelli	Mechanical Engineer	Mechanical Engineering					30	80								16		12		138
M. Lewis	Electrical Power Engineer	Electrical Engineering					30	80								16		60		186
K. Uthirapathy	Electrical Power Engineer	Electrical Engineering					30	60								16		120		226
A. Marsh	Relay and Coordination Engineer	Electrical Engineering					30	40								16				86
J. Beaudry	Lead I&C Engineer	I&C Engineer					30	80								16		80		206
D. Widner	Lead Microgrid Electrical Engineer	Electrical Engineering					30	40								16		60		146
M. Sutton	Electrical Engineer	Electrical Engineering					30	80								16		80		206
D. Scott	Distribution Engineer	Distribution Engineer					30	20								16		20		86
C. Vallenilla	Structural Engineer	Structures					30	80								16		80		206
G. Serna	Structural Engineer	Structures					30	80								16		80		206
CADD Person	Energy & Power	Energy & Power																		0
Assistant PM	Energy & Power	Energy & Power	80	400				80								20	40	400	80	1,100
Administrative Person	Energy & Power	Energy & Power	20	20	20	20	20	20	20				20	20	20	20		100		320
R. Schwass	Grant Application	Power					15											40		55
K. Fox	Quality Control - Power	Power						80												80
R. Carpenter	Cogeneration Construction Specialist	Cogeneration																		0
D. Elmaddah	Deputy Project Manager	Structures	80	240	240	80	120	80				40	520	40	40	80	40	240	80	1,920
R. Ferretti	Quality Manager	Quality	0	0	0	0	0	0	60	0	15	53	40	15	60	0	0	0	0	243
R. Sirabian	Rail Engineering and Coordination Leader	Rail	24	8	32	8	30	20	8	8	8	32	16	16	64	16	16	128	8	442
F. DiPalma	Regulatory & Stakeholder Coordination Leader	Regulatory	80																	80
M. Pytlik	Project Controls Leader	Project Controls		800	80	200	120													1,200
S. Grill	Procurement	Procurement	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	20
R. McPherson	Sr. Traction Power	Rail																		0
F. Velazquez	Signals	Rail	0			0	0	0	0	0	0	0	40	0	20	8	0	40	0	108
W. George	Communications	Communications	0			0	0	0	0	0	0	0	40	0	20	8	0	40	0	108
R. Rosa	SCADA Coordination	Electrical Engineering	0			0	0	0	4	0	0	0	0	0	0	8	0	40	0	52
M. Cabrera	Railroad Operations / Force Account	Railroad Construction	0		8	0	0	0	0	0	0	0	20	0	0	8	0	20	0	56
J. Homoki	Site / Civil Leader	Railroad - Site / Civil																160		160
TBD	Engineer	Site/Civil																		0
TBD	CADD Support	Site/Civil																		0
K. Bienkowski	Utilities Engineering / Relocation	Utilities																80		80
TBD	Utility Engineer	Utilities																		0
T. Decker	Hydraulics / Drainage Engineer	Water Resources																80		80
J.Patel	Engineer	Water Resources																		0
K. Mosley	Permitting	Water Resources																		0
M. Kaminski	Structural Engineer	Structures																		0
W. Williams	PJM Adm. Production O&M Costs	Regulatory																		0
M. Rafferty	PSE&G Interface, CBA	Regulatory																		0
C. Wedel	Financial Structure	Finance																		0
D. Legg	Constructability Leader	Structures						80	40				90	40		100				350
P. Semler	Constructability	Rail																		0
M. Kaminski	Constructability	Structures																		0
T. Decker	Constructability	Environmental Permitting																		0
T. Zelovle	Constructability Electrical	Traction power/signals																		0
S. Eichinger	Constructability Electrical	Electrical Engineering	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	100
VE SME	Subject Matter Experts	Value Engineering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M. Albergo	Risk Management Facilitator	Risk Management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P. Rasmus	Peer Review Leader	Civil Engineer														200				200
R. LaRuffa	Value Engineering Leader	Value Enginering	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Morgan	Scheduling	Scheduling / Project Controls	0	0	600	0	200	0	0	0	0	0	0	0	0	0	0	0	0	800
D. Cimino	Bid Support	Contract Administration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10
G. Ruggiero	Safety / Security Leader	Safety / Security	20	0	0	0	0	0	10	0	0	0	0	0	0	0	10	0	0	40
K. Herlihy	Site-Specific Plan	Safety / Security	20	0	0	0	0	0	10	0	0	0	0	0	0	0	10	0	0	40
S. Jones	Cost Estimating	Power																		0
S. Donohoe	Safety Design Coordinator	Safety														60				60
R. Markman	DBE Compliance Officer	DBE					120													120
J. Livingston	Agency Liaison	Agency Liaison																		0
J. Yost	FTA Reporting Compliance	FTA Compliance	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Stiles	Public Involvement	Planning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Dowling	Federal / State Environmental Review	Environmental Review	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Ricucci	Environmental Permitting	Environmental Permitting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K. Glinkin	Air / Noise	Planning - Air / Noise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Cheung	GIS Mapping	Planning - GIS Mapping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Homoki	Acquisition Support (Part of Site/Civil)	Civil Engineer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T. Schlagbaum	Landscape Architecture	Landscape Architecture																		0
M. Shelton	Corrosion Prevention	Corrosion Prevention																		0
C. Ellis	Lead Geotechnical Engineer	Geotechnical																		0
S.Cruz	Geotechnical Engineer	Geotechnical																		0
P. Casuba	Geotechnical Engineer	Geotechnical																		0
K. Tse	Geotechnical Engineer	Geotechnical																		0
E. Wang	Geotechnical Manager	Geotechnical																		0
CADD Person	CADD Support	CADD Support																		0
Administrative Person	Administrative Support	Site/Civil																80		80
	Subtotal		374	1,568	1,040	348	1,105	1,240	152	8	23	145	906	171	284	850	140	2,580	228	11,162
Firm Name	Burns Engineering, Inc.																			
M. Walton	Assistant Power Leader	Power																		0
B. Fiorentino	Quality Control Leader	Power						75	75	75	75	75	75	75	75					600
D. Petroski	Sr. Traction Power Leader	Rail																		0
R. Winks	Overhead Catenary System Leader	OCS																		0
W. Wiedman	Signals Leader	Signals																		0
S. Tong	Power Distribution Leader	Power/Rail																		0
TBD	Miscellaneous Engineering Support	Communications																		0
Amtrak Substation Engineering Support		Rail																		0
OCS & Transmission Engineering Support		OCS																		0
HBLR Distribution Support		Power																		0
Signals & Comms Engineering Support		Signals																		0
Drafting & Admin Support		Drafting																		0
	Subtotal		0	0	0	0	0	75	75	75	75	75	75	75	75	0	0	0	0	600
Firm Name	Levitan & Associates, Inc.																			
S. Parker	Economics & Financial Analysis Leader	Economics																300		300
E. Tsikirayi	PJM Regulations & Interconnection	Regulatory																		0
J. Bitler	Gas Supply	Regulatory																		0
A. Mattfolk	Modeling	Economics																		0
M. DeCourcey	Fuel Price Forecasts	Economics																		0
P. Curlett	Economics Screening Analysis	Economics																		0
R. Carlson	Regulatory / Economics	Economics/Regulatory																		0
	Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	0	300
Firm Name	LTK Engineering Services																			
William Lipfert	Rail Power Analysis / Operations Modeling	Modeling																		0
T. Manning	Traction Power Model QA/QC	Modeling																		0
N. Willey	Rail Operations	Modeling																		0
R. Rauceo	Traction Power Modeling	Modeling																		0
C. Farnsworth	Technical Support	Modeling																		0
P. Lai	Rolling Stock Characteristics	Vehicles																		0
A. Gutman	Rolling Stock Energy Demand Optimization	Vehicles																		0
T. Kneschke	Amtrak NEC Static Frequency Converter	Traction Power																		0
	Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	InfraMap Corp																			
DIRECT EXPENSE ONLY	NO HOURS	SUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	GTS Consultants, Inc.																			
R. Voss	Project Manager	Surveying																		0
M. Zavyazkin	Project Surveyor	Surveying																		0
TBD	Survey Crew Chief	Surveying																		0
TBD	Instrument Operator	Surveying																		0
TBD	CADD	Surveying																		0
	Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	Jersey Boring & Drilling																			
DIRECT EXPENSE ONLY	NO HOURS	Need	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	LKG-CMC, Inc.																			
V. Hollis	Configuration Management	Configuration Management	0	0	200	0	200	0	0	0	0	0	0	0	0	0	1,200	0	0	1,600
A. Kudravitsky	Document Control	Document Control	0	0	0	800	800	0	0	0	0	0	0	0	0	0	0	0	0	1,600

TASK 2 - ENGINEERING

Staff Person/ Classification	2.1	2.2	2.2.1	2.2.2	2.2.2.1	2.2.3	2.2.4	2.2.5	2.2.6	2.2.7	2.2.8	2.2.9	2.2.10	2.3	2.3.1	2.3.2	Subtotal Task 2
Jacobs Engineering Group, Inc.																	
S. Rosenblum																	0
R. Copeland	100	120	240	60	40			24	24		80	40	240	24			992
K. McAnally	400		30														430
B. Romero	200		1,200														1,400
H. Tull	40		400										200				640
J. Saltarelli	40		400														440
M. Lewis	40		1,200	200	80												1,520
K. Uthirapathy	80		1,200	200	80												1,560
A. Marsh			400	60	40												500
J. Beaudry			200	200	40						80						520
D. Widner	120	1,160	1,200										80				2,560
M. Sutton	300	1,000	900										120				2,320
D. Scott	12			60	33												105
C. Vallenilla	12	300			24					150							486
G. Serna	12	600			24					300							936
CADD Person		3,000								400							3,400
Assistant PM	100		500														600
Administrative Person		120	120	120			30	30	30	80	40		40	12	12	12	646
R. Schwass	40												60				100
K. Fox	80																80
R. Carpenter																	0
D. Elmaddah																	0
R. Ferretti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R. Sirabian	40	480	20	48	48	120	8	16	16	40	18	8	120	8	8	40	1,038
F. DiPalma			80						60								140
M. Pytlik																	0
S. Grill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R. McPherson	20			2,280													2,300
F. Velazquez	20	0	0	0	20	0	0	0	0	0	0	80	80	20	20	20	260
W. George	20	0	0	0	40	0	0	0	0	0	360	20	120	0	0	0	560
R. Rosa	20	0	0	80	120	0	0	0	0	0	120	80	200	0	0	0	620
M. Cabrera	20	160	0	0	0	0	0	0	0	0	0	0	80	0	0	0	260
J. Homoki						1,500		60	60						120	20	1,760
TBD						1,500		80	60						60	20	1,720
TBD						1,000									60	20	1,080
K. Bienkowski									500								500
TBD									300								300
T. Decker						120											120
J.Patel						200											200
K. Mosley						300											300
M. Kaminski										600							600
W. Williams			120														120
M. Rafferty									80				80				160
C. Wedel																	0
D. Legg																	0
P. Semler																	0
M. Kaminski																	0
T. Decker																	0
T. Zelovle																	0
S. Eichinger	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VE SME	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M. Albergo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
P. Rasmus																	0
R. LaRuffa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Morgan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Cimino	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G. Ruggiero	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K. Herlihy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Jones																	0
S. Donohoe																	0
R. Markman																	0
J. Livingston																	0
J. Yost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Stiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Dowling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. Ricucci	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K. Glinkin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Cheung	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J. Homoki	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	40	120
T. Schlagbaum		25															25
M. Shelton	12	20															32
C. Ellis				cannot determine at this time, see pgs 86-87		240											240
S.Cruz						500											500
P. Casuba						160											160
K. Tse						300											300
E. Wang						60											60
CADD Person																	0
Administrative Person						160			80						40	20	300
Subtotal	1,728	6,985	8,210	3,308	589	6,160	38	210	1,210	1,570	698	228	1,420	64	400	192	33,010
Burns Engineering, Inc.																	
M. Walton	100			1,600	100								100				1,900
B. Fiorentino	100												100				200
D. Petroski	100				650								100				850
R. Winks					1,300												1,300
W. Wiedman	100											400	100				600
S. Tong	100			200									100				400
TBD	200				1,300						800		200				2,500
Amtrak Substation Engineering Support					2,200												2,200
OCS & Transmission Engineering Support					2,400												2,400
HBLR Distribution Support				2,400													2,400
Signals & Comms Engineering Support											800						800
Drafting & Admin Support				2,400	1,800						1,200	400					5,800
Subtotal	700	0	0	6,600	9,750	0	0	0	0	0	2,800	800	700	0	0	0	21,350
Levitan & Associates, Inc.																	
S. Parker	318																318
E. Tsikirayi	524																524
J. Bitler	160																160
A. Mattfolk	380																380
M. DeCourcey													300				300
P. Curlett	200																200
R. Carlson	0																0
Subtotal	1,582	0	0	0	0	0	0	0	0	0	0	0	300	0	0	0	1,882
LTK Engineering Services																	
William Lipfert	104																104
T. Manning	160																160
N. Willey	484																484
R. Rauceo	1,160																1,160
C. Farnsworth	264																264
P. Lai	80																80
A. Gutman	200																200
T. Kneschke					600												600
Subtotal	2,452	0	0	0	600	0	0	0	0	0	0	0	0	0	0	0	3,052
InfraMap Corp																	
DIRECT EXPENSE ONLY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GTS Consultants, Inc.																	
R. Voss				500			24	60	24					60	80	20	768
M. Zavyazkin				500			32	120	48					120	144		964
TBD				500			56	240	80					80			956
TBD				500			56	240	80					80			956
TBD				500			40	220	72					180	280		1,292
Subtotal	0	0	0	2,500	0	0	208	880	304	0	0	0	0	520	504	20	4,936
Jersey Boring & Drilling																	
DIRECT EXPENSE ONLY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LKG-CMC, Inc.																	
V. Hollis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A. Kudravitsky	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TASKS 3-16 (Phase I) and TASKS 1-12 (Phase 2)

Staff Person/ Classification	3	4	5	6	7	8	8.1	9	9.1	10	11	12	13	14	15	16	Subtotal Tasks 3-16	Subtotal Phase I	1	2	3	4	5	6	7	8	9	10	11	12	Subtotal Phase 2	TOTAL
Jacobs Engineering Group, Inc.																																
S. Rosenblum																	0	0													0	0
R. Copeland	40	10	20		30	24		45	5	24	40	40	40	60	50		428	2,614	240	240	120	600	300	800	80	120	600	70	120		3,290	5,904
K. McAnally	80										20		12				112	708							40				40		80	788
B. Romero											20	20					40	1,440							40	80			40		160	1,600
H. Tull	120				80			20			20	20	24				284	1,130	600	120		400		240	40	120	400	80	40		2,040	3,170
J. Saltarelli					80							200					280	858				200			40				40		280	1,138
M. Lewis											40						40	1,746	600	80		120			40	60			40		940	2,686
K. Uthirapathy	40										40						80	1,866	800	80		120			40	120			40		1,200	3,066
A. Marsh											12						12	598	240			80		240	40	24	200		40		864	1,462
J. Beaudry	40										12						52	778	200	120		80			40	60	40		40		580	1,358
D. Widner	80				80			20			80						260	2,966	600	1,200		150		300	40	80	600	80	40		3,090	6,056
M. Sutton											24						24	2,550	600	120		120		120	40	120	600		40		1,760	4,310
D. Scott																	0	191	120	80					40	20			40		300	491
C. Vallenilla																	0	692	80						40	40			40		200	892
G. Serna											24						24	1,166	300	40					40	80			40		500	1,666
CADD Person																	0	3,400													0	3,400
Assistant PM	20	20	20	20	20	20		120		80	80	80	80	200	20		780	2,480	120	120	120	120	120	120	120	120	120	120	120		1,320	3,800
Administrative Person	80				60							20	80	80	60		380	1,346	80	200		80		80		80		120	40		680	2,026
R. Schwass															40		40	195													0	195
K. Fox																	0	160													0	160
R. Carpenter												200					200	200								80					80	280
D. Elmaddah					40	0	0	0	80	40	40	40	160	80			480	2,400	400	600	400	2,500	300	200	400	400	250	250	300		6,000	8,400
R. Ferretti	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	243	0	0	70	0	0	0	0	0	0	0	0		70	313
R. Sirabian	20	20	20	20	20	0	8		80		8	60	8	8	0		272	1,752	0	0	0	0	0	0	0	0	0	0	0		0	1,752
F. DiPalma					40										160		200	420	0	0	0	0	0	0	0	0	0	0	0		0	420
M. Pytlik										400							400	1,600		500	500				500	500					2,000	3,600
S. Grill	0	0	0	0	0	0	0	0	0	0	0	0	20	120	0		140	160	0	0	0	5	0	0	200	80	0	0	0		285	445
R. McPherson						20				20	8	16	8	20			92	2,392													0	2,392
F. Velazquez	40	0	0	0	0	0	5	0	0	40	20	20	40	40	0		205	573													0	573
W. George	40	0	0	0	0	20	60	0	0	40	20	20	20	20	0		240	908	120	32	8	40	10	80	32	32	40	24	16		434	1,342
R. Rosa	40	0	0	0	0	0	24	0	0	0	24	24	0	0	0		112	784	40	24	4	40	4	24	24	16	40	8	16		240	1,024
M. Cabrera	40	0	0	0	8	0	40	0	0	20	20	20	40	40	0		228	544	0	40	40	80	10	80	32	32	32	8	16		370	914
J. Homoki																	0	1,920													0	1,920
TBD																	0	1,720													0	1,720
TBD																	0	1,080													0	1,080
K. Bienkowski																	0	580													0	580
TBD																	0	300													0	300
T. Decker		40	80														120	320													0	320
J.Patel		40	100														140	340													0	340
K. Mosley			450														450	750													0	750
M. Kaminski																	0	600													0	600
W. Williams																	0	120	0	0	0	0	0	0	0	0	80	0	0		80	200
M. Rafferty															40		40	200	0	0	0	0	0	0	0	0	0	0	0		0	200
C. Wedel												80					80	80	0	0	0	0	0	0	0	0	0	0	0		0	80
D. Legg												80					80	430													0	430
P. Semler												80					80	80													0	80
M. Kaminski												80					80	80													0	80
T. Decker												30					30	30													0	30
T. Zelovle												30					30	30													0	30
S. Eichinger	0	0	0	0	0	0	0	0	0	0	50	80	0	0	0	0	130	230	0	0	0	0	0	0	0	0	0	0	0		0	230
VE SME	0	0	0	0	0	0	0	0	0	0	200	0	0	0	0	0	200	200	0	0	0	0	0	0	0	0	0	0	0		0	200
M. Albergo	0	0	0	0	360	0	0	0	0	0	0	0	0	0	0	0	360	360	0	0	0	0	0	0	0	0	0	0	0		0	360
P. Rasmus																	0	200													0	200
R. LaRuffa	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	80	80	0	0	0	0	0	0	0	0	0	0	0		0	80
D. Morgan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	800	0	0	2,080	0	0	0	0	0	0	0	0		2,080	2,880
D. Cimino	0	0	0	0	0	0	0	0	0	0	0	0	60	520	0	0	580	590	0	0	0	15	0	0	40	420	0	0	0		475	1,065
G. Ruggiero	0	0	0	0	10	600	0	0	0	0	0	0	0	0	0		610	650	0	20	0	20	0	30	0	0	0	0	0		70	720
K. Herlihy	0	0	0	0	10	100	0	0	0	0	0	0	0	0	0	0	110	150	0	0	0	0	0	0	0	0	0	0	0		0	150
S. Jones	1,000																1,000	1,000													0	1,000
S. Donohoe												80	60				140	200					120								120	320
R. Markman																	0	120													0	120
J. Livingston								100									100	100													0	100
J. Yost	0	200	20	0	0	0	0	200		0	0	0	0	0	0	0	420	420	0	0	0	0	0	0	0	0	0	0	0		0	420
J. Stiles	0	100	20	0	0	0	0	60	20	0	0	0	0	0	0	0	200	200	0	0	0	0	0	0	0	0	0	0	0		0	200
J. Dowling	0	200	80	0	0	0	0	30	30	0	0	0	0	0	0	0	340	340	0	0	0	0	0	0	0	0	0	0	0		0	340
S. Ricucci	0	150	120	0	0	0	0	5	20	0	0	0	0	0	0	0	295	295	0	0	0	0	0	0	0	0	0	0	0		0	295
K. Glinkin	0	80	80	0	0	0	0	40	40	0	0	0	0	0	0	0	240	240	0	0	0	0	0	0	0	0	0	0	0		0	240
J. Cheung	0	120	120	0	0	0	0	40	40	0	0	0	0	0	0	0	320	320	0	0	0	0	0	0	0	0	0	0	0		0	320
J. Homoki	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	0	0	0	0	0	0	0	0	0	0	0		0	120
T. Schlagbaum																	0	25													0	25
M. Shelton														20			20	52													0	52
C. Ellis	40																40	280	40	32									40		112	392
S.Cruz																	0	500	80										20		100	600
P. Casuba	40																40	200	20	24									40		84	284
K. Tse																	0	300	40												40	340
E. Wang																	0	60		16									20		36	96
CADD Person																	0	0													0	0
Administrative Person																	0	380													0	380
Subtotal	1,760	980	1,130	40	838	784	137	680	315	664	882	1,320	652	1,208	370	0	11,760	55,932	5,320	3,688	3,342	4,770	864	2,314	1,948	2,684	3,002	760	1,268	0	29,960	85,892
Burns Engineering, Inc.																																
M. Walton																	0	1,900	80	500		80		80	100	80	80	80	80		1,160	3,060
B. Fiorentino																	0	800				80	160	80		80	80	80	80		640	1,440
D. Petroski																	0	850	80	500		80		80	120	80	80	80	80		1,180	2,030
R. Winks																	0	1,300	80			80		80		80	80	80	80		560	1,860
W. Wiedman																	0	600	80	500		80		80		80	80	80	80		1,060	1,660
S. Tong																	0	400	1,300			80		80		80	80	80	80		1,780	2,180
TBD																	0	2,500	160			160		160		160	160	160	160		1,120	3,620
Amtrak Substation Engineering Support																	0	2,200	300	200	200	200	200	200	200	300	300	300	200		2,600	4,800
OCS & Transmission Engineering Support																	0	2,400	300	200	200	200	200	200	200	300	300	300	200		2,600	5,000
HBLR Distribution Support																	0	2,400	400	200	200	200	200	200	200	400	400	400	200		3,000	5,400
Signals & Comms Engineering Support																	0	800	400							400	400	400			1,600	2,400
Drafting & Admin Support																	0	5,800	400	200	200	200	200	200	200	400	200	400	400		3,000	8,800
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21,950	3,580	2,300	800	1,440	960	1,440	1,020	2,440	2,240	2,440	1,640	0	20,300	42,250
Levitan & Associates, Inc.																																
S. Parker					36										144		180	798													0	798
E. Tsikirayi															20		20	544													0	544
J. Bitler															60		60	220													0	220
A. Mattfolk																	0	380													0	380
M. DeCourcey																	0	300													0	300
P. Curlett																	0	200													0	200
R. Carlson					144												144	144													0	144
Subtotal	0	0	0	0	180	0	0	0	0	0	0	0	0	0	224	0	404	2,586	0	0	0	0	0	0	0	0	0	0	0	0	0	2,586
LTK Engineering Services																																
William Lipfert																	0	104													0	104
T. Manning																	0	160													0	160
N. Willey																	0	484													0	484
R. Rauceo																	0	1,160													0	1,160
C. Farnsworth																	0	264													0	264
P. Lai																	0	80													0	80
A. Gutman																	0	200													0	200
T. Kneschke																	0	600													0	600
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,052	0	0	0	0	0	0	0	0	0	0	0	0	0	3,052
InfraMap Corp																																
DIRECT EXPENSE ONLY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GTS Consultants, Inc.																																
R. Voss																	0	768													0	768
M. Zavyazkin																	0	964													0	964
TBD																	0	956													0	956
TBD																	0	956													0	956
TBD																	0	1,292													0	1,292
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,936	0	0	0	0	0	0	0	0	0	0	0	0	0	4,936
Jersey Boring & Drilling																																
DIRECT EXPENSE ONLY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LKG-CMC, Inc.																																
V. Hollis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600	6,900	0	0	0	0	0	0	0	0	0	0	0	6,900	8,500
A. Kudravitsky	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600	6,900	0	0	0	0	0	0	0	0	0	0	0	6,900	8,500

Preliminary and Final Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project
RFP No. 15-031

Matrix of Person-Hours by Firm

TASK 1 - PROJECT MANAGEMENT AND ADMINISTRATION

Staff Person/ Classification	Title	Discipline	1.1	1.2	1.2.1	1.2.2	1.2.3	1.3	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.4	1.5	1.6	1.7	Subtotal Task 1
E. Harris	Document Control	Document Control	0	0	0	600	600	0	0	0	0	0	0	0	0	0	0	0	400	1,600
Subtotal			0	0	200	1,400	1,600	0	0	0	0	0	0	0	0	0	1,200	0	400	4,800
Firm Name	Matrix New World Engineering, Inc.																			
A. Raichle	Project Director	Geotechnical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Heck	Project Geotechnical Engineer/Manager	Geotechnical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Bassett	Senior Geotechnical Engineer	Geotechnical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R. Persaud	Geotechnical Engineer	Geotechnical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A. Riccio	Senior CADD Operator	Geotechnical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Zilske	Administrative Support	Geotechnical	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	Richard Grubb & Associates, Inc.																			
P. McEachen	Archaeological Resources	Env.																		0
Subtotal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	SJH Engineering, PC																			
V. Tiruchirappalli	Cost Estimating	Cost Estimating																		0
Subtotal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	Sowinski Sullivan Architects, PC																			
R. Sullivan	Architecture	Architecture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	Sullivan Cove Consultants, LLC																			
J. Graham	FERC	Legal																		0
Subtotal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firm Name	exida Consulting, LLC																			
E. Persson	Cyberecurity	Cybersecurity	24	16	24	4	16	16	0	16	0	0	4	0	16	40	16	40	16	248
Subtotal			24	16	24	4	16	16	0	16	0	0	4	0	16	40	16	40	16	248
TOTAL HOURS			398	1,584	1,264	1,752	2,721	1,331	227	99	98	220	985	246	375	890	1,356	2,920	644	17,110

TASK 2 - ENGINEERING

Staff Person/ Classification	2.1	2.2	2.2.1	2.2.2	2.2.2.1	2.2.3	2.2.4	2.2.5	2.2.6	2.2.7	2.2.8	2.2.9	2.2.10	2.3	2.3.1	2.3.2	Subtotal Task 2
E. Harris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A. Raichle	0	0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	35
D. Heck	0	0	0	0	0	354	0	0	0	0	0	0	0	0	0	0	354
C. Bassett	0	0	0	0	0	365	0	0	0	0	0	0	0	0	0	0	365
R. Persaud	0	0	0	0	0	2,354	0	0	0	0	0	0	0	0	0	0	2,354
A. Riccio	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	40
C. Zilske	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	8
Subtotal	0	0	0	0	0	3,156	0	0	0	0	0	0	0	0	0	0	3,156
P. McEachen							245										245
Subtotal	0	0	0	0	0	0	245	0	0	0	0	0	0	0	0	0	245
V. Tiruchirappalli																	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R. Sullivan	120		1,450		500												2,070
Subtotal	120	0	1,450	0	500	0	0	0	0	0	0	0	0	0	0	0	2,070
J. Graham																	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Persson	40	16	80	80	110	0	0	0	0	32	120	110	32	0	0	0	620
Subtotal	40	16	80	80	110	0	0	0	0	32	120	110	32	0	0	0	620
TOTAL HOURS	6,622	7,001	9,740	12,488	11,549	9,316	491	1,090	1,514	1,602	3,618	1,138	2,452	584	904	212	70,321

Tasks 3-16

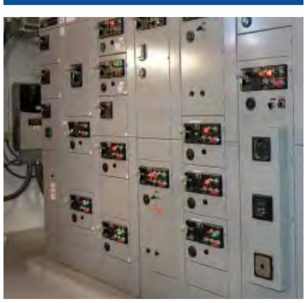
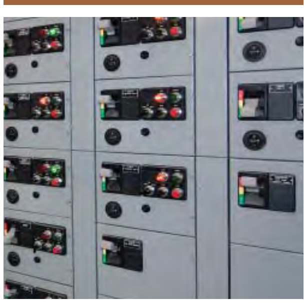
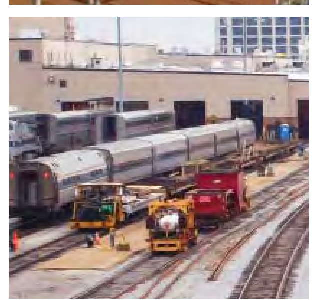
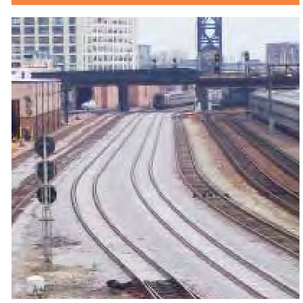
Staff Person/ Classification	TASK 3	TASK 4	TASK 5	TASK 6	TASK 7	TASK 8	TASK 8.1	TASK 9	TASK 9.1	TASK 10	TASK 11	TASK 12	TASK 13	TASK 14	TASK 15	TASK 16	Subtotal Tasks 3-16	Subtotal Phase I
E. Harris	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,600
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,800
A. Raichle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
D. Heck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	354
C. Bassett	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	365
R. Persaud	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,354
A. Riccio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
C. Zilske	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,156
P. McEachen																	0	245
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245
V. Tiruchirappalli	1,280																1,280	1,280
Subtotal	1,280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,280	1,280
R. Sullivan								80	80		40	40					240	2,310
Subtotal	0	0	0	0	0	0	0	80	80	0	40	40	0	0	0	0	240	2,310
J. Graham															80	80	160	160
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	80	160	160
E. Persson	80	0	0	0	24	0	40	32	32	16	0	32	0	32	32		320	1,188
Subtotal	80	0	0	0	24	0	40	32	32	16	0	32	0	32	32	0	320	1,188
TOTAL HOURS	3,120	980	1,130	40	1,042	784	177	792	427	680	922	1,392	652	1,240	706	80	14,164	101,595

Phase 2 Tasks

Staff Person/ Classification	TASK 1	TASK 2	TASK 3	TASK 4	TASK 5	TASK 6	TASK 7	TASK 8	TASK 9	TASK 10	TASK 11	TASK 12	Subtotal Phase 2	TOTAL
E. Harris	6,900	0	0	0	0	0	0	0	0	0	0	0	6,900	8,500
Subtotal	20,700	0	0	0	0	0	0	0	0	0	0	0	20,700	25,500
A. Raichle	0	0	0	0	0	0	0	0	0	0	0	0	0	35
D. Heck	0	0	0	0	0	0	0	0	0	0	0	0	0	354
C. Bassett	0	0	0	0	0	0	0	0	0	0	0	0	0	365
R. Persaud	0	0	0	0	0	0	0	0	0	0	0	0	0	2,354
A. Riccio	0	0	0	0	0	0	0	0	0	0	0	0	0	40
C. Zilske	0	0	0	0	0	0	0	0	0	0	0	0	0	8
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	3,156
P. McEachen	5	5	5	5	5	5	5	5	5	5	5		55	300
Subtotal	5	5	5	5	5	5	5	5	5	5	5	0	55	300
V. Tiruchirappalli			320										320	1,600
Subtotal	0	0	320	0	0	0	0	0	0	0	0	0	320	1,600
R. Sullivan	400	80		80			40	40		24	40		704	3,014
Subtotal	400	80	0	80	0	0	40	40	0	24	40	0	704	3,014
J. Graham	0	0	0	0	0	0	0	0	0	0	0	0	0	160
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	160
E. Persson	112	64	16	64	32	160	16	16	120	80	24		704	1,892
Subtotal	112	64	16	64	32	160	16	16	120	80	24	0	704	1,892
TOTAL HOURS	30,117	6,137	4,483	6,359	1,861	3,919	3,029	5,185	5,367	3,309	2,977	0	72,743	174,338

7 Quality Assurance Plan



Section 7 | Quality Assurance Plan

Our Policy Regarding Commitment to Quality Management

Jacobs requires the use of quality assurance, quality control, and quality improvement processes in order to deliver projects that fulfill NJ TRANSIT requirements. Our approach to Quality Management outlined below complies with ISO 9001:2008 and the U.S. DOT Federal Transit Administration Quality Management System Guidelines – FTA-PA-27-5194-12.1. These established guidelines supersede ISO 9001:2000, ISO 10013:2000, and ISO 8402:2000 described in Tasks 1.3.2 and 1.3.3.

Our quality procedures apply to all our employees and activities including planning, design, construction, project management, construction management, accounting, project controls, administration, and marketing. By using our procedures, our goals are to:

- Produce quality documents and projects
- Establish an environment where there is a continual striving for improvement
- Encourage communication
- Improve understanding of the NJ TRANSIT's requirements
- Build teamwork and cooperation in solving problems
- "Do it right the first time"

Quality Management Overview

1. Project Management Quality Responsibilities

It is Jacobs' policy that everyone who works on a project is responsible for quality. Although there are individual detailed Quality Control (QC) checks within each discipline, the project management and Jacobs senior management oversee for the overall quality of the product.

Responsibility for the overall quality on any project lies with the Project Manager (PM) who is directly answerable to NJ TRANSIT. The PM works closely with the Jacobs Quality Manager (QM) to verify a quality product.

On receipt of the contract, senior management thoroughly reviews the document. The PM places special emphasis on cost, schedule, and the technical statement of work and small / disadvantaged / minority / women-owned business participation requirements. If any discrepancies are noted or any unusual requirements identified, we clarify with NJ TRANSIT procurement and/or the NJ TRANSIT Project Manager. We ascertain a clearly defined project scope, budget, and schedule, and then prepare

Section 7

the Project Management Plan (PMP), Project Criteria Document (PCD), and the Quality Management Plan (QMP). These documents are prepared within 30 days of the NTP.

The PM and the QM verify the plans adhere to contractual requirements. They sign the documents attesting to the fact that all critical elements of the contract are addressed; thus, providing another check for the contract reviews. We revise/edit PMP/PCD and QMP documents and distribute them to the project team for implementation. In addition, we obtain input and approvals for the PCD/QMP from NJ TRANSIT. The subconsultants working on the job are required to adhere to these documents.

- *A Jacobs' Senior Manager will conduct a Client Survey to evaluate our performance and our effectiveness. The results are reported to our headquarters. A low score requires an action plan be developed and implemented.*

At issuance of a NTP, a senior-level Jacobs' Manager (someone not directly involved with the project) conducts an initial Client Expectation Survey (CES) with the NJ TRANSIT Project Manager to gain a mutual understanding of expectations, goals, priorities, and responsibilities. The PM also attends, so he hears first-hand what you expect – this way nothing is lost in translation. We document and frequently monitor this information throughout the course of the project. Periodically, the same senior-level Manager will conduct surveys to monitor performance and identify how we can better serve you and where we can make needed improvements or corrections.

2. Quality Controls – QC and QA

- *Prior to each new submittal, we verify all NJ TRANSIT comments from the previous submittal are addressed.*

Our procedures are customized to the project. To achieve this end, every effort is taken to do the work right the first time, then a systematic procedure of checking and reviewing is established before the product is submitted to NJ TRANSIT. Jacobs' quality control is based on a minimum of "two sets of eyes" participating in the review of all NJ TRANSIT deliverables and in all management decision-making and operations.

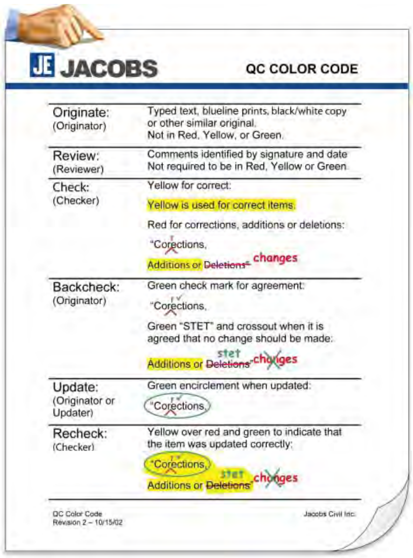
Check and review procedures are applied at various and distinct stages of the development process. The procedure used, and when it is applied within the design process, depends on the product or service provided.

Although originally developed for contract documents, the QC Color Coding System, levels of checking and review, and discipline matrices, have been designed to provide guidance for all services we routinely perform. A brief explanation of each level of checking and review is as follows:

Level 1 Check is a thorough inspection of a completed contract document to verify the product meets the requirements, is deliverable to NJ TRANSIT, and includes a numbers check performed by a technically qualified individual, other than the Originator.

Level 2 Check is a more general review of work in progress, or of a completed deliverable package. Level 2 Peer Reviews, Constructability Reviews and our Intra-Discipline Reviews are intended as a review by a qualified team of qualified individuals assembled to assess the performance, conduct, and progress of a project or document during various stages of its development. The Peer Review (independent of the project) verifies the work is complete, logical, has followed the

Section 7


JACOBS QC COLOR CODE

Originate: (Originator)	Typed text, blueline prints, black/white copy or other similar original. Not in Red, Yellow, or Green.
Review: (Reviewer)	Comments identified by signature and date Not required to be in Red, Yellow or Green.
Check: (Checker)	Yellow for correct: Yellow is used for correct items. Red for corrections, additions or deletions: "Corections, Additions or ~~Deletions~~" changes
Backcheck: (Originator)	Green check mark for agreement: "Corections, Green "STET" and crossout when it is agreed that no change should be made: Additions or ~~Deletions~~" stet ~~changes~~
Update: (Originator or Updater)	Green encirclement when updated: "Corections,
Recheck: (Checker)	Yellow over red and green to indicate that the item was updated correctly: "Corections, Additions or ~~Deletions~~" stet ~~changes~~

QC Color Code
Revision 2 – 10/15/02
Jacobs Civil Inc.

required procedures, and has used the correct specifications. The intent is for the reviewer(s) to apply their accumulated experience and professional judgment to verify the work is being performed to the established standards of both NJ TRANSIT and Jacobs. The Level 2 Review, however, is not intended to provide detailed check as required in a Level 1 Check.

Level 3 Check is a review of the product by senior management where a signature by an appropriate authority level is required before work can proceed through the rest of the process. Similar to the Level 2 Reviews, the Level 3 Review verifies the work is complete, logical, and has followed required procedures. The type of Level 3 Review performed is dependent upon the level of authority required. The PMP and QMP are examples of this type of review and approval. A Jacobs Principal reviews and signs off on each level.

Gatekeeper Audit is a documented review performed on the complete submittal package when the coordinated QC efforts have been completed for a milestone submission to NJ TRANSIT. The submittal must pass the audit or it will not be submitted. The Gatekeeper Audit is implemented to eliminate and mitigate errors and omission for all deliverables. The process involves reviewing the QC documents, Intra-discipline review log, Decisions Log, and NJ TRANSIT Comments, and then listing any findings and sending back to the responsible part to have corrective actions taken. All findings must be corrected and then verified by the Gatekeeper in writing prior to the release for submittal.

3. Document Control

The documents generated for a project could be either internal or external. The documents are readily retrievable and available for NJ TRANSIT review. The internal documents and their control are:

- Drawings, Calculations, Specifications and Estimates: We will retain the QC documents that have been checked, back-checked, corrected, and rechecked in Jacobs' offices for 7 years after the end of construction.
- Standards, Codes, and References: The books and manuals, such as ASTM, AASHTO, Building Codes, etc., that were used for a particular project, will be maintained in the central library. These books / manuals will be retained through the construction phase. Changes, revisions, addenda, etc. to these documents will be so noted and retained alongside the original documents.

- Construction Phase: During the construction phase, a shop drawing log indicating submittal type, date of receipt / review and return, name of reviewer, and status of approval will be noted. The Request for Information (RFI) from the field will be controlled in a manner similar to shop drawings (i.e. the PM or designee will maintain the RFI log.)

4. Product Identification and Traceability

Upon receipt of the NTP, each new project or task will receive a specific project number. This number will be retained throughout the life of the project, and will parallel that particular NJ TRANSIT Contract number. All contract modifications to the Release would also be included in this job number. For example, if the design component of a release has a specific unique job number, the construction phase services for that project will also have another unique job number.

All products generated for a particular project, a contract drawing, calculation, specification, or report are identified with that particular job number. The different disciplines will have their own letter suffixes attached to the job number. For example, Architectural will have the suffix "A," Structural will be "S," Civil will be "C," and Construction Inspection will be "CI." Each drawing and specification will have its own unique drawing number or specification number. Each deliverable or submittal will carry that particular submittal completion percentage. For example, the number "EB4203.A.101.30% indicates job number EB4203, A = architectural drawing, 101 = drawing number, and 30% = submittal percentage.

Revision controls are maintained by providing the documents revision status. Documents that are in draft are marked as draft and give a sequential letter assignment i.e. Draft A for the initial draft followed by Draft B etc. for subsequent updates made to the document.

Once a document is officially issued, it is given a numerical revision number starting at Revision 0. Revision 1 follows and is sequential if changes are made to the document.

Documents that are superseded are identified through revision control and are immediately removed from circulation and stored as archived documents assuring the latest revision is made available and retrievable.

When jobs are completed and the documents are archived, they will bear the unique job number, thus retrieval of project documents from archives is quick and accurate.

5. Corrective Action

The QC process details how non-conformities are detected, investigated, and corrected. If the corrective action is local and minor in nature, it will be handled at an individual stage. However, if the investigative process discovers a non-conformity that affects other disciplines (for example, CADD layering in survey work), a meeting will be convened of all involved participants. The non-conformity is documented, addressed, and a corrective action developed. The QM will verify that the corrective action plan is implemented. In certain instances, the QM may stop the project until corrective actions have been completed and verified.

Non-conformances are logged and tracked by the Quality Manager. The QM assigns the corrective actions, verify actions taken, and report to NJ TRANSIT.

6. Internal Quality Audits

A Jacobs Regional Quality Manger assigned Auditor will carry out internal quality audits. The quality audit procedure consists of two stages: a preliminary audit at 30 business days post NTP and quarterly progress audits. The preliminary audit is a review of the PMP, QMP, and related processes. The PMP is audited along with verification of certain contractual elements. During the progress audits, the plans and Quality Controls / Quality Assurance functions are audited for adherence to the project processes.

7. Quality Subtasks

As outlined in Section 5 of this proposal, Jacobs has reviewed the task requirements and will implement the work-plan for each task described below:

Quality Control – Task 1.3

Under this Quality Task, the Jacobs Team will provide Quality Management, Quality Assurance, and Quality Control services. Major deliverables under this Task will include the Quality Management Plan (QMP), the Quality Management System, and the Design Control Plan. Our execution of this Task is driven by Notice to Proceed of the contract and personal interaction with the NJ TRANSIT Quality Director. The most significant risk to be mitigated during this task is gathering external inputs in a timely manner to produce the plans and develop them through to approval.

Russell Ferretti, Jacobs Regional Quality Manager, and Bruno Fiorentino (Burns Engineering), Quality Control Task Leader, will lead this task. Russell will report directly to Stanley Rosenblum, the Project Executive. Bruno will report directly to Diaa Elmaddah for day-to-day guidance and to our Project Manager, Roger Copeland for overall project quality reporting and updates.

Russell is responsible for making sure the Quality Control procedures are followed. Bruno is responsible for working with the different groups to establish the Quality Control Plan and job specific quality plans. He will also be responsible for the quality control of the documents produced.

Quality Management Plan – Subtasks 1.3.1 and 1.3.2

The key actions required under this subtask include matching the plan to the scope, obtaining management inputs to the plans and processes, approvals of the plan, and roll out of the plans processes to the team and subconsultants for full understanding.

Jacobs will develop this plan in compliance with ISO 9001/2008 as well as the ISO 10013:2000 Guidelines for Quality Systems and development of Quality Manuals. As ISO 8402: 2000 is being revised by ISO/FDIS 9000, Jacobs will implement the Quality Vocabulary and terminology into the QMP.

Our successful execution of this work requires quick response times to input requests, workshopping processes that require tailored attention to the scope, and updating the plan to NJ TRANSIT's approval.

We will successfully execute the plans development through communicating with NJ TRANSIT, Jacobs project team, and project subconsultants on a regular basis.

Our approach to the plan will result in having the project members have a full understanding of the processes, roles and responsibilities, and project development resulting in deliverables of the highest quality.

The lead person responsible for the delivery of this subtask is Russell Ferretti – Jacobs Regional Quality Manager.

Specific to this project, Jacobs will implement the Project Quality Management Plan to cover Project Design, Planning, and Construction Support Services. We develop the QMP specific to the requirements of this project and in compliance with ISO-9001/2008 and the FTA Guidelines as described in our Quality Summary section of this proposal, which outlines our quality management processes. Additionally, we develop Project-Specific Quality Plans or PSQP (QC Matrix) unique to each deliverable task to effectively communicate and plan quality control functions. The PSQP Matrix breaks down by phase and by deliverable the staff required to perform QC, the level of QC, the date the effort is to be completed by, and provides for additional comments, as needed.

The following quality processes are outlined in the Quality Management Plan:

1. Project Management Quality Responsibilities
2. Quality Reporting Requirements
3. Design Quality Management System
4. Construction Phase Services Quality Management
5. Quality Records
6. Quality Control Processes and Checking procedure
7. Audits- Internal System Audits, as well as "Gatekeeper" Deliverable Audits
8. Non-Conformances
9. Corrective Action Requests

10. Performance Improvement Notices (PINS)

11. Client Surveys

12. Training

ISO 9001 Requirements – Subtask 1.3.3

Under this Quality task, the Jacobs Team will abide by current ISO Standards applicable to the project. Our execution of this Task is driven by Notice to Proceed of the contract and developing our QMP and Quality Management System to exceed the ISO Standards. The most significant risk to be mitigated during this task is verifying that the superseded standards below are carefully reviewed and implemented with the most current ISO Standards for each.

The lead person responsible for the delivery of this subtask is Russell Ferretti – Jacobs Regional Quality Manager.

ISO 9001:2000: Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation, and Servicing:

Jacobs will develop and manage our quality systems in compliance with ISO 9001:2008 (Quality Management Systems), the current version of the standard. Jacobs' quality system is currently established to comply with the requirements of ISO 9001:2008 and the QMP will describe the system in detail.

ISO 10013:2000: Guidelines for Quality Management System Documentation:

Jacobs will use the Guidelines in the development of the Plan. Jacobs has purchased the current ISO revision of this standard to apply the most current processes to the plan. Jacobs will develop all processes, work instructions, forms, and checklists in compliance with 10013:2000.

ISO 8402: 2000: Quality Management and Quality Assurance – Vocabulary:

This standard has been withdrawn by ISO and is under development/ revision by ISO/ FDIS 9000. Although the Standard is withdrawn and in the process of being updated, Jacobs will provide applicable acronyms, terms and vocabulary descriptions related to Quality in the QMP i.e. QA – Quality Assurance. This will be to the benefit of Jacobs, its subconsultants, and NJ TRANSIT as it provides mutual understanding of terminology.

Quality Manager – Subtask 1.3.4

The Regional Quality Manager – Russell Ferretti, will have no input or responsibility regarding the production of the project documents, and will be directly answerable to the Operations Manager. The Quality Manager will be at the same organizational level as the PM, but completely independent of the PM. The Quality Manager has the authority and responsibility to stop the project if and when a significant

non-conformance has been identified whether through Quality Controls or otherwise. The Quality Manager will be responsible for conducting Internal Audits in compliance with Jacobs procedures and will submit to NJ TRANSIT the audit reports, findings, and corrective actions on a quarterly basis.

Subconsultants quality is controlled by Bruno as the Quality Control Task Leader and audited by Russell as the Quality Manager, and their deliverables are subject to Jacobs Level 2 reviews outlined below.

The Quality Manager is responsible for making sure these procedures are followed. The Quality Manager will:

- Implement the Quality Control Processes and Quality Assurance for the Project.
- Has the Authority to Stop the project.
- Has direct access to and by the NJ TRANSIT Quality Director.
- Submit a monthly certification to NJ TRANSIT having verified all deliverables have been processed with procedures outlined in the QMP and that Quality Controls for checking have been completed by Jacobs and its subconsultants.
- Provide a bi-monthly quality report outlining progress and issues related to quality for the project.
- Initiate action to prevent the occurrence of nonconformity by performing reviews at various stages of the project.
- Identify and record any quality issues.
- Verify the implementation of solutions.
- Control further work or delivery of items until the deficiency or unsatisfactory condition has been corrected.
- Perform quarterly audits and report them to the PM and NJ TRANSIT.
- Track non-conformances through to completion of corrective actions and report to NJ TRANSIT.
- Assign “Gatekeeper” Audits of Design Deliverable prior to each Milestone submission.

Design Control Plan – Subtask 1.3.5

The key actions required under this subtask include Matching the Plan to the Project Scope, Obtaining Management Inputs to the plans and processes, Approvals of the plan and roll out of the plans processes to the project team and subconsultants for full understanding.

We will successfully execute the plans development through communicating with NJ TRANSIT, Jacobs project team, and project subconsultants on a regular basis.

Our approach to the plan will result in having the project design team have a full understanding of the processes, roles, and responsibilities.

The lead person responsible for the delivery of this subtask is Bruno Fiorentino – Regional Quality Control Task Leader with inputs from the Project Manager, Roger Copeland, Diaa Elmaddah, the Deputy Project Manager and Russell Ferretti, the Quality Manager. The Quality Manager will review and approve the Design Control Plan.

Immediately following the NTP, the PM will convene a meeting to define how to implement the quality system and to provide inputs into the Design Control Plan. The PM, Deputy Project Manager, Quality Control Task Leader, Quality Manager, and subconsultants will attend. NJ TRANSIT is invited to attend the meeting as well. At the meeting, the various components that make up the Design Control Plan (DCP) will be refined and documented in the Plan. We will emphasize the design control procedures and review processes. Constructability, Peer Review, and Value Engineering inputs and guidelines will also be included in the DCP.

Documents controlling and/or monitoring the quality process will be discussed and agreed upon. Lead engineers will identify persons who will check/back-check the drawings, calculations, reports, etc.

The PSQP Matrix described in Subtask 1.3.1 above is updated during the meeting.

A Quality Design Review Schedule, identifying dates when Jacobs quality controls are carried out, will also be agreed upon. These dates will fall within the contractually approved project milestones and incorporate into the Project Schedule.

Jacobs will implement Quality Reviews throughout the project. The Quality System will incorporate Senior Management Reviews, Intra-discipline Reviews, and QC checks. Intra-discipline reviews (including subconsultants and their deliverables) are performed and documented prior to our "pencils down" Level 1 checking procedures implementation. We believe that having the coordination between each discipline performed first is critical, so that when the QC process – a Level 1 (Checker, Back-Checker, Updater, and Rechecker) is performed, the coordination needed is already in place and each discipline can focus on checking their individual deliverables.

Jacobs also recommends the use of a "decisions log" to document, track, and verify all approved design inputs and changes are incorporated into the drawings, specifications, estimates, reports, and any additional milestone submittal products. The PM will maintain the log; and only inputs or changes approved by NJ TRANSIT and Jacobs are incorporated.

Control of Quality Records – Subtask 1.3.6

The lead person responsible for the delivery of this subtask is Russell Ferretti – Jacobs Regional Quality Manager.

Quality documents such as reports, audits, Non-conformances etc. are filed electronically in native format and PDF in the projects records management system. The files will be kept for a minimum of 7 years after the completion of construction.

The quality control records that will be filed and stored are scanned or hard copy documents that have undergone the QC procedures. In order for the documents to be accepted for filing, they have to contain the proper stamp and signatures of the checkers/originators.

Prior to accepting the quality records for filing, the PM will verify each stage of the QC procedure has been carried out. The Quality Manager will also verify this during the secondary audit review.

Subconsultants will also maintain their quality records, in a manner similar to that carried out by Jacobs.

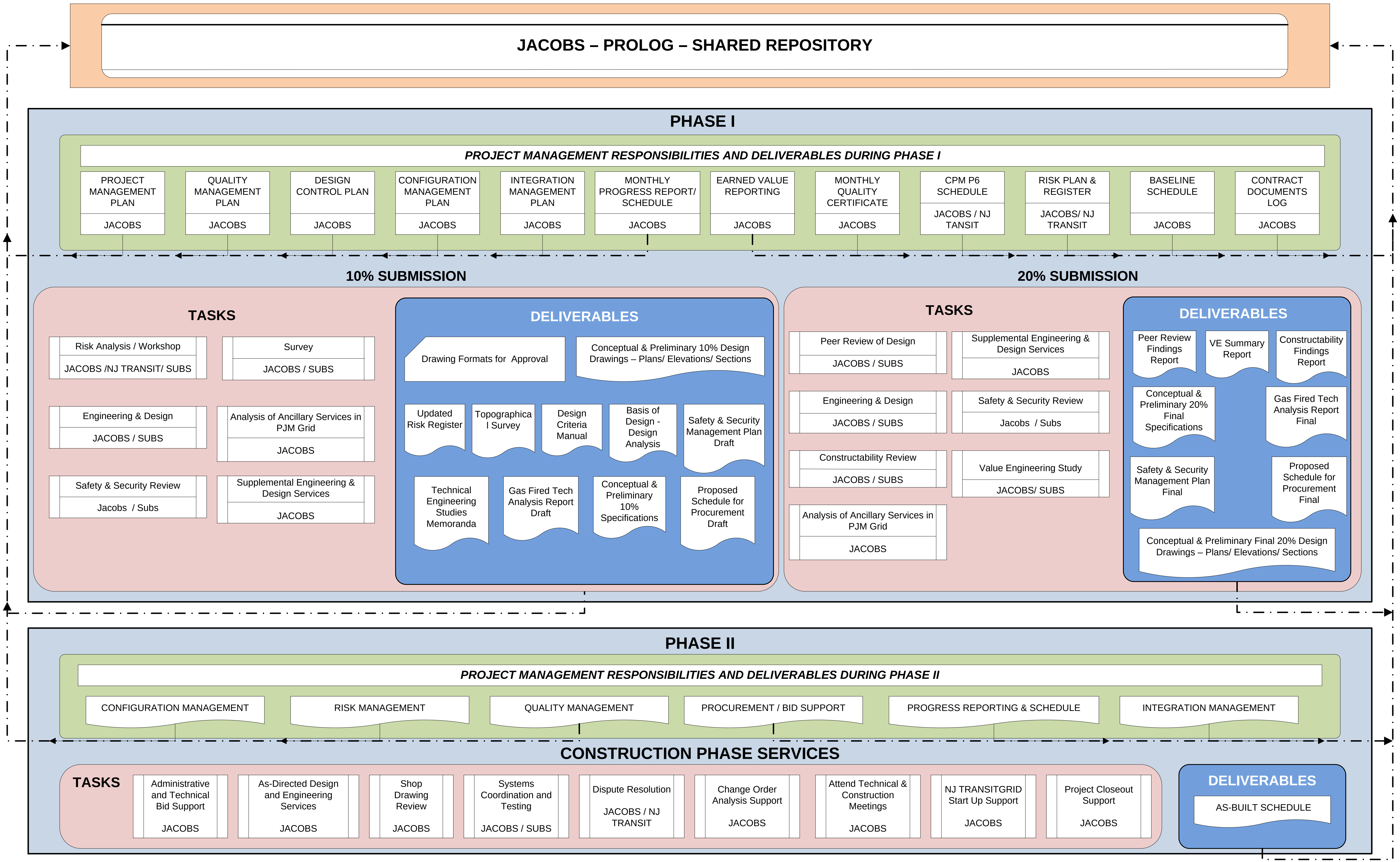
An Auditor from Jacobs will visit the subconsultants' offices as necessary to verify if the quality documents generated by them have been identified and maintained to specified requirements.

Internal Quality Audits – Subtask 1.3.7

The lead person responsible for the delivery of this subtask is Russell Ferretti – Jacobs Regional Quality Manager.

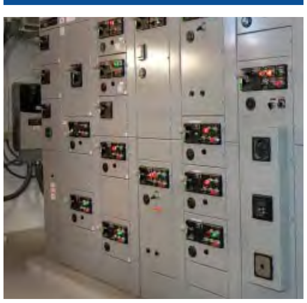
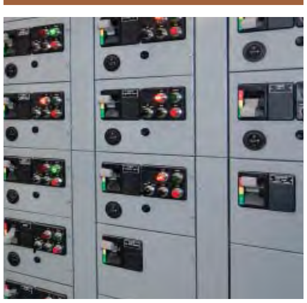
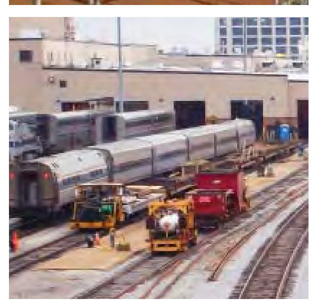
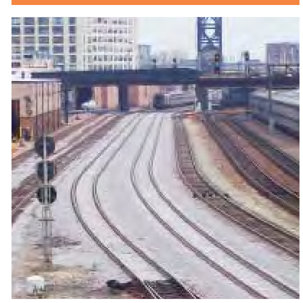
A Jacobs Regional Quality Manger assigned Auditor will carry out internal quality audits. The quality audit procedure typically consists of two stages: a preliminary Initial audit at 30 business days post NTP and a secondary audit at about 60% levels of effort of the project or tasks. The requirements of this project are for an audit to be performed quarterly. The QMP will detail the audits and audit schedule, which will include the single Initial audit and then Progress Audits to be performed quarterly. The preliminary audit is a review of the project set-up and establishment of the procedures. The progress audit reviews adherence to the QMS procedures and also includes reviews of the project's QC and deliverables for verification of adherence to the processes. The progress audits will occur quarterly throughout the life of the project. All audit reports will be reviewed or performed by the Quality Manager and reported to the NJ TRANSIT PM / Director of Quality as directed. All audit reports will be filed in the projects Quality Records as well as on the Jacobs QDS - Quality Data System, which reports audits and audit results to our headquarters and highest level of management in Pasadena, CA.

NJ TRANSITGRID PROJECT FLOW CHART



8 Schedule



Section 8

Section 8 | Schedule

The schedule for this first-of-its-kind microgrid has critical path drivers that we will effectively manage. This project is unique because of its engineering and regulatory issues and the required integration of the power and transit components into a seamless transit microgrid power system. This project requires significant third party review and approval, and understanding and minimizing these processes is essential. As your consultant, we will expedite the schedule by championing strategies and tactics that foster collaboration, drives decision making, and removes potential schedule pitfalls. We will work with you to promote a project culture of open mindedness, flexibility, and urgency based on the need to have the NJ TRANSITGrid operational for your customers and those who are dependent on transit.

We have developed a schedule to achieve your goal of going to bid within 15 months after NTP for this contract. As discussed in this document, the schedule has critical path drivers that we will effectively manage including alignment with all stakeholders and regulators. Our strategy to meet your project schedule goal is based on the following:

- Rapid start-up: We will leverage our earlier involvement on the microgrid, knowledge of Sandy requirements, and years of experience working with you to mobilize quickly and get engaged.
- Expeditious execution of rail power load analysis and recommendations: Our exclusive partner, LTK, will streamline the power load analysis because of prior work on the NEC. Locking in the power needs is a significant milestone achievement.
- Swift resolution of technology choice: Our expertise and knowledge of the potential options provide you with a clear set of options. Our ability to demonstrate the choices, analyze the pros/cons, and recommend solutions provide NJ TRANSIT a knowledge base to make a swift, but fully informed decision on the type of technology to be used.
- Nimble third party consensus building to generate stakeholder and regulatory support for the NJ TRANSITGrid will be achieved because we understand the concerns and have strong relationships with most, if not all of the third parties.
- Proper execution of the PJM application process and flawless understanding of the utility regulatory process will streamline decision making and minimize risk to you.
- Innovative, but necessary procurement of power plant equipment will allow PJM to conduct its assessment within their existing review cycle.
- Agile deployment of procurement strategies to mitigate Buy America concerns and attract a competitive bidding process for the microgrid will result in a successful execution of a design-build contract.

Early Purchase of Equipment is Key

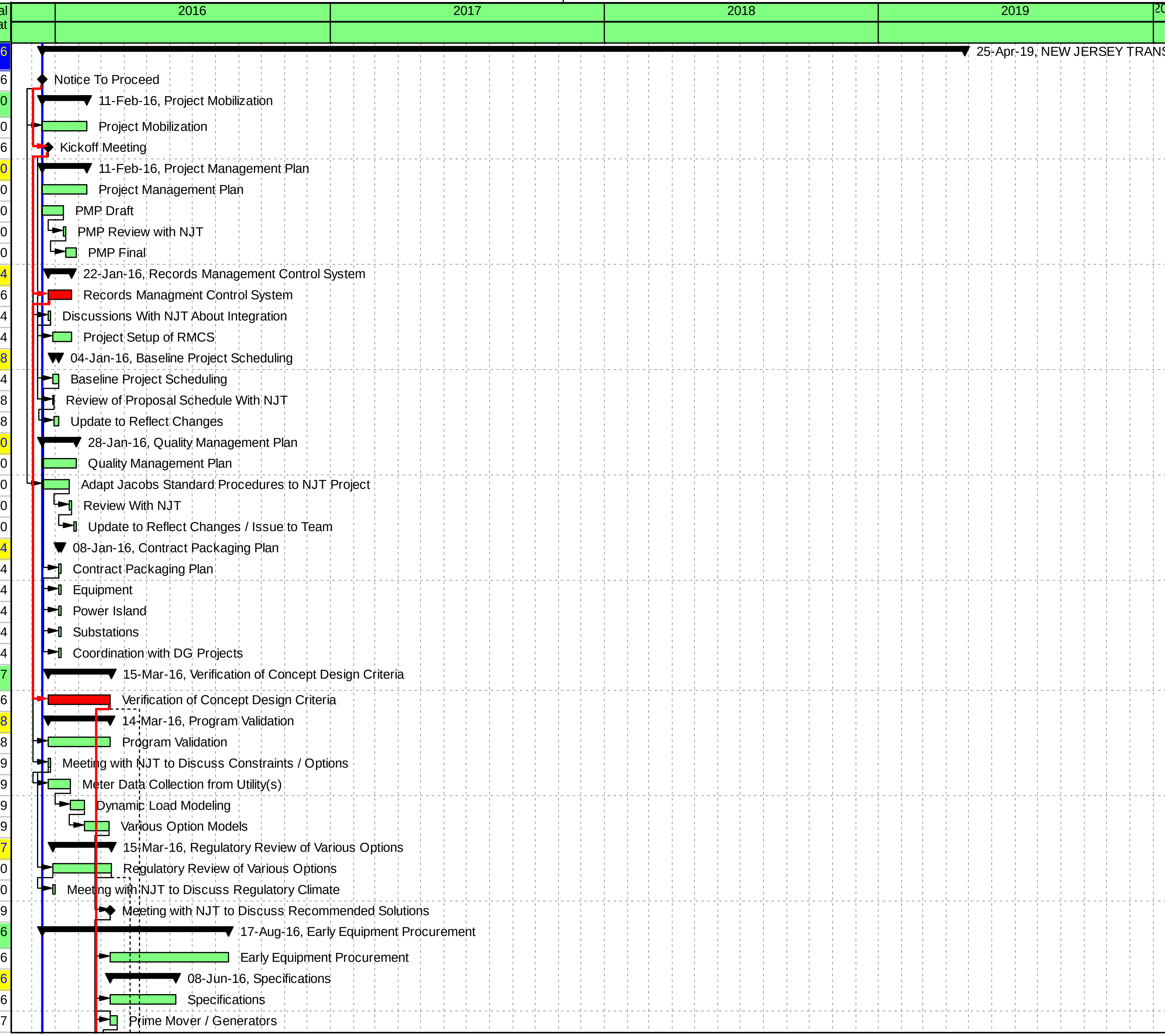
Our work plan is based on the process of equipment selection / procurement early in the schedule to allow the PJM and air permit approval processes to advance, as well as to move forward in confidence with basis of design decisions. You will see in the schedule that follows the process for each of these steps are defined as well as the requisite predecessors, allowing for completion of ready for bid documents at 15 months following NTP. The potential exposure to you of locking in equipment decisions early is mitigated by the benefits realized and by our proven risk avoidance advantages including:

- Reduced risk of project changes – Selection and procurement of the power generation equipment early in the design phase allows for design surety in the finished product. While you would face an early capital outlay for this, the equipment selected and assigned to the installation contractor reduces the variability and associated costs of alternative design solutions for the power generation equipment.
- Lower project costs and lost contingencies – As the largest single cost line item in the project, the prime mover equipment costs would carry significant mark-up and profit potential for installing design-build contractors. It is common for contractors to carry 10-15% markup on the costs of the major capital equipment, as well as another 10-20% of contingency that does not offer any material value to you. In a project with major equipment well in excess of $100M, there is significant real project value that would be paid to the contracting community in lieu of directing real value to NJ TRANSIT and the ridership.
- Schedule surety – In the power marketplace, the PJM regulations are a linear processes framed around private generation developers. PJM is required to provide open access to the transmission system per PURPA 1978 and EPACT 2005. However, the process by which they provide this access does require that generation developers have detailed technical information about the power generation and transmission equipment to be installed. This requires equipment selection and procurement to initiate the PJM process, which is an overall critical path activity for the delivery of the entire project. The PJM application process cannot be started until the specific equipment is selected, and you cannot project what the equipment will be since equipment selection will occur through an open procurement process.

Alternative Schedule

It is important to note, in the baseline schedule we are contemplating basic reciprocating engines as the solution to the microgrid per the RFP guidelines. This solution does not contemplate the concept of heat recovery, combined cycle, and energy storage, which may offer positive engineering and financial returns for the project. While not drastically different, implementation of this alternative design solution as outlined in prior sections of our proposal does require a more linear process for equipment optimization and selection. This concept is shown in the alternate schedule that follows the baseline schedule.

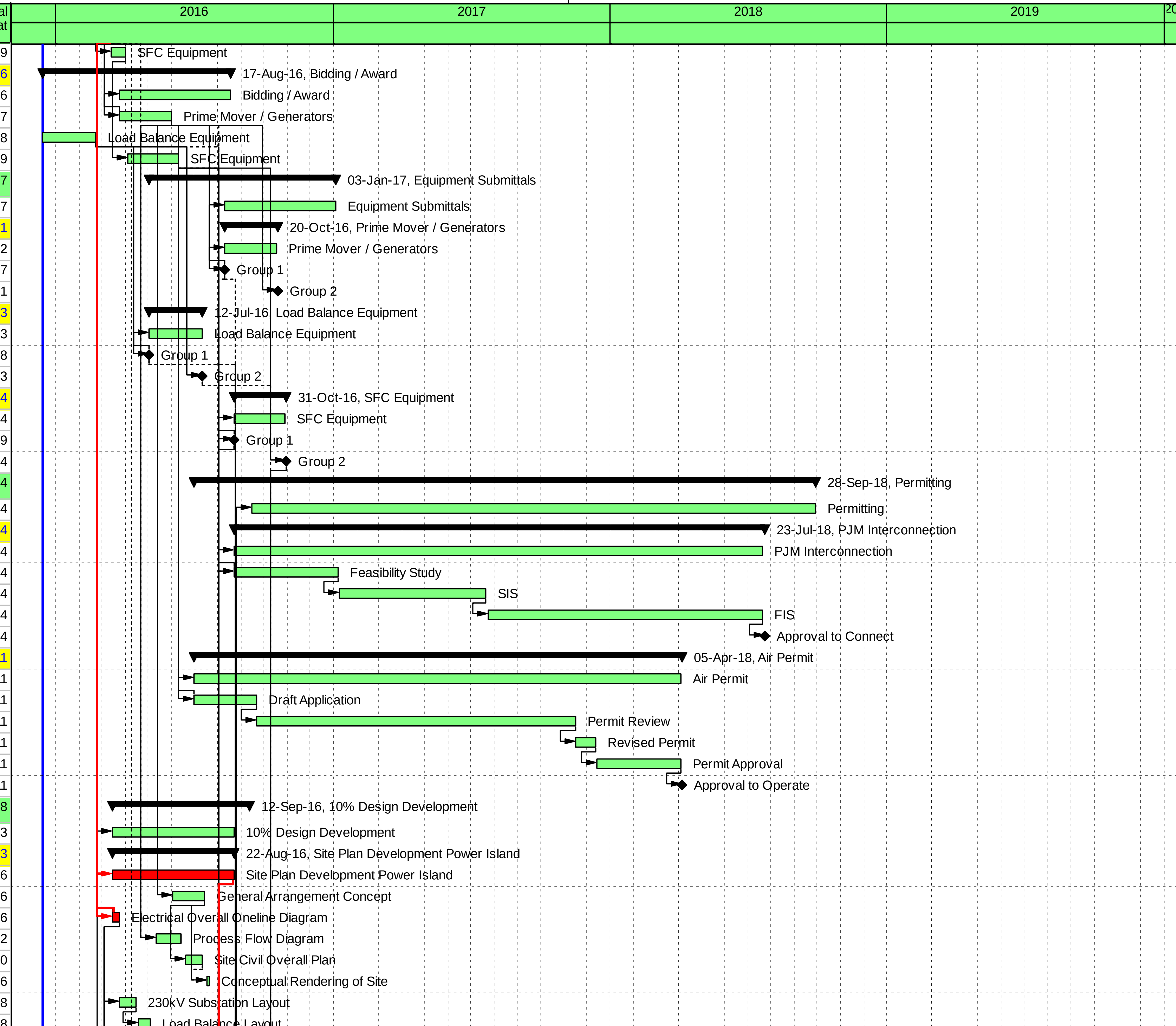
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
	NEW JERSEY TRANSITGRID - BASELINE	877	15-Dec-15	25-Apr-19	36
001	Notice To Proceed	0	15-Dec-15*		36
	Project Mobilization	43	15-Dec-15	11-Feb-16	870
002	Project Mobilization	43	15-Dec-15	11-Feb-16	870
003	Kickoff Meeting	0	22-Dec-15		36
	Project Management Plan	43	15-Dec-15	11-Feb-16	870
004	Project Management Plan	43	15-Dec-15	11-Feb-16	870
005	PMP Draft	20	15-Dec-15	11-Jan-16	880
006	PMP Review with NJT	3	12-Jan-16	14-Jan-16	880
007	PMP Final	10	15-Jan-16	28-Jan-16	880
	Records Management Control System	24	22-Dec-15	22-Jan-16	884
008	Records Managment Control System	24	22-Dec-15	22-Jan-16	36
009	Discussions With NJT About Integration	4	22-Dec-15	25-Dec-15	884
010	Project Setup of RMCS	20	28-Dec-15	22-Jan-16	884
	Baseline Project Scheduling	6	28-Dec-15	04-Jan-16	898
011	Baseline Project Scheduling	6	28-Dec-15	04-Jan-16	894
012	Review of Proposal Schedule With NJT	2	28-Dec-15	29-Dec-15	898
013	Update to Reflect Changes	4	30-Dec-15	04-Jan-16	898
	Quality Management Plan	33	15-Dec-15	28-Jan-16	880
014	Quality Management Plan	33	15-Dec-15	28-Jan-16	880
015	Adapt Jacobs Standard Procedures to NJT Project	25	15-Dec-15	18-Jan-16	880
016	Review With NJT	4	19-Jan-16	22-Jan-16	880
017	Update to Reflect Changes / Issue to Team	4	25-Jan-16	28-Jan-16	880
	Contract Packaging Plan	4	05-Jan-16	08-Jan-16	894
018	Contract Packaging Plan	4	05-Jan-16	08-Jan-16	894
019	Equipment	4	05-Jan-16	08-Jan-16	894
020	Power Island	4	05-Jan-16	08-Jan-16	894
021	Substations	4	05-Jan-16	08-Jan-16	894
023	Coordination with DG Projects	4	05-Jan-16	08-Jan-16	894
	Verification of Concept Design Criteria	61	22-Dec-15	15-Mar-16	847
024	Verification of Concept Design Criteria	60	22-Dec-15	14-Mar-16	36
	Program Validation	60	22-Dec-15	14-Mar-16	848
025	Program Validation	60	22-Dec-15	14-Mar-16	848
026	Meeting with NJT to Discuss Constraints / Options	4	22-Dec-15	25-Dec-15	69
027	Meter Data Collection from Utility(s)	22	22-Dec-15	20-Jan-16	69
028	Dynamic Load Modeling	13	21-Jan-16	08-Feb-16	69
029	Various Option Models	24	09-Feb-16	11-Mar-16	69
	Regulatory Review of Various Options	57	28-Dec-15	15-Mar-16	847
031	Regulatory Review of Various Options	57	28-Dec-15	15-Mar-16	80
032	Meeting with NJT to Discuss Regulatory Climate	4	28-Dec-15	31-Dec-15	900
033	Meeting with NJT to Discuss Recommended Solutio	0	14-Mar-16		69
	Early Equipment Procurement	177	15-Dec-15	17-Aug-16	736
034	Early Equipment Procurement	113	14-Mar-16	17-Aug-16	736
	Specifications	63	14-Mar-16	08-Jun-16	786
035	Specifications	63	14-Mar-16	08-Jun-16	786
036	Prime Mover / Generators	8	14-Mar-16	23-Mar-16	77



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

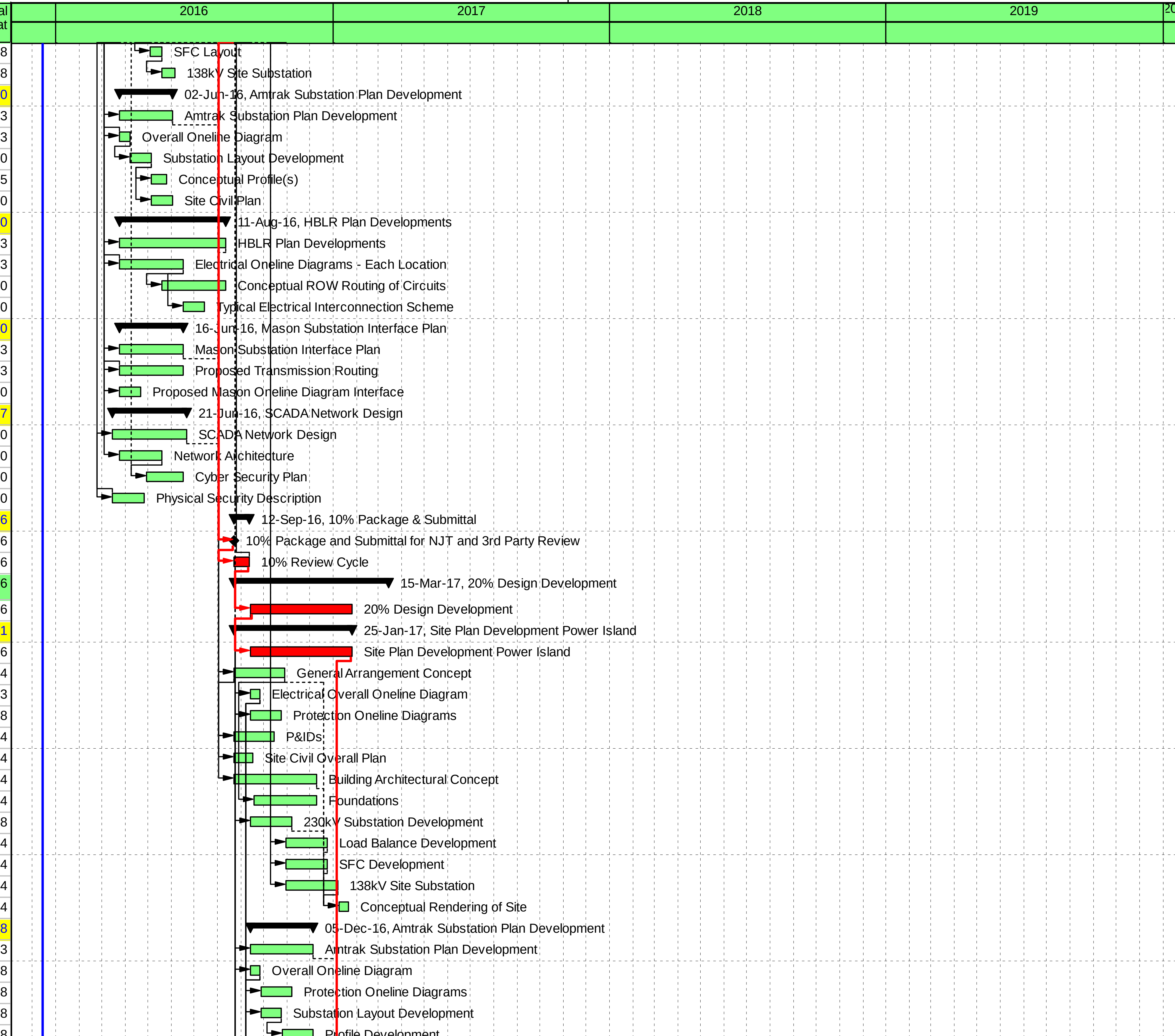
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
040	SFC Equipment	15	14-Mar-16	01-Apr-16	69
Bidding / Award		177	15-Dec-15	17-Aug-16	736
041	Bidding / Award	105	24-Mar-16	17-Aug-16	736
042	Prime Mover / Generators	50	24-Mar-16	01-Jun-16	77
045	Load Balance Equipment	50	15-Dec-15	22-Feb-16	148
046	SFC Equipment	50	04-Apr-16	10-Jun-16	69
Equipment Submittals		176	03-May-16	03-Jan-17	637
047	Equipment Submittals	105	10-Aug-16	03-Jan-17	637
Prime Mover / Generators		51	10-Aug-16	20-Oct-16	691
048	Prime Mover / Generators	50	10-Aug-16	18-Oct-16	692
049	Group 1	0	10-Aug-16		77
050	Group 2	0	20-Oct-16		691
Load Balance Equipment		50	03-May-16	12-Jul-16	763
057	Load Balance Equipment	50	03-May-16	11-Jul-16	763
058	Group 1	0	03-May-16		148
059	Group 2	0	12-Jul-16		713
SFC Equipment		50	22-Aug-16	31-Oct-16	684
060	SFC Equipment	50	22-Aug-16	28-Oct-16	684
061	Group 1	0	22-Aug-16		69
062	Group 2	0	31-Oct-16		624
Permitting		587	30-Jun-16	28-Sep-18	184
063	Permitting	532	15-Sep-16	28-Sep-18	184
PJM Interconnection		500	22-Aug-16	23-Jul-18	234
064	PJM Interconnection	500	22-Aug-16	20-Jul-18	234
065	Feasibility Study	100	22-Aug-16	06-Jan-17	234
066	SIS	140	09-Jan-17	21-Jul-17	234
067	FIS	260	24-Jul-17	20-Jul-18	234
068	Approval to Connect	0	23-Jul-18		234
Air Permit		460	30-Jun-16	05-Apr-18	311
069	Air Permit	460	30-Jun-16	04-Apr-18	311
070	Draft Application	60	30-Jun-16	21-Sep-16	311
071	Permit Review	300	22-Sep-16	15-Nov-17	311
072	Revised Permit	20	16-Nov-17	13-Dec-17	311
073	Permit Approval	80	14-Dec-17	04-Apr-18	311
074	Approval to Operate	0	05-Apr-18		311
10% Design Development		130	15-Mar-16	12-Sep-16	718
075	10% Design Development	115	15-Mar-16	22-Aug-16	733
Site Plan Development Power Island		115	15-Mar-16	22-Aug-16	733
076	Site Plan Development Power Island	115	15-Mar-16	22-Aug-16	36
077	General Arrangement Concept	32	02-Jun-16	15-Jul-16	756
078	Electrical Overall Oneline Diagram	8	15-Mar-16	24-Mar-16	36
079	Process Flow Diagram	24	12-May-16	14-Jun-16	782
080	Site Civil Overall Plan	16	20-Jun-16	11-Jul-16	760
081	Conceptual Rendering of Site	3	18-Jul-16	20-Jul-16	756
082	230kV Substation Layout	16	25-Mar-16	15-Apr-16	788
083	Load Balance Layout	12	18-Apr-16	03-May-16	788



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

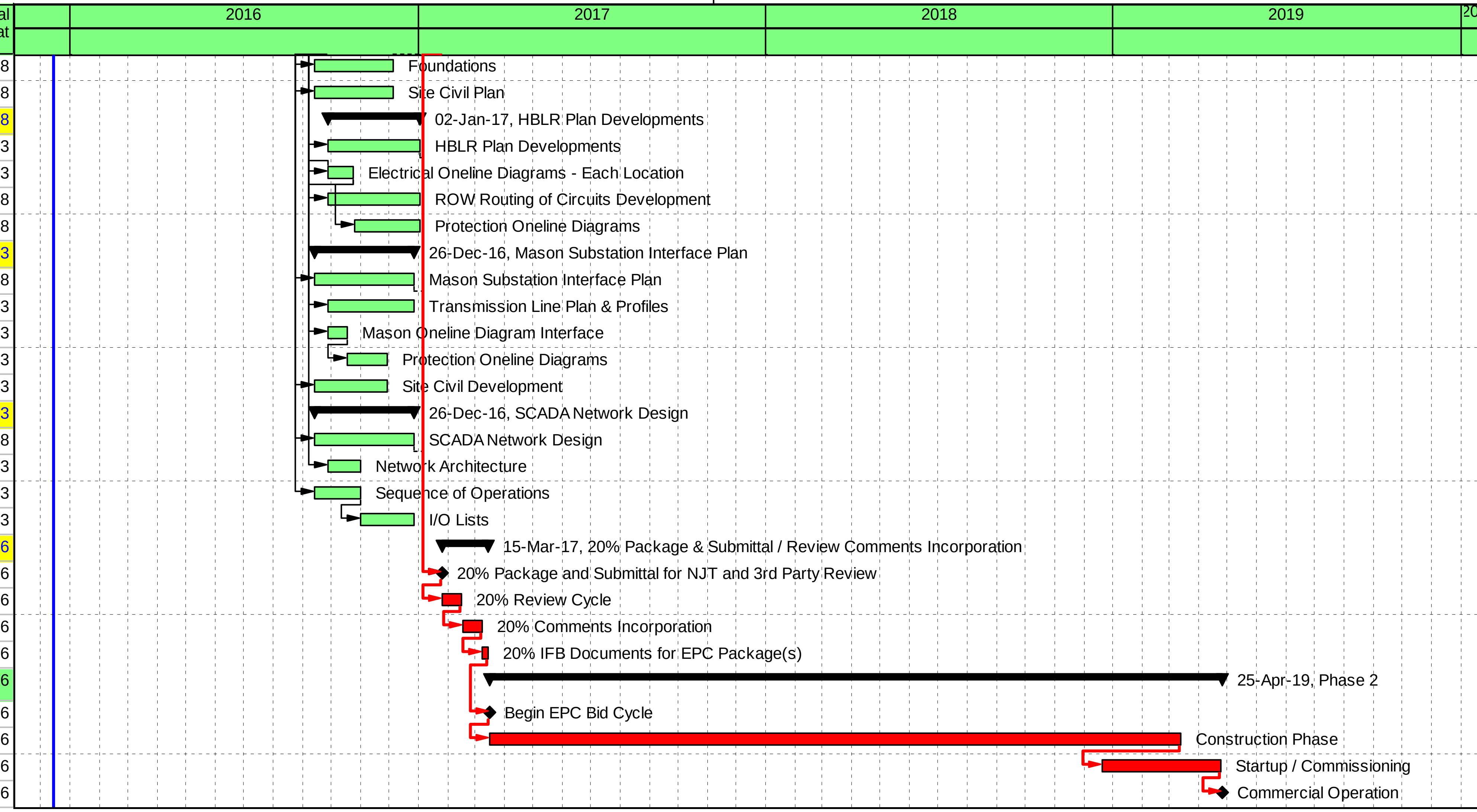
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
084	SFC Layout	12	04-May-16	19-May-16	788
085	138kV Site Substation	12	20-May-16	06-Jun-16	788
Amtrak Substation Plan Development		50	25-Mar-16	02-Jun-16	790
086	Amtrak Substation Plan Development	50	25-Mar-16	02-Jun-16	93
087	Overall Oneline Diagram	10	25-Mar-16	07-Apr-16	93
088	Substation Layout Development	20	08-Apr-16	05-May-16	790
089	Conceptual Profile(s)	15	06-May-16	26-May-16	795
090	Site Civil Plan	20	06-May-16	02-Jun-16	790
HBLR Plan Developments		100	25-Mar-16	11-Aug-16	740
091	HBLR Plan Developments	100	25-Mar-16	11-Aug-16	43
092	Electrical Oneline Diagrams - Each Location	60	25-Mar-16	16-Jun-16	43
093	Conceptual ROW Routing of Circuits	60	20-May-16	11-Aug-16	740
094	Typical Electrical Interconnection Scheme	20	17-Jun-16	14-Jul-16	760
Mason Substation Interface Plan		60	25-Mar-16	16-Jun-16	780
095	Mason Substation Interface Plan	60	25-Mar-16	16-Jun-16	83
096	Proposed Transmission Routing	60	25-Mar-16	16-Jun-16	83
097	Proposed Mason Oneline Diagram Interface	20	25-Mar-16	21-Apr-16	820
SCADA Network Design		70	16-Mar-16	21-Jun-16	777
098	SCADA Network Design	70	16-Mar-16	21-Jun-16	80
099	Network Architecture	40	25-Mar-16	19-May-16	780
100	Cyber Security Plan	35	29-Apr-16	16-Jun-16	780
101	Physical Security Description	30	16-Mar-16	26-Apr-16	80
10% Package & Submittal		15	23-Aug-16	12-Sep-16	36
102	10% Package and Submittal for NJT and 3rd Party F	0	23-Aug-16		36
103	10% Review Cycle	15	23-Aug-16	12-Sep-16	36
20% Design Development		148	22-Aug-16	15-Mar-17	586
104	20% Design Development	97	13-Sep-16	25-Jan-17	36
Site Plan Development Power Island		113	22-Aug-16	25-Jan-17	621
105	Site Plan Development Power Island	97	13-Sep-16	25-Jan-17	36
106	General Arrangement Concept	50	22-Aug-16	28-Oct-16	644
107	Electrical Overall Oneline Diagram	10	13-Sep-16	26-Sep-16	53
108	Protection Oneline Diagrams	30	13-Sep-16	24-Oct-16	688
109	P&IDs	40	22-Aug-16	14-Oct-16	694
110	Site Civil Overall Plan	20	22-Aug-16	16-Sep-16	714
111	Building Architectural Concept	80	22-Aug-16	09-Dec-16	644
112	Foundations	60	19-Sep-16	09-Dec-16	654
113	230kV Substation Development	40	13-Sep-16	07-Nov-16	668
114	Load Balance Development	40	31-Oct-16	23-Dec-16	634
115	SFC Development	40	31-Oct-16	23-Dec-16	634
116	138kV Site Substation	50	31-Oct-16	06-Jan-17	624
117	Conceptual Rendering of Site	10	09-Jan-17	20-Jan-17	624
Amtrak Substation Plan Development		60	13-Sep-16	05-Dec-16	658
118	Amtrak Substation Plan Development	60	13-Sep-16	05-Dec-16	73
119	Overall Oneline Diagram	10	13-Sep-16	26-Sep-16	658
120	Protection Oneline Diagrams	30	27-Sep-16	07-Nov-16	678
121	Substation Layout Development	20	27-Sep-16	24-Oct-16	658
122	Profile Development	30	25-Oct-16	05-Dec-16	658



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

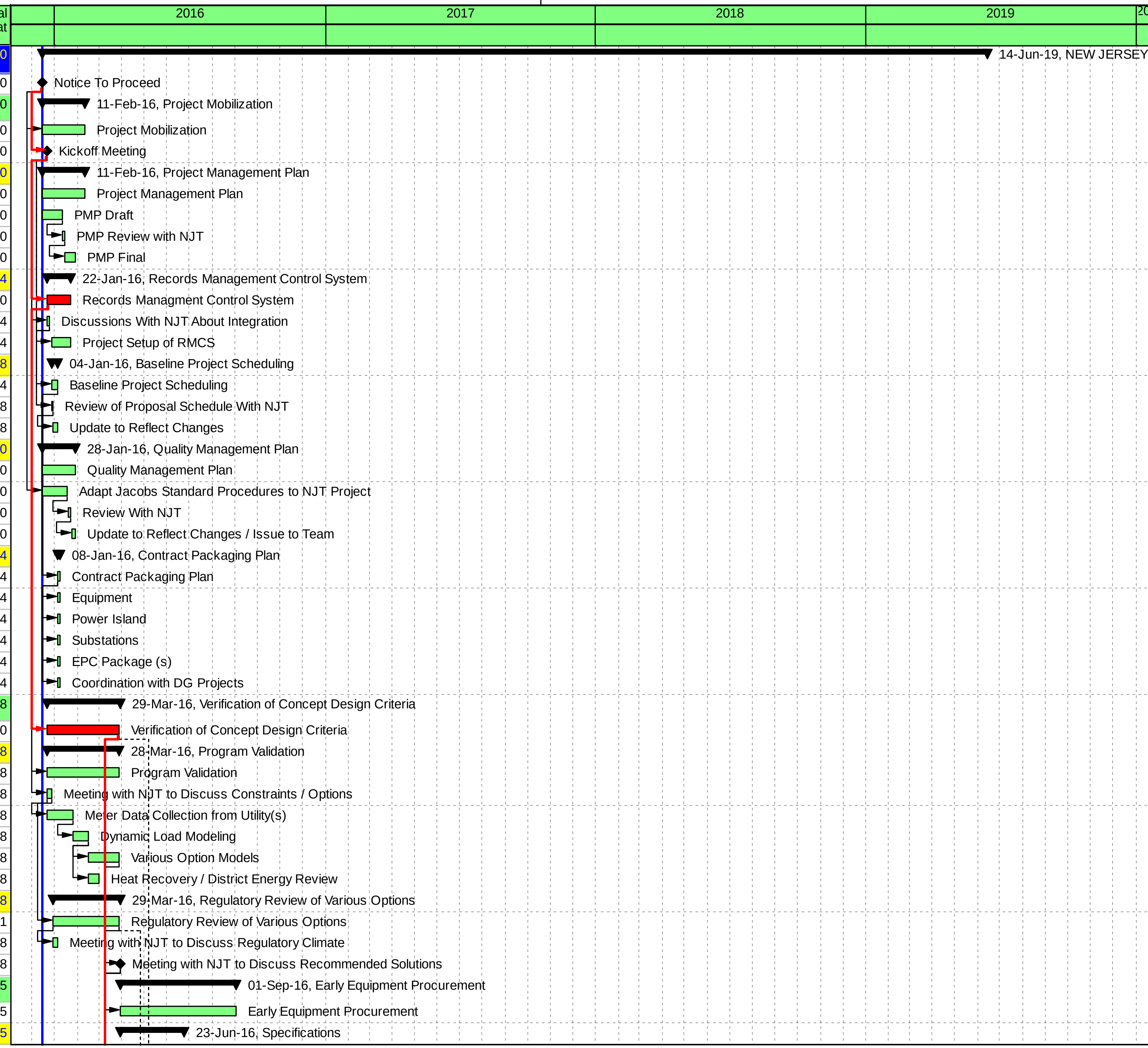
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
123	Foundations	60	13-Sep-16	05-Dec-16	658
124	Site Civil Plan	60	13-Sep-16	05-Dec-16	658
HBLR Plan Developments		70	27-Sep-16	02-Jan-17	638
125	HBLR Plan Developments	70	27-Sep-16	02-Jan-17	53
126	Electrical Oneline Diagrams - Each Location	20	27-Sep-16	24-Oct-16	53
127	ROW Routing of Circuits Development	70	27-Sep-16	02-Jan-17	638
128	Protection Oneline Diagrams	50	25-Oct-16	02-Jan-17	638
Mason Substation Interface Plan		75	13-Sep-16	26-Dec-16	643
129	Mason Substation Interface Plan	75	13-Sep-16	26-Dec-16	58
130	Transmission Line Plan & Profiles	65	27-Sep-16	26-Dec-16	643
131	Mason Oneline Diagram Interface	15	27-Sep-16	17-Oct-16	663
132	Protection Oneline Diagrams	30	18-Oct-16	28-Nov-16	663
133	Site Civil Development	55	13-Sep-16	28-Nov-16	663
SCADA Network Design		75	13-Sep-16	26-Dec-16	643
134	SCADA Network Design	75	13-Sep-16	26-Dec-16	58
135	Network Architecture	25	27-Sep-16	31-Oct-16	683
136	Sequence of Operations	35	13-Sep-16	31-Oct-16	643
137	I/O Lists	40	01-Nov-16	26-Dec-16	643
20% Package & Submittal / Review Comments Incor		35	26-Jan-17	15-Mar-17	36
138	20% Package and Submittal for NJT and 3rd Party F	0	26-Jan-17		36
139	20% Review Cycle	15	26-Jan-17	15-Feb-17	36
140	20% Comments Incorporation	15	16-Feb-17	08-Mar-17	36
141	20% IFB Documents for EPC Package(s)	5	09-Mar-17	15-Mar-17	36
Phase 2		550	16-Mar-17	25-Apr-19	36
142	Begin EPC Bid Cycle	0	16-Mar-17		36
143	Construction Phase	520	16-Mar-17	13-Mar-19	36
144	Startup / Commissioning	90	20-Dec-18	24-Apr-19	36
145	Commercial Operation	0	25-Apr-19		36



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

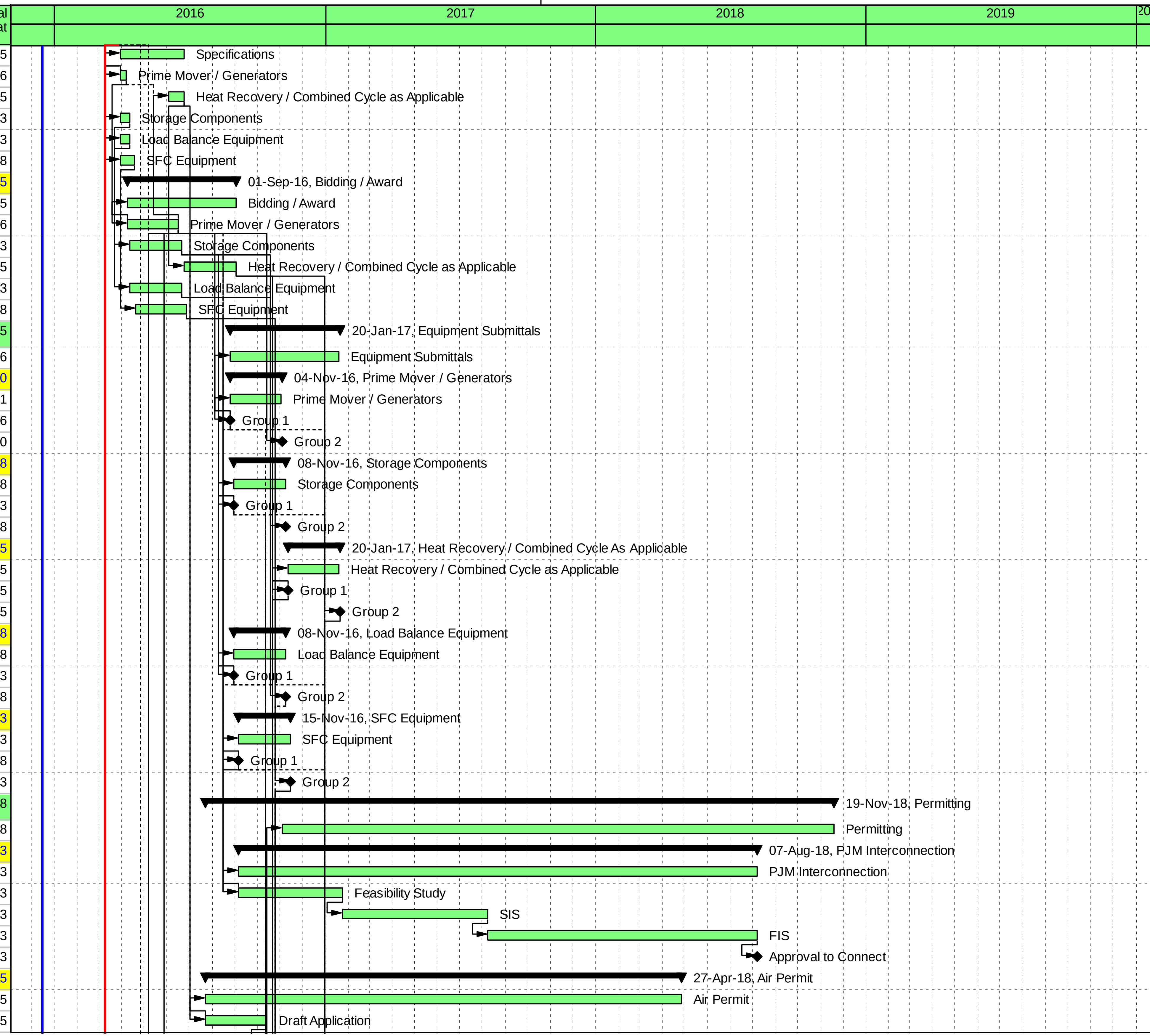
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
	NEW JERSEY TRANSITGRID - ALTERNATIVE	913	15-Dec-15	14-Jun-19	0
001	Notice To Proceed	0	15-Dec-15*		0
	Project Mobilization	43	15-Dec-15	11-Feb-16	870
002	Project Mobilization	43	15-Dec-15	11-Feb-16	870
003	Kickoff Meeting	0	22-Dec-15		0
	Project Management Plan	43	15-Dec-15	11-Feb-16	870
004	Project Management Plan	43	15-Dec-15	11-Feb-16	870
005	PMP Draft	20	15-Dec-15	11-Jan-16	880
006	PMP Review with NJT	3	12-Jan-16	14-Jan-16	880
007	PMP Final	10	15-Jan-16	28-Jan-16	880
	Records Management Control System	24	22-Dec-15	22-Jan-16	884
008	Records Managment Control System	24	22-Dec-15	22-Jan-16	0
009	Discussions With NJT About Integration	4	22-Dec-15	25-Dec-15	884
010	Project Setup of RMCS	20	28-Dec-15	22-Jan-16	884
	Baseline Project Scheduling	6	28-Dec-15	04-Jan-16	898
011	Baseline Project Scheduling	6	28-Dec-15	04-Jan-16	894
012	Review of Proposal Schedule With NJT	2	28-Dec-15	29-Dec-15	898
013	Update to Reflect Changes	4	30-Dec-15	04-Jan-16	898
	Quality Management Plan	33	15-Dec-15	28-Jan-16	880
014	Quality Management Plan	33	15-Dec-15	28-Jan-16	880
015	Adapt Jacobs Standard Procedures to NJT Project	25	15-Dec-15	18-Jan-16	880
016	Review With NJT	4	19-Jan-16	22-Jan-16	880
017	Update to Reflect Changes / Issue to Team	4	25-Jan-16	28-Jan-16	880
	Contract Packaging Plan	4	05-Jan-16	08-Jan-16	894
018	Contract Packaging Plan	4	05-Jan-16	08-Jan-16	894
019	Equipment	4	05-Jan-16	08-Jan-16	894
020	Power Island	4	05-Jan-16	08-Jan-16	894
021	Substations	4	05-Jan-16	08-Jan-16	894
022	EPC Package (s)	4	05-Jan-16	08-Jan-16	894
023	Coordination with DG Projects	4	05-Jan-16	08-Jan-16	894
	Verification of Concept Design Criteria	70	22-Dec-15	29-Mar-16	838
024	Verification of Concept Design Criteria	70	22-Dec-15	28-Mar-16	0
	Program Validation	70	22-Dec-15	28-Mar-16	838
025	Program Validation	70	22-Dec-15	28-Mar-16	838
026	Meeting with NJT to Discuss Constraints / Options	5	22-Dec-15	28-Dec-15	58
027	Meter Data Collection from Utility(s)	25	22-Dec-15	25-Jan-16	58
028	Dynamic Load Modeling	15	26-Jan-16	15-Feb-16	58
029	Various Option Models	30	16-Feb-16	28-Mar-16	58
030	Heat Recovery / District Energy Review	10	16-Feb-16	29-Feb-16	858
	Regulatory Review of Various Options	65	29-Dec-15	29-Mar-16	838
031	Regulatory Review of Various Options	65	29-Dec-15	28-Mar-16	71
032	Meeting with NJT to Discuss Regulatory Climate	5	29-Dec-15	04-Jan-16	898
033	Meeting with NJT to Discuss Recommended Solutions	0	29-Mar-16		58
	Early Equipment Procurement	113	29-Mar-16	01-Sep-16	725
034	Early Equipment Procurement	113	29-Mar-16	01-Sep-16	725
	Specifications	63	29-Mar-16	23-Jun-16	775



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

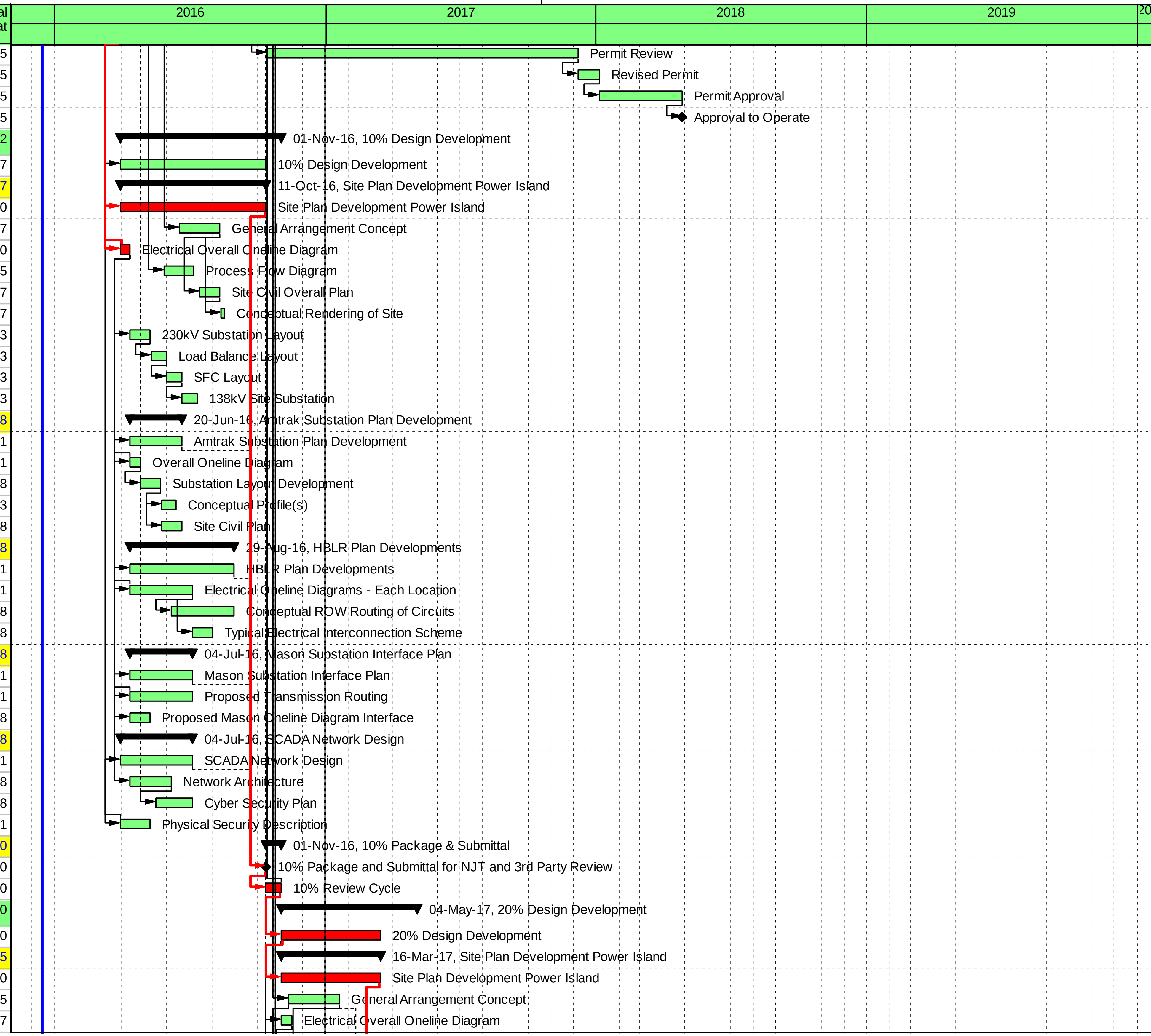
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
035	Specifications	63	29-Mar-16	23-Jun-16	775
036	Prime Mover / Generators	8	29-Mar-16	07-Apr-16	66
037	Heat Recovery / Combined Cycle as Applicable	15	03-Jun-16	23-Jun-16	295
038	Storage Components	10	29-Mar-16	11-Apr-16	63
039	Load Balance Equipment	10	29-Mar-16	11-Apr-16	63
040	SFC Equipment	15	29-Mar-16	18-Apr-16	58
Bidding / Award		105	08-Apr-16	01-Sep-16	725
041	Bidding / Award	105	08-Apr-16	01-Sep-16	725
042	Prime Mover / Generators	50	08-Apr-16	16-Jun-16	66
043	Storage Components	50	12-Apr-16	20-Jun-16	63
044	Heat Recovery / Combined Cycle as Applicable	50	24-Jun-16	01-Sep-16	585
045	Load Balance Equipment	50	12-Apr-16	20-Jun-16	63
046	SFC Equipment	50	19-Apr-16	27-Jun-16	58
Equipment Submittals		106	25-Aug-16	20-Jan-17	625
047	Equipment Submittals	105	25-Aug-16	18-Jan-17	626
Prime Mover / Generators		51	25-Aug-16	04-Nov-16	680
048	Prime Mover / Generators	50	25-Aug-16	02-Nov-16	681
049	Group 1	0	25-Aug-16		66
050	Group 2	0	04-Nov-16		680
Storage Components		50	30-Aug-16	08-Nov-16	678
051	Storage Components	50	30-Aug-16	07-Nov-16	678
052	Group 1	0	30-Aug-16		63
053	Group 2	0	08-Nov-16		678
Heat Recovery / Combined Cycle As Applicable		50	11-Nov-16	20-Jan-17	625
054	Heat Recovery / Combined Cycle as Applicable	50	11-Nov-16	19-Jan-17	625
055	Group 1	0	11-Nov-16		585
056	Group 2	0	20-Jan-17		585
Load Balance Equipment		50	30-Aug-16	08-Nov-16	678
057	Load Balance Equipment	50	30-Aug-16	07-Nov-16	678
058	Group 1	0	30-Aug-16		63
059	Group 2	0	08-Nov-16		628
SFC Equipment		50	06-Sep-16	15-Nov-16	673
060	SFC Equipment	50	06-Sep-16	14-Nov-16	673
061	Group 1	0	06-Sep-16		58
062	Group 2	0	15-Nov-16		613
Permitting		607	22-Jul-16	19-Nov-18	148
063	Permitting	532	04-Nov-16	19-Nov-18	148
PJM Interconnection		500	06-Sep-16	07-Aug-18	223
064	PJM Interconnection	500	06-Sep-16	06-Aug-18	223
065	Feasibility Study	100	06-Sep-16	23-Jan-17	223
066	SIS	140	24-Jan-17	07-Aug-17	223
067	FIS	260	08-Aug-17	06-Aug-18	223
068	Approval to Connect	0	07-Aug-18		223
Air Permit		460	22-Jul-16	27-Apr-18	295
069	Air Permit	460	22-Jul-16	26-Apr-18	295
070	Draft Application	60	22-Jul-16	13-Oct-16	295



Remaining Level of Effort	Remaining Work	Summary
Actual Level of Effort	Critical Remaining Work	WBS Summary Activity
Actual Work	Milestone	WBS Summary Progress

TASK filter: All Activities

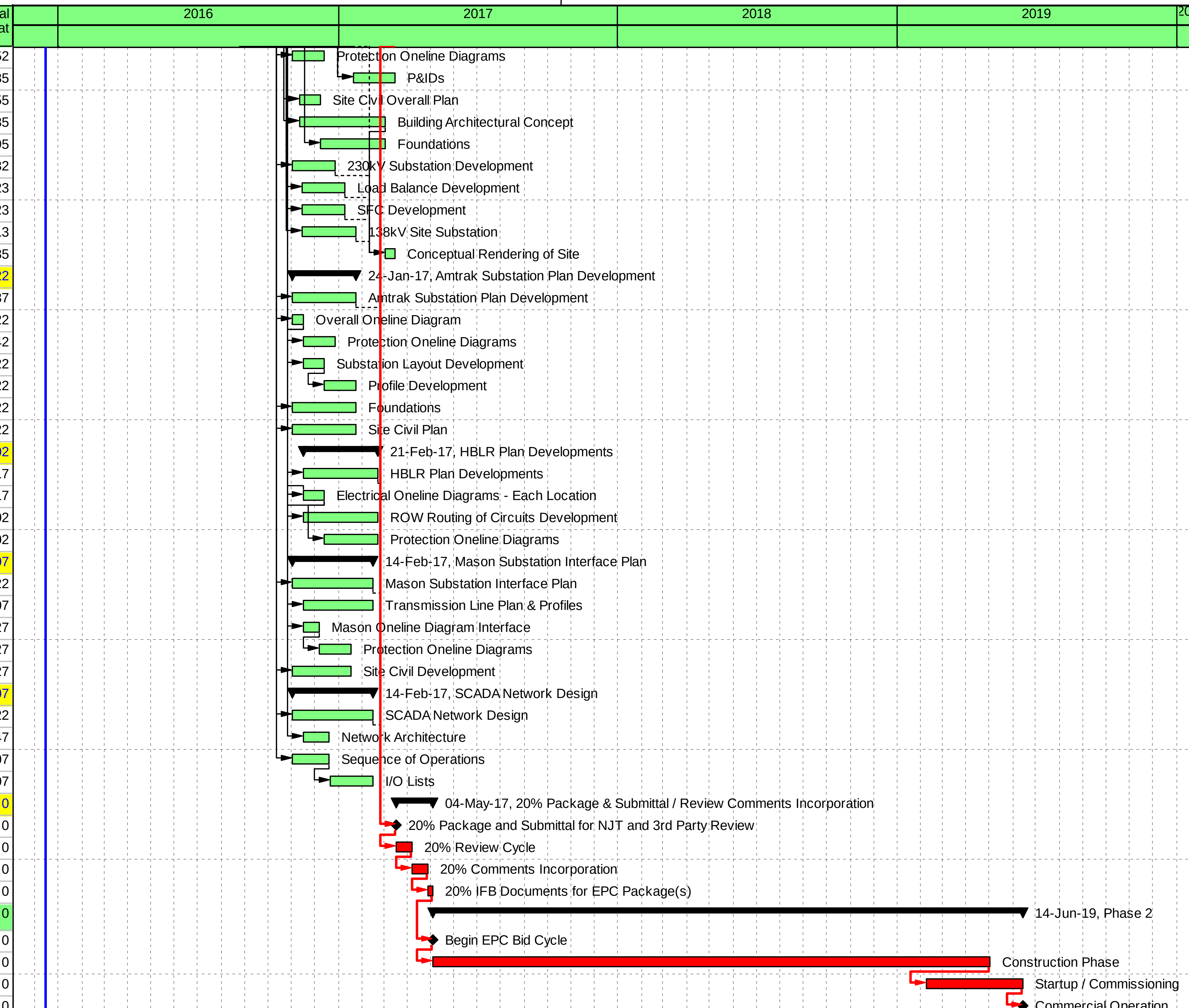
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
071	Permit Review	300	14-Oct-16	07-Dec-17	295
072	Revised Permit	20	08-Dec-17	04-Jan-18	295
073	Permit Approval	80	05-Jan-18	26-Apr-18	295
074	Approval to Operate	0	27-Apr-18		295
10% Design Development		156	29-Mar-16	01-Nov-16	682
075	10% Design Development	141	29-Mar-16	11-Oct-16	697
Site Plan Development Power Island		141	29-Mar-16	11-Oct-16	697
076	Site Plan Development Power Island	141	29-Mar-16	11-Oct-16	0
077	General Arrangement Concept	40	17-Jun-16	11-Aug-16	737
078	Electrical Overall Oneline Diagram	10	29-Mar-16	11-Apr-16	0
079	Process Flow Diagram	30	27-May-16	07-Jul-16	765
080	Site Civil Overall Plan	20	15-Jul-16	11-Aug-16	737
081	Conceptual Rendering of Site	3	12-Aug-16	16-Aug-16	737
082	230kV Substation Layout	20	12-Apr-16	09-May-16	763
083	Load Balance Layout	15	10-May-16	30-May-16	763
084	SFC Layout	15	31-May-16	20-Jun-16	763
085	138kV Site Substation	15	21-Jun-16	11-Jul-16	763
Amtrak Substation Plan Development		50	12-Apr-16	20-Jun-16	778
086	Amtrak Substation Plan Development	50	12-Apr-16	20-Jun-16	81
087	Overall Oneline Diagram	10	12-Apr-16	25-Apr-16	81
088	Substation Layout Development	20	26-Apr-16	23-May-16	778
089	Conceptual Profile(s)	15	24-May-16	13-Jun-16	783
090	Site Civil Plan	20	24-May-16	20-Jun-16	778
HBLR Plan Developments		100	12-Apr-16	29-Aug-16	728
091	HBLR Plan Developments	100	12-Apr-16	29-Aug-16	31
092	Electrical Oneline Diagrams - Each Location	60	12-Apr-16	04-Jul-16	31
093	Conceptual ROW Routing of Circuits	60	07-Jun-16	29-Aug-16	728
094	Typical Electrical Interconnection Scheme	20	05-Jul-16	01-Aug-16	748
Mason Substation Interface Plan		60	12-Apr-16	04-Jul-16	768
095	Mason Substation Interface Plan	60	12-Apr-16	04-Jul-16	71
096	Proposed Transmission Routing	60	12-Apr-16	04-Jul-16	71
097	Proposed Mason Oneline Diagram Interface	20	12-Apr-16	09-May-16	808
SCADA Network Design		70	29-Mar-16	04-Jul-16	768
098	SCADA Network Design	70	29-Mar-16	04-Jul-16	71
099	Network Architecture	40	12-Apr-16	06-Jun-16	768
100	Cyber Security Plan	35	17-May-16	04-Jul-16	768
101	Physical Security Description	30	29-Mar-16	09-May-16	71
10% Package & Submittal		15	12-Oct-16	01-Nov-16	0
102	10% Package and Submittal for NJT and 3rd Party Revie	0	12-Oct-16		0
103	10% Review Cycle	15	12-Oct-16	01-Nov-16	0
20% Design Development		132	02-Nov-16	04-May-17	550
104	20% Design Development	97	02-Nov-16	16-Mar-17	0
Site Plan Development Power Island		97	02-Nov-16	16-Mar-17	585
105	Site Plan Development Power Island	97	02-Nov-16	16-Mar-17	0
106	General Arrangement Concept	50	11-Nov-16	19-Jan-17	585
107	Electrical Overall Oneline Diagram	10	02-Nov-16	15-Nov-16	17



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

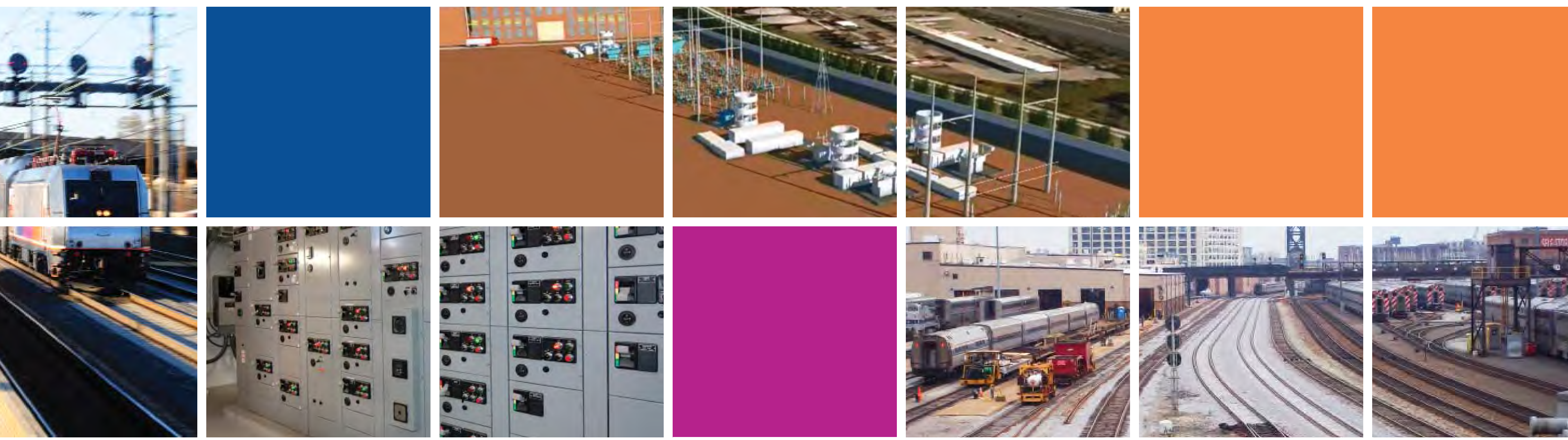
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
108	Protection Oneline Diagrams	30	02-Nov-16	13-Dec-16	652
109	P&IDs	40	20-Jan-17	16-Mar-17	585
110	Site Civil Overall Plan	20	11-Nov-16	08-Dec-16	655
111	Building Architectural Concept	80	11-Nov-16	02-Mar-17	585
112	Foundations	60	09-Dec-16	02-Mar-17	595
113	230kV Substation Development	40	02-Nov-16	27-Dec-16	632
114	Load Balance Development	40	15-Nov-16	09-Jan-17	623
115	SFC Development	40	15-Nov-16	09-Jan-17	623
116	138kV Site Substation	50	15-Nov-16	23-Jan-17	613
117	Conceptual Rendering of Site	10	03-Mar-17	16-Mar-17	585
Amtrak Substation Plan Development		60	02-Nov-16	24-Jan-17	622
118	Amtrak Substation Plan Development	60	02-Nov-16	24-Jan-17	37
119	Overall Oneline Diagram	10	02-Nov-16	15-Nov-16	622
120	Protection Oneline Diagrams	30	16-Nov-16	27-Dec-16	642
121	Substation Layout Development	20	16-Nov-16	13-Dec-16	622
122	Profile Development	30	14-Dec-16	24-Jan-17	622
123	Foundations	60	02-Nov-16	24-Jan-17	622
124	Site Civil Plan	60	02-Nov-16	24-Jan-17	622
HBLR Plan Developments		70	16-Nov-16	21-Feb-17	602
125	HBLR Plan Developments	70	16-Nov-16	21-Feb-17	17
126	Electrical Oneline Diagrams - Each Location	20	16-Nov-16	13-Dec-16	17
127	ROW Routing of Circuits Development	70	16-Nov-16	21-Feb-17	602
128	Protection Oneline Diagrams	50	14-Dec-16	21-Feb-17	602
Mason Substation Interface Plan		75	02-Nov-16	14-Feb-17	607
129	Mason Substation Interface Plan	75	02-Nov-16	14-Feb-17	22
130	Transmission Line Plan & Profiles	65	16-Nov-16	14-Feb-17	607
131	Mason Oneline Diagram Interface	15	16-Nov-16	06-Dec-16	627
132	Protection Oneline Diagrams	30	07-Dec-16	17-Jan-17	627
133	Site Civil Development	55	02-Nov-16	17-Jan-17	627
SCADA Network Design		75	02-Nov-16	14-Feb-17	607
134	SCADA Network Design	75	02-Nov-16	14-Feb-17	22
135	Network Architecture	25	16-Nov-16	20-Dec-16	647
136	Sequence of Operations	35	02-Nov-16	20-Dec-16	607
137	I/O Lists	40	21-Dec-16	14-Feb-17	607
20% Package & Submittal / Review Comments Incorpora		35	17-Mar-17	04-May-17	0
138	20% Package and Submittal for NJT and 3rd Party Revie	0	17-Mar-17		0
139	20% Review Cycle	15	17-Mar-17	06-Apr-17	0
140	20% Comments Incorporation	15	07-Apr-17	27-Apr-17	0
141	20% IFB Documents for EPC Package(s)	5	28-Apr-17	04-May-17	0
Phase 2		550	05-May-17	14-Jun-19	0
142	Begin EPC Bid Cycle	0	05-May-17		0
143	Construction Phase	520	05-May-17	02-May-19	0
144	Startup / Commissioning	90	08-Feb-19	13-Jun-19	0
145	Commercial Operation	0	14-Jun-19		0



Remaining Level of Effort | Remaining Work | Summary
Actual Level of Effort | Critical Remaining Work | WBS Summary Activity
Actual Work | Milestone | WBS Summary Progress

TASK filter: All Activities

Fully
charged. Ready
to go. Jacobs
NJ TRANSITGrid Team



NJ TRANSIT AGREEMENT No. 15-031

DESIGN, ENGINEERING, CONSTRUCTION ASSISTANCE AND OTHER TECHNICAL SERVICES FOR THE NJ TRANSITGRID

EXHIBIT B – COST INFORMATION

JACOBS

Jacobs Engineering Group Inc.
299 Madison Avenue
P.O. Box 1936
Morristown, New Jersey 07962-1936 U.S.A.
1.973.267.0555 Fax 1.973.267.3555

December 22, 2015

NJ TRANSIT Corp.
Procurement Department
One Penn Plaza East, 6th Floor
Newark, NJ 07105-2246
Attn: Thomas J. Fusco, Principal Contract Specialist

RE: REV 1 Cost Proposal for NJ TRANSIT RFP NO. 15-031 - Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project

Dear Mr. Fusco:

Jacobs Engineering Group Inc. (Jacobs) is pleased to submit one original and three copies of our cost proposal in response to NJ TRANSIT's letter dated December 2, 2015 for the referenced project, and follow on discussions with your team. We have reviewed the Scope of Work and all Addenda, and have prepared our hours and cost accordingly to deliver to you the services necessary for a cost-effective project.

Jacobs' staffing resources are provided under the singular leadership of our Building and Infrastructure Group. Although the two groups, North American Infrastructure (NAI) and Global Buildings North America Design (GBNA), report to one Senior Vice President and General Manager, at this time they have different audited overhead rates. In order to be compliant with audited overhead rate requirements, we priced the effort and associated overheads separately. Additionally, Sullivan Cove, Levitan, and Exida are privately held corporations and do not have FAR audited overhead rates and have offered fully loaded retail rates. Jersey Boring is included as a cost under GTS. We are offering passed through the same rates for consideration. If this is a problem, we will work with your team and subconsultants to address this issue.

We are fully committed to utilizing DBE firms and will meet your 18% goal for DBE participation on this project. To that end, we have included DBE firms GTS Consultants; Jersey Boring & Drilling; LKG-CMC, Inc.; Matrix New World Engineering Inc.; Richard Grubb & Associates, Inc.; SJH Engineers, P.C.; Sowinski-Sullivan Architects, P.C.; Esteban, and Sullivan Cove Consultants, LLC on our team with a revised DBE participation of 18% for Phase 1 after discussions with your team.

We look forward to working with NJ TRANSIT to deliver this project, and to continue supporting your efforts to meet the needs of your customers. Should you have any questions or require additional information, please contact, Roger Copeland, at 817-965-0036 or at roger.copeland@jacobs.com.

Sincerely,

JACOBS ENGINEERING GROUP INC.

Stanley Rosenblum, Vice President / Project Executive

Roger Copeland, Project Manager

Attachments: Assumptions & Clarifications for Cost Proposal
Cost Proposal Forms

Assumptions, Clarifications, and Exclusions

1. Assumes Roger Copeland travel for near full time attendance in Newark for the first 90 days of the project and then on site around 30% of the time for the duration. This assumption is for the purposes of quantifying travel costs only (already in proposal budget).
2. Assumes total of 121 air round trips from Texas to New Jersey for the Energy & Power team. This assumption is for the purposes of quantifying travel costs only (already in proposal budget).
3. Includes a total of 400 days for Energy & Power team to be in Newark. This assumption is for the purposes of quantifying travel costs only (already in proposal budget).
4. Assumes all design meetings, including those with Amtrak will be in the Greater Metropolitan Area. Jacobs understands the need to attend Amtrak meetings in Philadelphia with Amtrak. If additional travel is required, additional funds must be allocated.
5. Excludes any fees associated with the PJM interconnection permit, air permit, or other NEPA or similar permits. It is assumed these will be paid directly by NJT.
6. Proposal is based on utilizing existing staff offices for Jacobs and team. If additional office locations are required (Newark) then the stipulated overhead rates would be adjusted accordingly. We as a team will have access to the LTK offices at 400 Market Street, Suite 500, Newark NJ 07105.
7. Assumes $100,000 of reproduction expenses only. If additional copies or submittals are required that exceed this budget, additional compensation shall be appropriated. These expenses are expected to be subcontracted to Esteban and have been added to the DBE participation summary.
8. Proposal is based on 2016 labor rates and accounts for provisional 3% annual labor escalation for work encumbered post 2016. This is down from 4% with the fee delta added to as-directed hours for NJT use.
9. LEED/Green Globes certification for the power plant building and associated documentation are not included in base fee.
10. The cost and scope is based on each boring being performed during normal business hours, Monday through Friday, 7 AM to 5 PM.
11. It is assumed that track outages, if warranted, and use of railroad protective services and personnel, such as flagmen, will be provided by the railroad at no cost, and coordinated by the client.
12. If contaminated soil or groundwater is encountered during soil boring, the bore will be terminated and backfilled. We will prepare a supplemental proposal for completing the investigation, if necessary. The drilling subcontractor will contact the One Call service for general utility markout; however we expect NJ TRANSIT and Amtrak to assist in locating utilities on their property. We understand that all related activities must be coordinated with BEM.
13. The geotechnical investigation scope is based on a set of assumed borings as noted below (assumed to be conservative).
    a. 6 borings for SUB 41 location; depth about 110 feet which includes 10 feet rock core
    b. 12 site borings; depth about 105 feet which includes 5 feet rock core
    c. 44 borings for the PLANT location; depth about 110 feet which includes 10 feet rock core
    d. 30 borings for the AUXILLARY STRUCTURE; depth about 105 feet which includes 5 feet rock core
    e. 7 miscellaneous borings; depth about 110 feet which includes 10 feet rock core

f. 12 borings for the MED PRESSURE GAS LINE; depth about 30 feet
g. 12 borings for the HIGH PRESSURE GAS LINE; depth about 30 feet

14. Assumes that licenses for client's ECMS will not be required. If needed, additional funds shall be appropriated to cover this cost.
15. Proposal is based on the scope in the NJT RFP, which is based on simple cycle reciprocating engines. It does not account for early equipment procurement for combined cycle or other optimized solutions which may prove valuable to the project. The time allocated in the project schedule will have to be adjusted (and associated management efforts per our proposed alternative schedule, due to the linear nature of this design process) If this process is elected, additional hours will be allocated to advance the project.
16. Proposal is based on the scope in the NJT RFP. It does not account for full PJM interconnection processes since this engagement is only for phase 1 and the PJM process will extend beyond this engagement. It is assumed that completion will be in Phase 2 or by the EPC D/B contractor in the RFP.
17. Proposal is based on the scope in the NJT RFP. It does not account for full air permit processes since this engagement is only for phase 1 and the air permit process will extend beyond this engagement. It is assumed that completion will be in Phase 2 or by the EPC D/B contractor in the RFP.
18. Proposal is for Phase 1 services only.
19. Phase 1 is expected not to exceed 15 months in schedule based on the RFP requirements. If additional schedule delays are encountered not as a result of Jacobs' effort, additional project management and oversite hours will be appropriated to advance the project.
20. For connection to Substation 42, no mapping is proposed. It is assumed that all connections will be installed on existing AMTRAK ROW. It is also assumed that sufficient design details will be able to be provided from existing data with surveying performed by the design build contractor(s). If additional survey collection or geotechnical investigations are needed, it will be additional scope.
21. For distribution along HBLR with service to Henderson and Hoboken, no mapping proposed. It is assumed that all connections will be installed on existing NJ Transit ROW. It is also assumed that sufficient design details will be able to be provided from existing data with surveying performed by the design build contractor(s). If additional survey collection or geotechnical investigations are needed, it will be additional scope.
22. As indicated in Jacobs Section 10 on the technical proposal, Jacobs and its subconsultant Burns Engineering, Inc. can comply with the insurance requirements included in the agreement, but our other subs, particularly DBE subs, cannot meet the stipulated limits. We respectfully request that the insurance provision recently incorporated in the County Yard Agreement be included in the agreement for this project.

PHASE 1

TASK : 1.1 - Project Management Plan

Rate escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ +10 94.09	$ 3,763.47
Assistant PM - (GBNA)	Energy & Power	80	$ -40 56.95	$ 4,555.90
Administrative Person - (GBNA)	Energy & Power	20	$ -10 31.44	$ 628.71
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 95.97	$ 7,677.78
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	24	$ +16 123.92	$ 2,974.16
F. DiPalma - (NAI)	Regulatory & Stakeholder Coordination Lead	80	$ 103.86	$ 8,308.46
S. Grill - (GBNA)	Procurement	10	$ 117.90	$ 1,179.05
G. Ruggiero - (NAI)	Safety / Security Lead	20	$ 68.15	$ 1,363.06
K. Herlihy - (NAI)	Site-Specific Plan	20	$ 64.27	$ 1,285.32
				$ 31,735.92
TOTAL ESTIMATED HOURS		374		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 10,127.12
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 21,608.79
OVERHEAD (JACOBS-GBNA)	100.90%		$ 10,218.27
OVERHEAD (JACOBS-NAI)	109.46%		$ 23,652.99
SUBTOTAL -- SALARY + OVERHEAD			$ 65,607.17
FIXED FEE	10%	% of Bare Cost + Overhead	$ 6,560.72
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 72,167.89

PHASE I

TASK : 1.2 -Project Control

FIRM : JACOBS

Rate escalation factor 1.078

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	100	$ 98.45	$ 9,844.95
Assistant PM - (GBNA)	Energy & Power	400	$ 59.59	$ 23,835.77
Administrative Person - (GBNA)	Energy & Power	20	$ 32.89	$ 657.87
D. Elmaddah - (NAI)	Deputy Project Manager	240	$ 100.42	$ 24,101.42
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 129.67	$ 1,037.36
M. Pytlik - (NAI)	Project Controls Lead	800	$ 64.51	$ 51,606.15
				$ 111,083.52
TOTAL ESTIMATED HOURS		1,568		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 34,338.59
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 76,744.93
OVERHEAD (JACOBS-GBNA)	100.90%		$ 34,647.64
OVERHEAD (JACOBS-NAI)	109.46%		$ 84,005.00
SUBTOTAL -- SALARY + OVERHEAD			$ 229,736.16
FIXED FEE	10%	% of Bare Cost + Overhead	$ 22,973.62
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 252,709.78

PHASE I

TASK : 1.2.1 - Final Scoping / Prel. Engineering (PE) Schedule) Rate escalation factor 1.032

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	60	$ 94.23	$ 5,653.67
Administrative Person - (GBNA)	Energy & Power	20	$ 31.48	$ 629.66
D. Elmaddah - (NAI)	Deputy Project Manager	240	$ 96.12	$ 23,067.90
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	32	$ 124.11	$ 3,971.50
M. Pytlik - (NAI)	Project Controls Lead	80	$ 61.74	$ 4,939.32
M. Cabrera - (NAI)	Railroad Operations / Force Account	8	$ 55.24	$ 441.91
D. Morgan - (NAI)	Scheduling	600	$ 60.21	$ 36,126.77
				$ 74,830.73
TOTAL ESTIMATED HOURS		1,040		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 6,283.32
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 68,547.41
OVERHEAD (JACOBS-GBNA)	100.90%		$ 6,339.87
OVERHEAD (JACOBS-NAI)	109.46%		$ 75,031.99
SUBTOTAL -- SALARY + OVERHEAD			$ 156,202.60
FIXED FEE	10%	% of Bare Cost + Overhead	$ 15,620.26
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 171,822.86

PHASE I

TASK : 1.2.2 - Records Management Control System

Rate escalation factor 1.039

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.90	$ 3,796.18
Administrative Person - (GBNA)	Energy & Power	20	$ 31.71	$ 634.18
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 96.81	$ 7,744.53
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 125.00	$ 1,000.01
M. Pytlik - (NAI)	Project Controls Lead	200	$ 62.18	$ 12,436.98
				$ 25,611.88
TOTAL ESTIMATED HOURS		348		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 4,430.36
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 21,181.52
OVERHEAD (JACOBS-GBNA)	100.90%		$ 4,470.23
OVERHEAD (JACOBS-NAI)	109.46%		$ 23,185.29
SUBTOTAL -- SALARY + OVERHEAD			$ 53,267.40
FIXED FEE	10%	% of Bare Cost + Overhead	$ 5,326.74
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 58,594.14

PHASE I

TASK : 1.2.3 - Monthly Progress Reporting

Rate escalation factor 1.032

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	120	$ 94.23	$ 11,307.34
K. McAnally - (GBNA)	Lead Power Process Engineer	30	$ 87.30	$ 2,619.02
H. Tull - (GBNA)	Lead Mechanical Engineer	30	$ 61.99	$ 1,859.76
J. Saltarelli - (GBNA)	Mechanical Engineer	30	$ 74.05	$ 2,221.50
M. Lewis - (GBNA)	Electrical Power Engineer	30	$ 69.43	$ 2,082.98
K. Uthirapathy - (GBNA)	Electrical Power Engineer	30	$ 59.51	$ 1,785.37
A. Marsh - (GBNA)	Relay and Coordination Engineer	30	$ 64.47	$ 1,934.15
S. Flynn - (GBNA)	Lead I&C Engineer	30	$ 73.39	$ 2,201.83
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	30	$ 77.61	$ 2,328.42
M. Sutton - (GBNA)	Electrical Engineer	30	$ 53.31	$ 1,599.39
Dist. Eng. TBD - (GBNA)	Distribution Engineer	30	$ 71.64	$ 2,149.22
C. Vallenilla - (GBNA)	Structural Engineer	30	$ 109.34	$ 3,280.33
G. Serna - (GBNA)	Structural Engineer	30	$ 50.44	$ 1,513.27
Administrative Person - (GBNA)	Energy & Power	20	$ 31.48	$ 629.66
R. Schwass - (GBNA)	Grant Application	15	$ 87.04	$ 1,305.55
D. Elmaddah - (NAI)	Deputy Project Manager	120	$ 96.12	$ 11,533.95
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	30	$ 124.11	$ 3,723.28
M. Pytlik - (NAI)	Project Controls Lead	120	$ 61.74	$ 7,408.98
D. Morgan - (NAI)	Scheduling	200	$ 60.21	$ 12,042.26
R. Markman - (NAI)	DBE Compliance Officer	120	$ 67.36	$ 8,083.41
				$ 81,609.69
TOTAL ESTIMATED HOURS		1,105		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 38,817.81
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 42,791.88
OVERHEAD (JACOBS-GBNA)	100.90%		$ 39,167.17
OVERHEAD (JACOBS-NAI)	109.46%		$ 46,839.99
SUBTOTAL -- SALARY + OVERHEAD			$ 167,616.85
FIXED FEE	10%	% of Bare Cost + Overhead	$ 16,761.69
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 184,378.54

PHASE I

TASK : 1.3 - Quality Control

Rate escalation factor 1.032

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	80	$ 94.23	$ 7,538.23
K. McAnally - (GBNA)	Lead Power Process Engineer	80	$ 87.30	$ 6,984.06
H. Tull - (GBNA)	Lead Mechanical Engineer	80	$ 61.99	$ 4,959.36
J. Saltarelli - (GBNA)	Mechanical Engineer	80	$ 74.05	$ 5,924.01
M. Lewis - (GBNA)	Electrical Power Engineer	80	$ 69.43	$ 5,554.62
K. Uthirapathy - (GBNA)	Electrical Power Engineer	60	$ 59.51	$ 3,570.74
A. Marsh - (GBNA)	Relay and Coordination Engineer	40	$ 64.47	$ 2,578.87
S. Flynn - (GBNA)	Lead I&C Engineer	80	$ 73.39	$ 5,871.55
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	40	$ 77.61	$ 3,104.56
M. Sutton - (GBNA)	Electrical Engineer	80	$ 53.31	$ 4,265.05
Dist. Eng. TBD - (GBNA)	Distribution Engineer	20	$ 71.64	$ 1,432.82
C. Vallenilla - (GBNA)	Structural Engineer	80	$ 109.34	$ 8,747.55
G. Serna - (GBNA)	Structural Engineer	80	$ 50.44	$ 4,035.40
Assistant PM - (GBNA)	Energy & Power	80	$ 57.03	$ 4,562.73
Administrative Person - (GBNA)	Energy & Power	20	$ 31.48	$ 629.66
K. Fox - (GBNA)	Quality Control - Power	80	$ 96.21	$ 7,696.93
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 96.12	$ 7,689.30
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 124.11	$ 2,482.19
D. Legg - (NAI)	Constructability Leader	80	$ 126.29	$ 10,103.34
				$ 97,730.96
TOTAL ESTIMATED HOURS		1,240		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 77,456.13
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 20,274.83
OVERHEAD (JACOBS-GBNA)	100.90%		$ 78,153.23
OVERHEAD (JACOBS-NAI)	109.46%		$ 22,192.83
SUBTOTAL -- SALARY + OVERHEAD			$ 198,077.02
FIXED FEE	10%	% of Bare Cost + Overhead	$ 19,807.70
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 217,884.72

PHASE I
TASK : 1.3.1 - Quality Management Plan (QMP)

Rate escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
Administrative Person - (GBNA)	Energy & Power	20	$ 31.44	$ 628.71
R. Ferretti - (NAI)	Quality Manager	60	$ 69.33	$ 4,159.76
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 123.92	$ 991.39
R. Rosa - (NAI)	SCADA Coordination	4	$ 84.46	$ 337.82
D. Legg - (NAI)	Constructability Leader	40	$ 126.10	$ 5,044.10
G. Ruggiero - (NAI)	Safety / Security Lead	10	$ 68.15	$ 681.53
K. Herlihy - (NAI)	Site-Specific Plan	10	$ 64.27	$ 642.66
				$ 12,485.98
TOTAL ESTIMATED HOURS		152		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 628.71
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 11,857.27
OVERHEAD (JACOBS-GBNA)	100.90%		$ 634.37
OVERHEAD (JACOBS-NAI)	109.46%		$ 12,978.96
SUBTOTAL -- SALARY + OVERHEAD			$ 26,099.31
FIXED FEE	10%	% of Bare Cost + Overhead	$ 2,609.93
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 28,709.24

PHASE I

TASK : 1.3.2 - Quality Management Plan Requirements

Rate escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 123.92	$ 991.39
				$ 991.39
TOTAL ESTIMATED HOURS		8		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ -
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 991.39
OVERHEAD (JACOBS-GBNA)	100.90%		$ -
OVERHEAD (JACOBS-NAI)	109.46%		$ 1,085.17
SUBTOTAL -- SALARY + OVERHEAD			$ 2,076.56
FIXED FEE	10%	% of Bare Cost + Overhead	$ 207.66
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 2,284.22

PHASE I

TASK : 1.3.3 - ISO 9001 Requirements — Rate escalation factor 1.030 — FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Ferretti - (NAI)	Quality Manager	15	$ 69.33	$ 1,039.94
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 123.92	$ 991.39
				$ 2,031.33
TOTAL ESTIMATED HOURS		23		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ -
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 2,031.33
OVERHEAD (JACOBS-GBNA)	100.90%		$ -
OVERHEAD (JACOBS-NAI)	109.46%		$ 2,223.49
SUBTOTAL -- SALARY + OVERHEAD			$ 4,254.82
FIXED FEE	10%	% of Bare Cost + Overhead	$ 425.48
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 4,680.30

PHASE I

TASK : 1.3.4 - Quality Manager and Other Resources

Rate escalation factor 1.032

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	20	$ 94.23	$ 1,884.56
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.12	$ 3,844.65
R. Ferretti - (NAI)	Quality Manager	53	$ 69.43	$ 3,679.96
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	32	$ 124.11	$ 3,971.50
				$ 13,380.67
TOTAL ESTIMATED HOURS		145		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 1,884.56
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 11,496.12
OVERHEAD (JACOBS-GBNA)	100.90%		$ 1,901.52
OVERHEAD (JACOBS-NAI)	109.46%		$ 12,583.65
SUBTOTAL -- SALARY + OVERHEAD			$ 27,865.84
FIXED FEE	10%	% of Bare Cost + Overhead	$ 2,786.58
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 30,652.42

PHASE I

TASK : 1.3.5 - Design Control

Rate escalation factor 1.032

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	120	$ 94.23	$ 11,307.34
Administrative Person - (GBNA)	Energy & Power	20	$ 31.48	$ 629.66
D. Elmaddah - (NAI)	Deputy Project Manager	520	$ 96.12	$ 49,980.46
R. Ferretti - (NAI)	Quality Manager	40	$ 69.43	$ 2,777.33
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	16	$ 124.11	$ 1,985.75
F. Velazquez - (NAI)	Signals	40	$ 93.01	$ 3,720.49
W. George - (NAI)	Communications	40	$ 101.60	$ 4,063.96
M. Cabrera - (NAI)	Railroad Operations / Force Account	20	$ 55.24	$ 1,104.78
D. Legg - (NAI)	Constructability Leader	90	$ 126.29	$ 11,366.26
				$ 86,936.03
TOTAL ESTIMATED HOURS		906		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 11,936.99
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 74,999.04
OVERHEAD (JACOBS-GBNA)	100.90%		$ 12,044.43
OVERHEAD (JACOBS-NAI)	109.46%		$ 82,093.95
SUBTOTAL -- SALARY + OVERHEAD			$ 181,074.41
FIXED FEE	10%	% of Bare Cost + Overhead	$ 18,107.44
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 199,181.85

PHASE I

TASK : 1.3.6 - Control of Quality Records

Rate escalation factor 1.032

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.23	$ 3,769.11
Administrative Person - (GBNA)	Energy & Power	20	$ 31.48	$ 629.66
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.12	$ 3,844.65
R. Ferretti - (NAI)	Quality Manager	15	$ 69.43	$ 1,041.50
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	16	$ 124.11	$ 1,985.75
D. Legg - (NAI)	Constructability Leader	40	$ 126.29	$ 5,051.67
				$ 16,322.34
TOTAL ESTIMATED HOURS		171		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 4,398.77
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 11,923.57
OVERHEAD (JACOBS-GBNA)	100.90%		$ 4,438.36
OVERHEAD (JACOBS-NAI)	109.46%		$ 13,051.54
SUBTOTAL -- SALARY + OVERHEAD			$ 33,812.24
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,381.22
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 37,193.46

PHASE I

TASK : 1.3.7 - Internal Quality Audits

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	60	$ 94.37	$ 5,662.14
Administrative Person - (GBNA)	Energy & Power	20	$ 31.53	$ 630.60
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.26	$ 3,850.41
R. Ferretti - (NAI)	Quality Manager	60	$ 69.54	$ 4,172.24
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	64	$ 124.30	$ 7,954.90
F. Velazquez - (NAI)	Signals	20	$ 93.15	$ 1,863.03
W. George - (NAI)	Communications	20	$ 101.75	$ 2,035.02
				$ 26,168.34
TOTAL ESTIMATED HOURS		284		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 6,292.74
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 19,875.60
OVERHEAD (JACOBS-GBNA)	100.90%		$ 6,349.37
OVERHEAD (JACOBS-NAI)	109.46%		$ 21,755.84
SUBTOTAL -- SALARY + OVERHEAD			$ 54,273.54
FIXED FEE	10%	% of Bare Cost + Overhead	$ 5,427.35
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 59,700.90

PHASE I

TASK : 1.4 - Peer Review of Design

Rate escalation factor 1.045

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	30	$ 95.50	$ 2,864.94
K. McAnally - (GBNA)	Lead Power Process Engineer	16	$ 88.48	$ 1,415.64
H. Tull - (GBNA)	Lead Mechanical Engineer	16	$ 62.83	$ 1,005.24
J. Saltarelli - (GBNA)	Mechanical Engineer	16	$ 75.05	$ 1,200.77
M. Lewis - (GBNA)	Electrical Power Engineer	16	$ 70.37	$ 1,125.90
K. Uthirapathy - (GBNA)	Electrical Power Engineer	16	$ 60.31	$ 965.03
A. Marsh - (GBNA)	Relay and Coordination Engineer	16	$ 65.34	$ 1,045.45
S. Flynn - (GBNA)	Lead I&C Engineer	16	$ 74.38	$ 1,190.14
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	16	$ 78.66	$ 1,258.56
M. Sutton - (GBNA)	Electrical Engineer	16	$ 54.03	$ 864.51
T Line Eng. TBD - (GBNA)	Transmission Engineer	0	$ 83.64	$ -
Dist. Eng. TBD - (GBNA)	Distribution Engineer	16	$ 72.61	$ 1,161.70
C. Vallenilla - (GBNA)	Structural Engineer	16	$ 110.82	$ 1,773.09
G. Serna - (GBNA)	Structural Engineer	16	$ 51.12	$ 817.96
Assistant PM - (GBNA)	Energy & Power	20	$ 57.80	$ 1,156.06
Administrative Person - (GBNA)	Energy & Power	20	$ 31.91	$ 638.14
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 97.41	$ 7,792.95
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	16	$ 125.78	$ 2,012.52
F. Velazquez - (NAI)	Signals	8	$ 94.27	$ 754.13
W. George - (NAI)	Communications	8	$ 102.97	$ 823.75
R. Rosa - (NAI)	SCADA Coordination	8	$ 85.72	$ 685.78
M. Cabrera - (NAI)	Railroad Operations / Force Account	8	$ 55.98	$ 447.87
D. Legg - (NAI)	Constructability Leader	100	$ 127.99	$ 12,799.41
S. Eichinger - (NAI)	Constructability Lead	100	$ 116.73	$ 11,672.75
TBD - (NAI)	Peer Review Lead	200	$ 73.70	$ 14,740.85
TBD - (NAI)	Safety Design Coordinator	60	$ 145.76	$ 8,745.40
				$ 78,958.56
TOTAL ESTIMATED HOURS		850		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 18,483.15
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 60,475.41
OVERHEAD (JACOBS-GBNA)	100.90%		$ 18,649.50
OVERHEAD (JACOBS-NAI)	109.46%		$ 66,196.38
SUBTOTAL -- SALARY + OVERHEAD			$ 163,804.44
FIXED FEE	10%	% of Bare Cost + Overhead	$ 16,380.44
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 180,184.88

PHASE I

TASK : 1.5 - Configuration Management

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	24	$ 94.37	$ 2,264.85
Assistant PM - (GBNA)	Energy & Power	40	$ 57.12	$ 2,284.78
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.26	$ 3,850.41
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	16	$ 124.30	$ 1,988.72
G. Ruggiero - (NAI)	Safety / Security Lead	10	$ 68.36	$ 683.58
K. Herlihy - (NAI)	Site-Specific Plan	10	$ 64.46	$ 644.59
				$ 11,716.94
TOTAL ESTIMATED HOURS		140		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 4,549.64
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 7,167.30
OVERHEAD (JACOBS-GBNA)	100.90%		$ 4,590.58
OVERHEAD (JACOBS-NAI)	109.46%		$ 7,845.33
SUBTOTAL -- SALARY + OVERHEAD			$ 24,152.85
FIXED FEE	10%	% of Bare Cost + Overhead	$ 2,415.28
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 26,568.13

PHASE I

TASK : 1.6 - Project Meetings

Rate escalation factor 1.094

FIRM : JACOBS

TECHNICAL STAFF						
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY		TOTAL SALARY	
R. Copeland - (GBNA)	Project Manager	400	$	99.90	$	39,961.52
K. McAnally - (GBNA)	Lead Power Process Engineer	40	$	92.56	$	3,702.38
H. Tull - (GBNA)	Lead Mechanical Engineer	80	$	65.73	$	5,258.10
J. Saltarelli - (GBNA)	Mechanical Engineer	12	$	78.51	$	942.13
M. Lewis - (GBNA)	Electrical Power Engineer	60	$	73.62	$	4,416.91
K. Uthirapathy - (GBNA)	Electrical Power Engineer	120	$	63.10	$	7,571.66
S. Flynn - (GBNA)	Lead I&C Engineer	80	$	77.82	$	6,225.24
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	60	$	82.29	$	4,937.35
M. Sutton - (GBNA)	Electrical Engineer	80	$	56.52	$	4,521.96
Dist. Eng. TBD - (GBNA)	Distribution Engineer	20	$	75.96	$	1,519.12
C. Vallenilla - (GBNA)	Structural Engineer	80	$	115.93	$	9,274.48
G. Serna - (GBNA)	Structural Engineer	80	$	53.48	$	4,278.48
Assistant PM - (GBNA)	Energy & Power	400	$	60.47	$	24,187.87
Administrative Person - (GBNA)	Energy & Power	100	$	33.38	$	3,337.92
R. Schwass - (GBNA)	Grant Application	40	$	92.28	$	3,691.19
D. Elmaddah - (NAI)	Deputy Project Manager	240	$	101.91	$	24,457.44
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	128	$	131.59	$	16,842.93
S. Grill - (GBNA)	Procurement	10	$	125.19	$	1,251.94
F. Velazquez - (NAI)	Signals	40	$	98.62	$	3,944.60
W. George - (NAI)	Communications	40	$	107.72	$	4,308.76
R. Rosa - (NAI)	SCADA Coordination	40	$	89.68	$	3,587.08
M. Cabrera - (NAI)	Railroad Operations / Force Account	20	$	58.57	$	1,171.33
J. Homoki - (NAI)	Site / Civil Lead	160	$	82.16	$	13,145.77
K. Bienkowski - (NAI)	Utilities Engineering / Relocation	80	$	86.83	$	6,946.44
T. Decker - (NAI)	Hydraulics / Drainage Engineer	80	$	104.84	$	8,387.33
D. Cimino - (NAI)	Bid Support	10	$	90.49	$	904.86
Administrative Person - (NAI)	Administrative Support	80	$	41.78	$	3,342.29
					$	212,117.08
TOTAL ESTIMATED HOURS		2,580				

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$	125,078.24
TOTAL SALARY (BARE COST)-JACOBS NAI			$	87,038.84
OVERHEAD (JACOBS-GBNA)	100.90%		$	126,203.94
OVERHEAD (JACOBS-NAI)	109.46%		$	95,272.72
SUBTOTAL -- SALARY + OVERHEAD			$	433,593.74
FIXED FEE	10%	% of Bare Cost + Overhead	$	43,359.37
ESTIMATED DIRECT EXPENDITURES				
Travel Expenses			$	265,594.41
Reproduction				
Overnight Mail / Messenger				
Misc.			$	-
TOTAL DIRECT EXPENSES			$	265,594.41
TOTAL THIS TASK			$	742,547.53

PHASE I

TASK : 1.7 - Payment Procedures

Rate escalation factor 1.094

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	60	$ 99.90	$ 5,994.23
Assistant PM - (GBNA)	Energy & Power	80	$ 60.47	$ 4,837.57
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 101.91	$ 8,152.48
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 131.59	$ 1,052.68
				$ 20,036.97
TOTAL ESTIMATED HOURS		228		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 10,831.80
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 9,205.16
OVERHEAD (JACOBS-GBNA)	100.90%		$ 10,929.29
OVERHEAD (JACOBS-NAI)	109.46%		$ 10,075.97
SUBTOTAL -- SALARY + OVERHEAD			$ 41,042.23
FIXED FEE	10%	% of Bare Cost + Overhead	$ 4,104.22
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 45,146.45

PHASE I

TASK : 2.1 - Verification of Concept

Rate escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	100	$ 94.09	$ 9,408.67
K. McAnally - (GBNA)	Lead Power Process Engineer	400	$ 87.17	$ 34,868.01
B. Romero - (GBNA)	Mechanical Engineer	200	$ 55.80	$ 11,160.71
H. Tull - (GBNA)	Lead Mechanical Engineer	40	$ 61.90	$ 2,475.97
J. Saltarelli - (GBNA)	Mechanical Engineer	40	$ 73.94	$ 2,957.57
M. Lewis - (GBNA)	Electrical Power Engineer	40	$ 69.33	$ 2,773.15
K. Uthirapathy - (GBNA)	Electrical Power Engineer	80	$ 59.42	$ 4,753.85
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	120	$ 77.50	$ 9,299.73
M. Sutton - (GBNA)	Electrical Engineer	300	$ 53.23	$ 15,969.99
Dist. Eng. TBD - (GBNA)	Distribution Engineer	12	$ 71.53	$ 858.40
C. Vallenilla - (GBNA)	Structural Engineer	12	$ 109.18	$ 1,310.17
G. Serna - (GBNA)	Structural Engineer	12	$ 50.37	$ 604.40
Assistant PM - (GBNA)	Energy & Power	100	$ 56.95	$ 5,694.87
R. Schwass - (GBNA)	Grant Application	40	$ 86.91	$ 3,476.26
K. Fox - (GBNA)	Quality Control - Power	80	$ 96.07	$ 7,685.40
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	40	$ 123.92	$ 4,956.94
R. McPherson - (NAI)	Sr. Traction Power	20	$ 106.14	$ 2,122.71
F. Velazquez - (NAI)	Signals	20	$ 92.87	$ 1,857.46
W. George - (NAI)	Communications	20	$ 101.45	$ 2,028.94
R. Rosa - (NAI)	SCADA Coordination	20	$ 84.46	$ 1,689.11
M. Cabrera - (NAI)	Railroad Operations / Force Account	20	$ 55.16	$ 1,103.13
TBD - (NAI)	Corrosion Prevention	12	$ 107.83	$ 1,293.97
				$ 128,349.40
TOTAL ESTIMATED HOURS		1,728		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 113,297.14
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 15,052.26
OVERHEAD (JACOBS-GBNA)	100.90%		$ 114,316.81
OVERHEAD (JACOBS-NAI)	109.46%		$ 16,476.21
SUBTOTAL -- SALARY + OVERHEAD			$ 259,142.42
FIXED FEE	10%	% of Bare Cost + Overhead	$ 25,914.24
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 285,056.67

PHASE I

TASK : 2.2 - Engineering and Design

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	120	$ 94.37	$ 11,324.27
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	1,160	$ 77.73	$ 90,167.04
M. Sutton - (GBNA)	Electrical Engineer	1,000	$ 53.39	$ 53,392.98
C. Vallenilla - (GBNA)	Structural Engineer	300	$ 109.51	$ 32,852.45
G. Serna - (GBNA)	Structural Engineer	600	$ 50.52	$ 30,310.80
CADD Person - (GBNA)	Energy & Power	3,000	$ 33.16	$ 99,486.57
Administrative Person - (GBNA)	Energy & Power	120	$ 31.53	$ 3,783.59
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	480	$ 124.30	$ 59,661.74
M. Cabrera - (NAI)	Railroad Operations / Force Account	160	$ 55.32	$ 8,851.52
T. Schlagbaum - (GBNA)	Landscape Architecture	25	$ 57.65	$ 1,441.20
TBD - (NAI)	Corrosion Prevention	20	$ 108.15	$ 2,163.08
				$ 393,435.24
TOTAL ESTIMATED HOURS		6,985		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 322,758.90
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 70,676.34
OVERHEAD (JACOBS-GBNA)	100.90%		$ 325,663.73
OVERHEAD (JACOBS-NAI)	109.46%		$ 77,362.32
SUBTOTAL -- SALARY + OVERHEAD			$ 796,461.29
FIXED FEE	10%	% of Bare Cost + Overhead	$ 79,646.13
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 876,107.42

PHASE I

TASK : **2.2.1 - Power Plant Design** | Rate escalation factor 1.033 | FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	240	$ 94.37	$ 22,648.55
K. McAnally - (GBNA)	Lead Power Process Engineer	30	$ 87.43	$ 2,622.95
B. Romero - (GBNA)	Mechanical Engineer	1,200	$ 55.97	$ 67,165.15
H. Tull - (GBNA)	Lead Mechanical Engineer	400	$ 62.08	$ 24,833.95
J. Saltarelli - (GBNA)	Mechanical Engineer	400	$ 74.16	$ 29,664.39
M. Lewis - (GBNA)	Electrical Power Engineer	1,200	$ 69.54	$ 83,444.13
K. Uthirapathy - (GBNA)	Electrical Power Engineer	1,200	$ 59.60	$ 71,521.73
A. Marsh - (GBNA)	Relay and Coordination Engineer	400	$ 64.57	$ 25,827.33
S. Flynn - (GBNA)	Lead I&C Engineer	200	$ 73.50	$ 14,700.87
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	1,200	$ 77.73	$ 93,276.25
M. Sutton - (GBNA)	Electrical Engineer	900	$ 53.39	$ 48,053.69
Assistant PM - (GBNA)	Energy & Power	500	$ 57.12	$ 28,559.77
Administrative Person - (GBNA)	Energy & Power	120	$ 31.53	$ 3,783.59
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 124.30	$ 2,485.91
F. DiPalma - (NAI)	Regulatory & Stakeholder Coordination Lead	80	$ 104.17	$ 8,333.38
TBD - (NAI)	PJM Adm, Production O&M Costs	120	$ 80.83	$ 9,699.48
				$ 536,621.11
TOTAL ESTIMATED HOURS		8,210		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 516,102.35
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 20,518.76
OVERHEAD (JACOBS-GBNA)	100.90%		$ 520,747.27
OVERHEAD (JACOBS-NAI)	109.46%		$ 22,459.84
SUBTOTAL -- SALARY + OVERHEAD			$ 1,079,828.22
FIXED FEE	10%	% of Bare Cost + Overhead	$ 107,982.82
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 1,187,811.04

PHASE I **FIRM : JACOBS**

TASK : **2.2.2 - Electric Traction Power Facilities and Power Management System Design** — **Rate escalation factor 1.033**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	60	$ 94.37	$ 5,662.14
M. Lewis - (GBNA)	Electrical Power Engineer	200	$ 69.54	$ 13,907.35
K. Uthirapathy - (GBNA)	Electrical Power Engineer	200	$ 59.60	$ 11,920.29
A. Marsh - (GBNA)	Relay and Coordination Engineer	60	$ 64.57	$ 3,874.10
S. Flynn - (GBNA)	Lead I&C Engineer	200	$ 73.50	$ 14,700.87
Dist. Eng. TBD - (GBNA)	Distribution Engineer	60	$ 71.75	$ 4,304.89
Administrative Person - (GBNA)	Energy & Power	120	$ 31.53	$ 3,783.59
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	48	$ 124.30	$ 5,966.17
R. McPherson - (NAI)	Sr. Traction Power	2,280	$ 106.45	$ 242,715.44
R. Rosa - (NAI)	SCADA Coordination	80	$ 84.71	$ 6,776.71
				$ 313,611.54
TOTAL ESTIMATED HOURS		3,308		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 58,153.22
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 255,458.32
OVERHEAD (JACOBS-GBNA)	100.90%		$ 58,676.60
OVERHEAD (JACOBS-NAI)	109.46%		$ 279,624.67
SUBTOTAL -- SALARY + OVERHEAD			$ 651,912.82
FIXED FEE	10%	% of Bare Cost + Overhead	$ 65,191.28
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 717,104.10

PHASE I

TASK : 2.2.2.1 - Amtrak Electric Traction Power / Overhead Catenary System Sub 41 (Kearny Substation)

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.37	$ 3,774.76
M. Lewis - (GBNA)	Electrical Power Engineer	80	$ 69.54	$ 5,562.94
K. Uthirapathy - (GBNA)	Electrical Power Engineer	80	$ 59.60	$ 4,768.12
A. Marsh - (GBNA)	Relay and Coordination Engineer	40	$ 64.57	$ 2,582.73
S. Flynn - (GBNA)	Lead I&C Engineer	40	$ 73.50	$ 2,940.17
Dist. Eng. TBD - (GBNA)	Distribution Engineer	33	$ 71.75	$ 2,367.69
C. Vallenilla - (GBNA)	Structural Engineer	24	$ 109.51	$ 2,628.20
G. Serna - (GBNA)	Structural Engineer	24	$ 50.52	$ 1,212.43
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	48	$ 124.30	$ 5,966.17
F. Velazquez - (NAI)	Signals	20	$ 93.15	$ 1,863.03
W. George - (NAI)	Communications	40	$ 101.75	$ 4,070.05
R. Rosa - (NAI)	SCADA Coordination	120	$ 84.71	$ 10,165.06
				$ 47,901.35
TOTAL ESTIMATED HOURS		589		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 25,837.04
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 22,064.31
OVERHEAD (JACOBS-GBNA)	100.90%		$ 26,069.57
OVERHEAD (JACOBS-NAI)	109.46%		$ 24,151.60
SUBTOTAL -- SALARY + OVERHEAD			$ 98,122.52
FIXED FEE	10%	% of Bare Cost + Overhead	$ 9,812.25
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 107,934.77

PHASE I **FIRM :**

TASK : **2.2.3 - Civil, Structural, Geotechnical, & Hydraulic** **Rate escalation factor 1.033** **JACOBS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	120	$ 124.30	$ 14,915.44
J. Homoki - (NAI)	Site / Civil Lead	1,500	$ 77.61	$ 116,413.79
Staff 1 - TBD - (NAI)	Engineer	1,500	$ 64.55	$ 96,821.19
Staff 2 - TBD - (NAI)	CADD Support	1,000	$ 57.77	$ 57,770.39
T. Decker - (NAI)	Hydraulics / Drainage Engineer	120	$ 99.03	$ 11,883.99
J.Patel - (NAI)	Engineer	200	$ 56.69	$ 11,338.78
K. Mosley - (NAI)	Permitting	300	$ 51.59	$ 15,475.90
C. Ellis - (NAI)	Lead Geotechnical Engineer	240	$ 72.15	$ 17,316.70
S.Cruz - (NAI)	Geotechnical Engineer	170	$ 35.19	$ 5,983.07
P. Casuba - (NAI)	Geotechnical Engineer	140	$ 71.27	$ 9,978.26
K. Tse - (NAI)	Geotechnical Engineer	200	$ 32.72	$ 6,544.11
E. Wang - (NAI)	Geotechnical Manager	60	$ 116.20	$ 6,972.12
Administrative Person - (NAI)	Administrative Support	160	$ 39.46	$ 6,314.25
				$ 377,727.99
TOTAL ESTIMATED HOURS		5,710		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ -
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 377,727.99
OVERHEAD (JACOBS-GBNA)	100.90%		$ -
OVERHEAD (JACOBS-NAI)	109.46%		$ 413,461.05
SUBTOTAL -- SALARY + OVERHEAD			$ 791,189.04
FIXED FEE	10%	% of Bare Cost + Overhead	$ 79,118.90
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 870,307.94

PHASE I **FIRM :**

TASK : **2.2.4 - Subsurface Investigation** **Rate escalation factor 1.030** **JACOBS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
Administrative Person - (GBNA)	Energy & Power	30	$ 31.44	$ 943.07
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 123.92	$ 991.39
				$ 1,934.46
TOTAL ESTIMATED HOURS		38		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 943.07
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 991.39
OVERHEAD (JACOBS-GBNA)	100.90%		$ 951.56
OVERHEAD (JACOBS-NAI)	109.46%		$ 1,085.17
SUBTOTAL -- SALARY + OVERHEAD			$ 3,971.19
FIXED FEE	10%	% of Bare Cost + Overhead	$ 397.12
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 4,368.30

PHASE I

TASK : 2.2.5 - Topographical Survey Reference NJDOT Survey StandaRdte escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	24	$ 94.09	$ 2,258.08
Administrative Person - (GBNA)	Energy & Power	30	$ 31.44	$ 943.07
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	16	$ 123.92	$ 1,982.78
J. Homoki - (NAI)	Site / Civil Lead	60	$ 77.38	$ 4,642.62
Staff 1 - TBD - (NAI)	Engineer	80	$ 64.35	$ 5,148.35
				$ 14,974.90
TOTAL ESTIMATED HOURS		210		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 3,201.15
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 11,773.75
OVERHEAD (JACOBS-GBNA)	100.90%		$ 3,229.96
OVERHEAD (JACOBS-NAI)	109.46%		$ 12,887.55
SUBTOTAL -- SALARY + OVERHEAD			$ 31,092.41
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,109.24
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 34,201.65

PHASE I

TASK : **2.2.6 - Utility Engineering** | Rate escalation factor 1.033 | FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	24	$ 94.37	$ 2,264.85
Administrative Person - (GBNA)	Energy & Power	30	$ 31.53	$ 945.90
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	16	$ 124.30	$ 1,988.72
F. DiPalma - (NAI)	Regulatory & Stakeholder Coordination Lead	60	$ 104.17	$ 6,250.04
J. Homoki - (NAI)	Site / Civil Lead	60	$ 77.61	$ 4,656.55
Staff 1 - TBD - (NAI)	Engineer	60	$ 64.55	$ 3,872.85
K. Bienkowski - (NAI)	Utilities Engineering / Relocation	500	$ 82.02	$ 41,009.96
Staff 3 - TBD - (NAI)	Utility Engineer	300	$ 64.55	$ 19,364.24
TBD - (NAI)	PJM Adm, Production O&M Costs	80	$ 80.83	$ 6,466.32
Administrative Person - (NAI)	Administrative Support	80	$ 39.46	$ 3,157.12
				$ 89,976.56
TOTAL ESTIMATED HOURS		1,210		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 3,210.75
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 86,765.80
OVERHEAD (JACOBS-GBNA)	100.90%		$ 3,239.65
OVERHEAD (JACOBS-NAI)	109.46%		$ 94,973.85
SUBTOTAL -- SALARY + OVERHEAD			$ 188,190.06
FIXED FEE	10%	% of Bare Cost + Overhead	$ 18,819.01
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 207,009.06

PHASE I

TASK : 2.2.7 - Structures

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
C. Vallenilla - (GBNA)	Structural Engineer	150	$ 109.51	$ 16,426.22
G. Serna - (GBNA)	Structural Engineer	300	$ 50.52	$ 15,155.40
CADD Person - (GBNA)	Energy & Power	400	$ 33.16	$ 13,264.88
Administrative Person - (GBNA)	Energy & Power	80	$ 31.53	$ 2,522.39
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	40	$ 124.30	$ 4,971.81
				$ 52,340.70
TOTAL ESTIMATED HOURS		970		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 47,368.89
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 4,971.81
OVERHEAD (JACOBS-GBNA)	100.90%		$ 47,795.21
OVERHEAD (JACOBS-NAI)	109.46%		$ 5,442.15
SUBTOTAL -- SALARY + OVERHEAD			$ 105,578.06
FIXED FEE	10%	% of Bare Cost + Overhead	$ 10,557.81
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 116,135.87

PHASE I

TASK : 2.2.8 - Communications Systems and Power Management Communications

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	80	$ 94.37	$ 7,549.52
S. Flynn - (GBNA)	Lead I&C Engineer	80	$ 73.50	$ 5,880.35
Administrative Person - (GBNA)	Energy & Power	40	$ 31.53	$ 1,261.20
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	18	$ 124.30	$ 2,237.32
W. George - (NAI)	Communications	360	$ 101.75	$ 36,630.45
R. Rosa - (NAI)	SCADA Coordination	120	$ 84.71	$ 10,165.06
				$ 63,723.88
TOTAL ESTIMATED HOURS		698		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 14,691.06
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 49,032.82
OVERHEAD (JACOBS-GBNA)	100.90%		$ 14,823.28
OVERHEAD (JACOBS-NAI)	109.46%		$ 53,671.33
SUBTOTAL -- SALARY + OVERHEAD			$ 132,218.49
FIXED FEE	10%	% of Bare Cost + Overhead	$ 13,221.85
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 145,440.34

PHASE I **FIRM :**

TASK : **2.2.9 - Signals / Train Control Architecture** **Rate escalation factor 1.033** **JACOBS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.37	$ 3,774.76
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 124.30	$ 994.36
F. Velazquez - (NAI)	Signals	80	$ 93.15	$ 7,452.13
W. George - (NAI)	Communications	20	$ 101.75	$ 2,035.02
R. Rosa - (NAI)	SCADA Coordination	80	$ 84.71	$ 6,776.71
				$ 21,032.98
TOTAL ESTIMATED HOURS		228		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 3,774.76
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 17,258.23
OVERHEAD (JACOBS-GBNA)	100.90%		$ 3,808.73
OVERHEAD (JACOBS-NAI)	109.46%		$ 18,890.85
SUBTOTAL -- SALARY + OVERHEAD			$ 43,732.57
FIXED FEE	10%	% of Bare Cost + Overhead	$ 4,373.26
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 48,105.82

PHASE I
TASK : 2.2.10 - Concept of Operations

Rate escalation factor 1.036

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	240	$ 94.65	$ 22,716.29
H. Tull - (GBNA)	Lead Mechanical Engineer	200	$ 62.27	$ 12,454.12
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	80	$ 77.96	$ 6,237.02
M. Sutton - (GBNA)	Electrical Engineer	120	$ 53.55	$ 6,426.32
Administrative Person - (GBNA)	Energy & Power	40	$ 31.62	$ 1,264.97
R. Schwass - (GBNA)	Grant Application	60	$ 87.43	$ 5,245.67
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	120	$ 124.67	$ 14,960.05
F. Velazquez - (NAI)	Signals	80	$ 93.43	$ 7,474.42
W. George - (NAI)	Communications	120	$ 102.06	$ 12,246.67
R. Rosa - (NAI)	SCADA Coordination	200	$ 84.96	$ 16,992.44
M. Cabrera - (NAI)	Railroad Operations / Force Account	80	$ 55.49	$ 4,439.00
TBD - (NAI)	PJM Adm, Production O&M Costs	80	$ 81.07	$ 6,485.66
				$ 116,942.62
TOTAL ESTIMATED HOURS		1,420		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 54,344.39
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 62,598.23
OVERHEAD (JACOBS-GBNA)	100.90%		$ 54,833.49
OVERHEAD (JACOBS-NAI)	109.46%		$ 68,520.02
SUBTOTAL -- SALARY + OVERHEAD			$ 240,296.13
FIXED FEE	10%	% of Bare Cost + Overhead	$ 24,029.61
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 264,325.74

PHASE I

TASK : 2.3 - Existing Right-of-Way (ROW) | Rate escalation factor 1.033 | FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	24	$ 94.37	$ 2,264.85
Administrative Person - (GBNA)	Energy & Power	12	$ 31.53	$ 378.36
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 124.30	$ 994.36
F. Velazquez - (NAI)	Signals	20	$ 93.15	$ 1,863.03
				$ 5,500.61
TOTAL ESTIMATED HOURS		64		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 2,643.21
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 2,857.40
OVERHEAD (JACOBS-GBNA)	100.90%		$ 2,667.00
OVERHEAD (JACOBS-NAI)	109.46%		$ 3,127.71
SUBTOTAL -- SALARY + OVERHEAD			$ 11,295.32
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,129.53
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 12,424.85

PHASE I

TASK : 2.3.1 - Right-of-Way Research and Property Acquisition PrepaRateescalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
Administrative Person - (GBNA)	Energy & Power	12	$ 31.44	$ 377.23
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 123.92	$ 991.39
F. Velazquez - (NAI)	Signals	20	$ 92.87	$ 1,857.46
J. Homoki - (NAI)	Site / Civil Lead	120	$ 77.38	$ 9,285.25
Staff 1 - TBD - (NAI)	Engineer	60	$ 64.35	$ 3,861.26
Staff 2 - TBD - (NAI)	CADD Support	60	$ 57.60	$ 3,455.86
J. Homoki - (NAI)	Acquisition Support (Part of Site/Civil)	80	$ 77.38	$ 6,190.16
Administrative Person - (NAI)	Administrative Support	40	$ 39.35	$ 1,573.84
				$ 27,592.45
TOTAL ESTIMATED HOURS		400		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 377.23
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 27,215.22
OVERHEAD (JACOBS-GBNA)	100.90%		$ 380.62
OVERHEAD (JACOBS-NAI)	109.46%		$ 29,789.78
SUBTOTAL -- SALARY + OVERHEAD			$ 57,762.85
FIXED FEE	10%	% of Bare Cost + Overhead	$ 5,776.29
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 63,539.14

PHASE I

TASK : 2.3.2 - Screening of Parcels and PAECE Process — Rate escalation factor 1.030 — FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
Administrative Person - (GBNA)	Energy & Power	12	$ 31.44	$ 377.23
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	40	$ 123.92	$ 4,956.94
F. Velazquez - (NAI)	Signals	20	$ 92.87	$ 1,857.46
J. Homoki - (NAI)	Site / Civil Lead	20	$ 77.38	$ 1,547.54
Staff 1 - TBD - (NAI)	Engineer	20	$ 64.35	$ 1,287.09
Staff 2 - TBD - (NAI)	CADD Support	20	$ 57.60	$ 1,151.95
J. Homoki - (NAI)	Acquisition Support (Part of Site/Civil)	40	$ 77.38	$ 3,095.08
Administrative Person - (NAI)	Administrative Support	20	$ 39.35	$ 786.92
				$ 15,060.21
TOTAL ESTIMATED HOURS		192		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 377.23
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 14,682.99
OVERHEAD (JACOBS-GBNA)	100.90%		$ 380.62
OVERHEAD (JACOBS-NAI)	109.46%		$ 16,072.00
SUBTOTAL -- SALARY + OVERHEAD			$ 31,512.83
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,151.28
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 34,664.11

PHASE I
TASK : 3 - Cost Estimating

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.37	$ 3,774.76
K. McAnally - (GBNA)	Lead Power Process Engineer	80	$ 87.43	$ 6,994.52
H. Tull - (GBNA)	Lead Mechanical Engineer	120	$ 62.08	$ 7,450.19
K. Uthirapathy - (GBNA)	Electrical Power Engineer	40	$ 59.60	$ 2,384.06
S. Flynn - (GBNA)	Lead I&C Engineer	40	$ 73.50	$ 2,940.17
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	80	$ 77.73	$ 6,218.42
Assistant PM - (GBNA)	Energy & Power	20	$ 57.12	$ 1,142.39
Administrative Person - (GBNA)	Energy & Power	80	$ 31.53	$ 2,522.39
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 124.30	$ 2,485.91
F. Velazquez - (NAI)	Signals	40	$ 93.15	$ 3,726.07
W. George - (NAI)	Communications	40	$ 101.75	$ 4,070.05
R. Rosa - (NAI)	SCADA Coordination	40	$ 84.71	$ 3,388.35
M. Cabrera - (NAI)	Railroad Operations / Force Account	40	$ 55.32	$ 2,212.88
TBD - (NAI)	Cost Estimating	1,000	$ 78.25	$ 78,246.24
C. Ellis - (NAI)	Lead Geotechnical Engineer	40	$ 72.15	$ 2,886.12
P. Casuba - (NAI)	Geotechnical Engineer	40	$ 71.27	$ 2,850.93
				$ 133,293.44
TOTAL ESTIMATED HOURS		1,760		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 33,426.90
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 99,866.54
OVERHEAD (JACOBS-GBNA)	100.90%		$ 33,727.74
OVERHEAD (JACOBS-NAI)	109.46%	See Note 1 on Summary Shee	$ 109,313.91
SUBTOTAL -- SALARY + OVERHEAD			$ 276,335.09
FIXED FEE	10%	% of Bare Cost + Overhead	$ 27,633.51
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Credit OH Variance			
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 303,968.60

PHASE I

TASK : 4 - Federal Environmental Impact Statement (EIS) Rate escalation factor 1.030 FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	10	$ 94.09	$ 940.87
Assistant PM - (GBNA)	Energy & Power	20	$ 56.95	$ 1,138.97
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 123.92	$ 2,478.47
T. Decker - (NAI)	Hydraulics / Drainage Engineer	40	$ 98.74	$ 3,949.48
J.Patel - (NAI)	Engineer	40	$ 56.52	$ 2,260.97
J. Yost - (NAI)	FTA Reporting Compliance	200	$ 60.35	$ 12,070.47
J. Stiles - (NAI)	Public Involvement	100	$ 155.99	$ 15,598.84
J. Dowling - (NAI)	Federal / State Environmental Review	200	$ 107.20	$ 21,440.48
S. Ricucci - (NAI)	Environmental Permitting	150	$ 53.46	$ 8,018.28
K. Glinkin - (NAI)	Air / Noise	80	$ 83.82	$ 6,705.46
M. Cheang - (NAI)	GIS Mapping	120	$ 41.02	$ 4,922.20
				$ 79,524.49
TOTAL ESTIMATED HOURS		980		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 2,079.84
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 77,444.65
OVERHEAD (JACOBS-GBNA)	100.90%		$ 2,098.56
OVERHEAD (JACOBS-NAI)	109.46%		$ 84,770.92
SUBTOTAL -- SALARY + OVERHEAD			$ 166,393.97
FIXED FEE	10%	% of Bare Cost + Overhead	$ 16,639.40
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 183,033.37

PHASE I
TASK : **5 - State and Federal Permits** | Rate escalation factor 1.033 | FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	20	$ 94.37	$ 1,887.38
Assistant PM - (GBNA)	Energy & Power	20	$ 57.12	$ 1,142.39
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 124.30	$ 2,485.91
T. Decker - (NAI)	Hydraulics / Drainage Engineer	80	$ 99.03	$ 7,922.66
J.Patel - (NAI)	Engineer	100	$ 56.69	$ 5,669.39
K. Mosley - (NAI)	Permitting	450	$ 51.59	$ 23,213.86
J. Yost - (NAI)	FTA Reporting Compliance	20	$ 60.53	$ 1,210.67
J. Stiles - (NAI)	Public Involvement	20	$ 156.46	$ 3,129.13
J. Dowling - (NAI)	Federal / State Environmental Review	80	$ 107.52	$ 8,601.92
S. Ricucci - (NAI)	Environmental Permitting	120	$ 53.62	$ 6,433.87
K. Glinkin - (NAI)	Air / Noise	80	$ 84.07	$ 6,725.58
M. Cheang - (NAI)	GIS Mapping	120	$ 41.14	$ 4,936.97
				$ 73,359.71
TOTAL ESTIMATED HOURS		1,130		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 3,029.77
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 70,329.94
OVERHEAD (JACOBS-GBNA)	100.90%		$ 3,057.04
OVERHEAD (JACOBS-NAI)	109.46%		$ 76,983.15
SUBTOTAL -- SALARY + OVERHEAD			$ 153,399.90
FIXED FEE	10%	% of Bare Cost + Overhead	$ 15,339.99
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 168,739.89

PHASE I

TASK : 6 - NJDEP Site Remediation Compliance

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
Assistant PM - (GBNA)	Energy & Power	20	$ 57.12	$ 1,142.39
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 124.30	$ 2,485.91
				$ 3,628.30
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 1,142.39
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 2,485.91
OVERHEAD (JACOBS-GBNA)	100.90%		$ 1,152.67
OVERHEAD (JACOBS-NAI)	109.46%		$ 2,721.07
SUBTOTAL -- SALARY + OVERHEAD			$ 7,502.04
FIXED FEE	10%	% of Bare Cost + Overhead	$ 750.20
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 8,252.25

PHASE I

TASK : 7 -Risk Management

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	30	$ 94.37	$ 2,831.07
H. Tull - (GBNA)	Lead Mechanical Engineer	80	$ 62.08	$ 4,966.79
J. Saltarelli - (GBNA)	Mechanical Engineer	80	$ 74.16	$ 5,932.88
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	80	$ 77.73	$ 6,218.42
Assistant PM - (GBNA)	Energy & Power	20	$ 57.12	$ 1,142.39
Administrative Person - (GBNA)	Energy & Power	60	$ 31.53	$ 1,891.79
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.26	$ 3,850.41
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	20	$ 124.30	$ 2,485.91
F. DiPalma - (NAI)	Regulatory & Stakeholder Coordination Lead	40	$ 104.17	$ 4,166.69
M. Cabrera - (NAI)	Railroad Operations / Force Account	8	$ 55.32	$ 442.58
S. McDonagh - (NAI)	Risk Management Facilitator	360	$ 102.07	$ 36,746.46
G. Ruggiero - (NAI)	Safety / Security Lead	10	$ 68.36	$ 683.58
K. Herlihy - (NAI)	Site-Specific Plan	10	$ 64.46	$ 644.59
				$ 72,003.54
TOTAL ESTIMATED HOURS		838		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 22,983.34
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 49,020.20
OVERHEAD (JACOBS-GBNA)	100.90%		$ 23,190.19
OVERHEAD (JACOBS-NAI)	109.46%		$ 53,657.52
SUBTOTAL -- SALARY + OVERHEAD			$ 148,851.25
FIXED FEE	10%	% of Bare Cost + Overhead	$ 14,885.12
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 163,736.37

PHASE I | FIRM :
TASK : 8 - System Safety and Security Management | Rate escalation factor 1.033 | JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	24	$ 94.37	$ 2,264.85
Assistant PM - (GBNA)	Energy & Power	20	$ 57.12	$ 1,142.39
R. McPherson - (NAI)	Sr. Traction Power	20	$ 106.45	$ 2,129.08
W. George - (NAI)	Communications	20	$ 101.75	$ 2,035.02
G. Ruggiero - (NAI)	Safety / Security Lead	600	$ 68.36	$ 41,014.56
K. Herlihy - (NAI)	Site-Specific Plan	100	$ 64.46	$ 6,445.90
				$ 55,031.82
TOTAL ESTIMATED HOURS		784		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 3,407.25
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 51,624.57
OVERHEAD (JACOBS-GBNA)	100.90%		$ 3,437.91
OVERHEAD (JACOBS-NAI)	109.46%		$ 56,508.26
SUBTOTAL -- SALARY + OVERHEAD			$ 114,977.99
FIXED FEE	10%	% of Bare Cost + Overhead	$ 11,497.80
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 126,475.78

PHASE I

TASK : 8.1 - Safety and Security Management Plan

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 124.30	$ 994.36
F. Velazquez - (NAI)	Signals	5	$ 93.15	$ 465.76
W. George - (NAI)	Communications	60	$ 101.75	$ 6,105.07
R. Rosa - (NAI)	SCADA Coordination	24	$ 84.71	$ 2,033.01
M. Cabrera - (NAI)	Railroad Operations / Force Account	40	$ 55.32	$ 2,212.88
				$ 11,811.09
TOTAL ESTIMATED HOURS		137		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ -
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 11,811.09
OVERHEAD (JACOBS-GBNA)	100.90%		$ -
OVERHEAD (JACOBS-NAI)	109.46%		$ 12,928.41
SUBTOTAL -- SALARY + OVERHEAD			$ 24,739.50
FIXED FEE	10%	% of Bare Cost + Overhead	$ 2,473.95
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 27,213.45

PHASE I

TASK : 9 - Public Involvement and Agency Coordination

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	45	$ 94.37	$ 4,246.60
H. Tull - (GBNA)	Lead Mechanical Engineer	20	$ 62.08	$ 1,241.70
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	20	$ 77.73	$ 1,554.60
Assistant PM - (GBNA)	Energy & Power	120	$ 57.12	$ 6,854.35
J. Livingston - (NAI)	Agency Liaison	100	$ 73.38	$ 7,338.04
J. Yost - (NAI)	FTA Reporting Compliance	200	$ 60.53	$ 12,106.68
J. Stiles - (NAI)	Public Involvement	60	$ 156.46	$ 9,387.38
J. Dowling - (NAI)	Federal / State Environmental Review	30	$ 107.52	$ 3,225.72
S. Ricucci - (NAI)	Environmental Permitting	5	$ 53.62	$ 268.08
K. Glinkin - (NAI)	Air / Noise	40	$ 84.07	$ 3,362.79
M. Cheang - (NAI)	GIS Mapping	40	$ 41.14	$ 1,645.66
				$ 51,231.59
TOTAL ESTIMATED HOURS		680		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 13,897.25
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 37,334.34
OVERHEAD (JACOBS-GBNA)	100.90%		$ 14,022.33
OVERHEAD (JACOBS-NAI)	109.46%		$ 40,866.17
SUBTOTAL -- SALARY + OVERHEAD			$ 106,120.08
FIXED FEE	10%	% of Bare Cost + Overhead	$ 10,612.01
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 116,732.09

PHASE I **FIRM :**
TASK : **9.1 - Open Houses and Meetings** **Rate escalation factor 1.033** **JACOBS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	5	$ 94.37	$ 471.84
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 96.26	$ 7,700.82
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	80	$ 124.30	$ 9,943.62
J. Stiles - (NAI)	Public Involvement	20	$ 156.46	$ 3,129.13
J. Dowling - (NAI)	Federal / State Environmental Review	30	$ 107.52	$ 3,225.72
S. Ricucci - (NAI)	Environmental Permitting	20	$ 53.62	$ 1,072.31
K. Glinkin - (NAI)	Air / Noise	40	$ 84.07	$ 3,362.79
M. Cheang - (NAI)	GIS Mapping	40	$ 41.14	$ 1,645.66
				$ 30,551.89
TOTAL ESTIMATED HOURS		315		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 471.84
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 30,080.04
OVERHEAD (JACOBS-GBNA)	100.90%		$ 476.09
OVERHEAD (JACOBS-NAI)	109.46%		$ 32,925.62
SUBTOTAL -- SALARY + OVERHEAD			$ 63,953.60
FIXED FEE	10%	% of Bare Cost + Overhead	$ 6,395.36
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 70,348.95

PHASE I

TASK : 10 - Integration and Interface

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	24	$ 94.37	$ 2,264.85
Assistant PM - (GBNA)	Energy & Power	80	$ 57.12	$ 4,569.56
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.26	$ 3,850.41
M. Pytlik - (NAI)	Project Controls Lead	400	$ 61.83	$ 24,733.58
R. McPherson - (NAI)	Sr. Traction Power	20	$ 106.45	$ 2,129.08
F. Velazquez - (NAI)	Signals	40	$ 93.15	$ 3,726.07
W. George - (NAI)	Communications	40	$ 101.75	$ 4,070.05
M. Cabrera - (NAI)	Railroad Operations / Force Account	20	$ 55.32	$ 1,106.44
				$ 46,450.05
TOTAL ESTIMATED HOURS		664		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 6,834.42
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 39,615.63
OVERHEAD (JACOBS-GBNA)	100.90%		$ 6,895.93
OVERHEAD (JACOBS-NAI)	109.46%		$ 43,363.27
SUBTOTAL -- SALARY + OVERHEAD			$ 96,709.24
FIXED FEE	10%	% of Bare Cost + Overhead	$ 9,670.92
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 106,380.16

PHASE I

TASK : 11 - Value Engineering

Rate escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.09	$ 3,763.47
K. McAnally - (GBNA)	Lead Power Process Engineer	20	$ 87.17	$ 1,743.40
B. Romero - (GBNA)	Mechanical Engineer	20	$ 55.80	$ 1,116.07
H. Tull - (GBNA)	Lead Mechanical Engineer	20	$ 61.90	$ 1,237.98
M. Lewis - (GBNA)	Electrical Power Engineer	40	$ 69.33	$ 2,773.15
K. Uthirapathy - (GBNA)	Electrical Power Engineer	40	$ 59.42	$ 2,376.93
A. Marsh - (GBNA)	Relay and Coordination Engineer	12	$ 64.38	$ 772.50
S. Flynn - (GBNA)	Lead I&C Engineer	12	$ 73.28	$ 879.41
D. Widner - (GBNA)	Lead Microgrid Electrical Engineer	80	$ 77.50	$ 6,199.82
M. Sutton - (GBNA)	Electrical Engineer	24	$ 53.23	$ 1,277.60
G. Serna - (GBNA)	Structural Engineer	24	$ 50.37	$ 1,208.81
Assistant PM - (GBNA)	Energy & Power	80	$ 56.95	$ 4,555.90
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 95.97	$ 3,838.89
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 123.92	$ 991.39
R. McPherson - (NAI)	Sr. Traction Power	8	$ 106.14	$ 849.09
F. Velazquez - (NAI)	Signals	20	$ 92.87	$ 1,857.46
W. George - (NAI)	Communications	20	$ 101.45	$ 2,028.94
R. Rosa - (NAI)	SCADA Coordination	24	$ 84.46	$ 2,026.93
M. Cabrera - (NAI)	Railroad Operations / Force Account	20	$ 55.16	$ 1,103.13
S. Eichinger - (NAI)	Constructability Lead	50	$ 115.00	$ 5,750.13
VE SME - (NAI)	Subject Matter Experts	200	$ 92.70	$ 18,540.00
R. LaRuffa - (NAI)	Value Engineering Lead	80	$ 124.29	$ 9,943.46
				$ 74,834.45
TOTAL ESTIMATED HOURS		882		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 27,905.04
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 46,929.41
OVERHEAD (JACOBS-GBNA)	100.90%		$ 28,156.18
OVERHEAD (JACOBS-NAI)	109.46%		$ 51,368.94
SUBTOTAL -- SALARY + OVERHEAD			$ 154,359.57
FIXED FEE	10%	% of Bare Cost + Overhead	$ 15,435.96
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 169,795.52

PHASE I

TASK : 12 - Constructability Reviews

Rate escalation factor 1.033

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.37	$ 3,774.76
B. Romero - (GBNA)	Mechanical Engineer	20	$ 55.97	$ 1,119.42
H. Tull - (GBNA)	Lead Mechanical Engineer	20	$ 62.08	$ 1,241.70
J. Saltarelli - (GBNA)	Mechanical Engineer	200	$ 74.16	$ 14,832.20
Assistant PM - (GBNA)	Energy & Power	80	$ 57.12	$ 4,569.56
Administrative Person - (GBNA)	Energy & Power	20	$ 31.53	$ 630.60
R. Carpenter - (GBNA)	Cogeneration Construction Specialist	200	$ 85.66	$ 17,131.15
D. Elmaddah - (NAI)	Deputy Project Manager	40	$ 96.26	$ 3,850.41
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	60	$ 124.30	$ 7,457.72
R. McPherson - (NAI)	Sr. Traction Power	16	$ 106.45	$ 1,703.27
F. Velazquez - (NAI)	Signals	20	$ 93.15	$ 1,863.03
W. George - (NAI)	Communications	20	$ 101.75	$ 2,035.02
R. Rosa - (NAI)	SCADA Coordination	24	$ 84.71	$ 2,033.01
M. Cabrera - (NAI)	Railroad Operations / Force Account	20	$ 55.32	$ 1,106.44
C. Wedel - (NAI)	Financial Structure	80	$ 103.31	$ 8,264.72
D. Legg - (NAI)	Constructability Leader	80	$ 126.48	$ 10,118.47
P. Semler - (NAI)	Constructability	80	$ 131.89	$ 10,551.36
M. Kaminski - (NAI)	Constructability	80	$ 82.97	$ 6,637.65
T. Decker - (NAI)	Constructability	30	$ 99.03	$ 2,971.00
T. Zeloyle - (NAI)	Constructability Electrical	30	$ 109.30	$ 3,278.92
S. Eichinger - (NAI)	Constructability Lead	80	$ 115.35	$ 9,227.80
TBD - (NAI)	Safety Design Coordinator	80	$ 144.03	$ 11,522.67
				$ 125,920.88
TOTAL ESTIMATED HOURS		1,320		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 43,299.39
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 82,621.49
OVERHEAD (JACOBS-GBNA)	100.90%		$ 43,689.08
OVERHEAD (JACOBS-NAI)	109.46%		$ 90,437.49
SUBTOTAL -- SALARY + OVERHEAD			$ 260,047.45
FIXED FEE	10%	% of Bare Cost + Overhead	$ 26,004.74
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 286,052.19

PHASE I

TASK : 13 - Contract Packaging

Rate escalation factor 1.036

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	40	$ 94.65	$ 3,786.05
K. McAnally - (GBNA)	Lead Power Process Engineer	12	$ 87.69	$ 1,052.32
H. Tull - (GBNA)	Lead Mechanical Engineer	24	$ 62.27	$ 1,494.49
Assistant PM - (GBNA)	Energy & Power	80	$ 57.29	$ 4,583.23
Administrative Person - (GBNA)	Energy & Power	80	$ 31.62	$ 2,529.94
D. Elmaddah - (NAI)	Deputy Project Manager	160	$ 96.55	$ 15,447.70
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 124.67	$ 997.34
S. Grill - (GBNA)	Procurement	20	$ 118.61	$ 2,372.24
R. McPherson - (NAI)	Sr. Traction Power	8	$ 106.77	$ 854.18
F. Velazquez - (NAI)	Signals	40	$ 93.43	$ 3,737.21
W. George - (NAI)	Communications	20	$ 102.06	$ 2,041.11
M. Cabrera - (NAI)	Railroad Operations / Force Account	40	$ 55.49	$ 2,219.50
D. Cimino - (NAI)	Bid Support	60	$ 85.73	$ 5,143.69
TBD - (NAI)	Safety Design Coordinator	60	$ 144.46	$ 8,667.85
				$ 54,926.85
TOTAL ESTIMATED HOURS		652		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 15,818.27
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 39,108.58
OVERHEAD (JACOBS-GBNA)	100.90%		$ 15,960.63
OVERHEAD (JACOBS-NAI)	109.46%		$ 42,808.25
SUBTOTAL -- SALARY + OVERHEAD			$ 113,695.73
FIXED FEE	10%	% of Bare Cost + Overhead	$ 11,369.57
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 125,065.31

PHASE I

FIRM : JACOBS

TASK : 14 - Preparation of Subsequent Support of Contract Bid Documents and Bidding Process

Rate escalation factor 1.049

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	60	$ 95.78	$ 5,746.81
Assistant PM - (GBNA)	Energy & Power	200	$ 57.97	$ 11,594.76
Administrative Person - (GBNA)	Energy & Power	80	$ 32.00	$ 2,560.12
D. Elmaddah - (NAI)	Deputy Project Manager	80	$ 97.70	$ 7,815.98
R. Sirabian - (NAI)	Rail Engineering and Coordination Lead	8	$ 126.15	$ 1,009.23
S. Grill - (GBNA)	Procurement	120	$ 120.03	$ 14,403.23
R. McPherson - (NAI)	Sr. Traction Power	20	$ 108.05	$ 2,160.92
F. Velazquez - (NAI)	Signals	40	$ 94.54	$ 3,781.79
W. George - (NAI)	Communications	20	$ 103.27	$ 2,065.46
M. Cabrera - (NAI)	Railroad Operations / Force Account	40	$ 56.15	$ 2,245.97
D. Cimino - (NAI)	Bid Support	520	$ 86.75	$ 45,110.37
TBD - (NAI)	Corrosion Prevention	20	$ 109.77	$ 2,195.43
				$ 100,690.08
TOTAL ESTIMATED HOURS		1,208		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 34,304.91
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 66,385.17
OVERHEAD (JACOBS-GBNA)	100.90%		$ 34,613.66
OVERHEAD (JACOBS-NAI)	109.46%		$ 72,665.21
SUBTOTAL -- SALARY + OVERHEAD			$ 207,968.95
FIXED FEE	10%	% of Bare Cost + Overhead	$ 20,796.89
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 228,765.84

PHASE I

TASK : 15 - Analysis of Ancillary Services Market Revenue Ops. Rate escalation factor 1.030

FIRM : JACOBS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Copeland - (GBNA)	Project Manager	50	$ 94.09	$ 4,704.33
Assistant PM - (GBNA)	Energy & Power	20	$ 56.95	$ 1,138.97
Administrative Person - (GBNA)	Energy & Power	60	$ 31.44	$ 1,886.14
R. Schwass - (GBNA)	Grant Application	40	$ 86.91	$ 3,476.26
F. DiPalma - (NAI)	Regulatory & Stakeholder Coordination Lead	160	$ 103.86	$ 16,616.92
TBD - (NAI)	PJM Adm, Production O&M Costs	40	$ 80.59	$ 3,223.49
				$ 31,046.11
TOTAL ESTIMATED HOURS		370		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ 11,205.70
TOTAL SALARY (BARE COST)-JACOBS NAI			$ 19,840.40
OVERHEAD (JACOBS-GBNA)	100.90%		$ 11,306.55
OVERHEAD (JACOBS-NAI)	109.46%		$ 21,717.31
SUBTOTAL -- SALARY + OVERHEAD			$ 64,069.97
FIXED FEE	10%	% of Bare Cost + Overhead	$ 6,407.00
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 70,476.96

PHASE I **FIRM :**

TASK : <u>16 - As Directed by NJ TRANSIT</u> <u>Rate escalation factor</u> <u>1.000</u> <u>JACOBS</u>

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
TOTAL ESTIMATED HOURS		0		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)-JACOBS GBNA			$ -
TOTAL SALARY (BARE COST)-JACOBS NAI			$ -
OVERHEAD (JACOBS-GBNA)	100.90%		$ -
OVERHEAD (JACOBS-NAI)	109.46%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ -
FIXED FEE	10%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ -

PHASE I

TASK : 1.3 - Quality Control

Rate escalation factor 1.032

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.38	$ 6,628.71
				$ 6,628.71
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,628.71
OVERHEAD	148.64%		$ 9,852.69
SUBTOTAL -- SALARY + OVERHEAD			$ 16,481.40
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,648.14
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 1,500.00
Reproduction			$ 500.00
Overnight Mail / Messenger			$ 500.00
Misc.			$ 1,000.00
TOTAL DIRECT EXPENSES			$ 3,500.00
TOTAL THIS TASK			$ 21,629.54

PHASE I

TASK : 1.3.1 - Quality Management Plan (QMP) Rate escalation factor 1.030 FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.25	$ 6,618.78
				$ 6,618.78
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,618.78
OVERHEAD	148.64%		$ 9,837.94
SUBTOTAL -- SALARY + OVERHEAD			$ 16,456.72
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,645.67
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,102.39

PHASE I | **FIRM :**

TASK : **1.3.2 - Quality Management Plan Requirements** | **Rate escalation factor 1.030** | **BURNS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.25	$ 6,618.78
				$ 6,618.78
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,618.78
OVERHEAD	148.64%		$ 9,837.94
SUBTOTAL -- SALARY + OVERHEAD			$ 16,456.72
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,645.67
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,102.39

PHASE I

TASK : 1.3.3 - ISO 9001 Requirements

Rate escalation factor 1.030

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.25	$ 6,618.78
				$ 6,618.78
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,618.78
OVERHEAD	148.64%		$ 9,837.94
SUBTOTAL -- SALARY + OVERHEAD			$ 16,456.72
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,645.67
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,102.39

PHASE I

TASK : 1.3.4 - Quality Manager and Other Resources

Rate escalation factor 1.032

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.38	$ 6,628.71
				$ 6,628.71
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,628.71
OVERHEAD	148.64%		$ 9,852.69
SUBTOTAL -- SALARY + OVERHEAD			$ 16,481.40
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,648.14
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,129.54

PHASE I

TASK : **1.3.5 - Design Control** **Rate escalation factor 1.032** **FIRM : BURNS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.38	$ 6,628.71
				$ 6,628.71
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,628.71
OVERHEAD	148.64%		$ 9,852.69
SUBTOTAL -- SALARY + OVERHEAD			$ 16,481.40
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,648.14
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,129.54

PHASE I

TASK : **1.3.6 - Control of Quality Records** Rate escalation factor 1.032

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.38	$ 6,628.71
				$ 6,628.71
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,628.71
OVERHEAD	148.64%		$ 9,852.69
SUBTOTAL -- SALARY + OVERHEAD			$ 16,481.40
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,648.14
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,129.54

PHASE I

TASK : 1.3.7 - Internal Quality Audits | Rate escalation factor 1.033 | FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
B. Fiorentino	Quality Control Lead	75	$ 88.52	$ 6,638.64
				$ 6,638.64
TOTAL ESTIMATED HOURS		75		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,638.64
OVERHEAD	148.64%		$ 9,867.45
SUBTOTAL -- SALARY + OVERHEAD			$ 16,506.09
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,650.61
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 18,156.69

PHASE I

TASK : **2.1 - Verification of Concept** | **Rate escalation factor 1.030** | FIRM : **BURNS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
M. Walton	Assistant Power Lead	100	$ 71.64	$ 7,163.65
B. Fiorentino	Quality Control Lead	100	$ 88.25	$ 8,825.04
D. Petroski	Sr. Traction Power Lead	100	$ 93.44	$ 9,344.16
W. Wiedman	Signals Lead	100	$ 88.51	$ 8,850.79
M. Maziarz	Sr. Traction Power	100	$ 85.81	$ 8,580.93
S. Tong	Power Distribution Lead	100	$ 49.32	$ 4,931.64
E. Stryker	Communications Lead	100	$ 51.91	$ 5,191.20
				$ 52,887.41
TOTAL ESTIMATED HOURS		700		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 52,887.41
OVERHEAD	148.64%		$ 78,610.10
SUBTOTAL -- SALARY + OVERHEAD			$ 131,497.51
FIXED FEE	10%	% of Bare Cost + Overhead	$ 13,149.75
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 1,500.00
Reproduction			$ 500.00
Overnight Mail / Messenger			$ 500.00
Misc.			$ 1,000.00
TOTAL DIRECT EXPENSES			$ 3,500.00
TOTAL THIS TASK			$ 148,147.26

PHASE I

TASK : 2.2.2 - Electric Traction Power Facilities and Power Management System Design

Rate escalation factor 1.033

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
M. Walton	Assistant Power Lead	1,600	$ 71.85	$ 114,962.26
S. Tong	Power Distribution Lead	200	$ 49.46	$ 9,892.87
Staff 3 - TBD	HBLR Distribution Support	2,000	$ 52.07	$ 104,135.47
Staff 5 - TBD	Drafting & Admin Support	2,400	$ 36.45	$ 87,473.80
				$ 316,464.39
TOTAL ESTIMATED HOURS		6,200		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 316,464.39
OVERHEAD	148.64%		$ 470,382.23
SUBTOTAL -- SALARY + OVERHEAD			$ 786,846.62
FIXED FEE	10%	% of Bare Cost + Overhead	$ 78,684.66
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 15,000.00
Reproduction			$ 2,500.00
Overnight Mail / Messenger			$ 2,500.00
Misc.			$ 2,500.00
TOTAL DIRECT EXPENSES			$ 22,500.00
TOTAL THIS TASK			$ 888,031.29

PHASE I | **FIRM : BURNS**

TASK : 2.2.2.1 - Amtrak Electric Traction Power / Overhead Catenary System Sub 41 (Kearny Substation) — Rate escalation factor 1.033

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
M. Walton	Assistant Power Lead	100	$ 71.85	$ 7,185.14
D. Petroski	Sr. Traction Power Lead	650	$ 93.72	$ 60,919.25
R. Winks	Overhead Catenary System Lead	1,300	$ 70.81	$ 92,050.39
M. Maziarz	Sr. Traction Power	1,300	$ 86.07	$ 111,886.75
Staff 1 - TBD	Amtrak Substation Engineering Support	2,200	$ 52.07	$ 114,549.02
Staff 2 - TBD	OCS & Transmission Engineering Support	2,000	$ 52.07	$ 104,135.47
Staff 5 - TBD	Drafting & Admin Support	1,800	$ 36.45	$ 65,605.35
				$ 556,331.36
TOTAL ESTIMATED HOURS		9,350		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 556,331.36
OVERHEAD	148.64%		$ 826,912.58
SUBTOTAL -- SALARY + OVERHEAD			$ 1,383,243.94
FIXED FEE	10%	% of Bare Cost + Overhead	$ 138,324.39
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 15,000.00
Reproduction			$ 2,500.00
Overnight Mail / Messenger			$ 2,500.00
Misc.			$ 2,500.00
TOTAL DIRECT EXPENSES			$ 22,500.00
TOTAL THIS TASK			$ 1,544,068.33

PHASE I **FIRM :**

TASK : **2.2.8 - Communications Systems and Power Management** **Rate escalation factor 1.033** **BURNS**

Communications

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Stryker	Communications Lead	800	$ 52.07	$ 41,654.19
Staff 4 - TBD	Signals & Comms Engineering Support	800	$ 52.07	$ 41,654.19
Staff 5 - TBD	Drafting & Admin Support	1,200	$ 36.45	$ 43,736.90
				$ 127,045.28
TOTAL ESTIMATED HOURS		2,800		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 127,045.28
OVERHEAD	148.64%		$ 188,835.91
SUBTOTAL -- SALARY + OVERHEAD			$ 315,881.18
FIXED FEE	10%	% of Bare Cost + Overhead	$ 31,588.12
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 3,000.00
Reproduction			$ 1,000.00
Overnight Mail / Messenger			$ 1,000.00
Misc.			$ 2,000.00
TOTAL DIRECT EXPENSES			$ 7,000.00
TOTAL THIS TASK			$ 354,469.30

PHASE I

TASK : 2.2.9 - Signals / Train Control Architecture

Rate escalation factor 1.033

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
W. Wiedman	Signals Lead	400	$ 88.77	$ 35,509.37
Staff 5 - TBD	Drafting & Admin Support	400	$ 36.45	$ 14,578.97
				$ 50,088.34
TOTAL ESTIMATED HOURS		800		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 50,088.34
OVERHEAD	148.64%		$ 74,449.65
SUBTOTAL -- SALARY + OVERHEAD			$ 124,537.98
FIXED FEE	10%	% of Bare Cost + Overhead	$ 12,453.80
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 1,500.00
Reproduction			$ 500.00
Overnight Mail / Messenger			$ 500.00
Misc.			$ 1,000.00
TOTAL DIRECT EXPENSES			$ 3,500.00
TOTAL THIS TASK			$ 140,491.78

PHASE I

TASK : 2.2.10 - Concept of Operations

Rate escalation factor 1.036

FIRM : BURNS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
M. Walton	Assistant Power Lead	100	$ 72.07	$ 7,206.63
B. Fiorentino	Quality Control Lead	100	$ 88.78	$ 8,877.99
D. Petroski	Sr. Traction Power Lead	100	$ 94.00	$ 9,400.22
W. Wiedman	Signals Lead	100	$ 89.04	$ 8,903.89
M. Maziarz	Sr. Traction Power	100	$ 86.32	$ 8,632.42
S. Tong	Power Distribution Lead	100	$ 49.61	$ 4,961.23
E. Stryker	Communications Lead	100	$ 52.22	$ 5,222.35
				$ 53,204.73
TOTAL ESTIMATED HOURS		700		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 53,204.73
OVERHEAD	148.64%		$ 79,081.76
SUBTOTAL -- SALARY + OVERHEAD			$ 132,286.50
FIXED FEE	10%	% of Bare Cost + Overhead	$ 13,228.65
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 1,500.00
Reproduction			$ 500.00
Overnight Mail / Messenger			$ 500.00
Misc.			$ 1,000.00
TOTAL DIRECT EXPENSES			$ 3,500.00
TOTAL THIS TASK			$ 149,015.15

PHASE I

TASK : 1.6 - Project Meetings

Rate escalation factor 1.000

FIRM : Levitan

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
S. Parker	Economics & Financial Analysis Lead	265	$ 295.00	$ 78,312.71
				$ 78,312.71
TOTAL ESTIMATED HOURS		265		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 78,312.71
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 78,312.71
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 78,312.71

PHASE I

TASK : 2.1 - Verification of Concept

Rate escalation factor 1.000

FIRM : Levitan

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
S. Parker	Economics & Financial Analysis Lead	290	$ 295.00	$ 85,550.00
E. Tsikirayi	PJM Regulations & Interconnection	480	$ 225.00	$ 108,000.00
J. Bitler	Gas Supply	140	$ 295.00	$ 41,300.00
A. Mattfolk	Power Price Forecasts, Plant Operational Modeling	350	$ 190.00	$ 66,500.00
P. Curlett	Economics Screening Analysis	150	$ 275.00	$ 41,250.00
				$ 342,600.00
TOTAL ESTIMATED HOURS		1,410		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 342,600.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 342,600.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 342,600.00

PHASE I

TASK : 2.2.10 - Concept of Operations | Rate escalation factor 1.000 | FIRM : Levitan

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
M. DeCourcey	Fuel Price Forecasts	280	$ 190.00	$ 53,200.00
				$ 53,200.00
TOTAL ESTIMATED HOURS		280		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 53,200.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 53,200.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 53,200.00

PHASE I
TASK : 7 -Risk Management

Rate escalation factor 1.000

FIRM : Levitan

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
S. Parker	Economics & Financial Analysis Lead	36	$ 295.00	$ 10,620.00
R. Carlson	Regulatory / Economics	125	$ 295.00	$ 36,875.00
				$ 47,495.00
TOTAL ESTIMATED HOURS		161		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 47,495.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 47,495.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 47,495.00

PHASE I

TASK : 15 - Analysis of Ancillary Services Market Revenue Ops. Rate escalation factor 1.000

FIRM : Levitan

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
S. Parker	Economics & Financial Analysis Lead	120	$ 295.00	$ 35,400.00
E. Tsikirayi	PJM Regulations & Interconnection	20	$ 225.00	$ 4,500.00
J. Bitler	Gas Supply	60	$ 295.00	$ 17,700.00
				$ 57,600.00
TOTAL ESTIMATED HOURS		200		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 57,600.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 57,600.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 57,600.00

PHASE I

TASK : 1.3.7 - Internal Quality Audits

Rate escalation factor 1.033

FIRM : LTK

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
T. Manning	Traction Power Model QA/QC	160	$ 83.58	$ 13,372.32
				$ 13,372.32
TOTAL ESTIMATED HOURS		160		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 13,372.32
OVERHEAD	146.65%		$ 19,610.50
SUBTOTAL -- SALARY + OVERHEAD			$ 32,982.82
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,298.28
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 36,281.10

PHASE I

TASK : **2.1 - Verification of Concept** | **Rate escalation factor 1.030** | **FIRM : LTK**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
W. Lipfert	Rail Power Analysis / Operations Modeling	104	$ 102.22	$ 10,630.59
N. Willey	Rail Operations	200	$ 47.08	$ 9,416.26
R. Rauceo	Traction Power Modeling	360	$ 52.54	$ 18,914.51
C. Farnsworth	Technical Support	264	$ 33.46	$ 8,834.68
				$ 47,796.04
TOTAL ESTIMATED HOURS		928		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 47,796.04
OVERHEAD	146.65%		$ 70,092.89
SUBTOTAL -- SALARY + OVERHEAD			$ 117,888.93
FIXED FEE	10%	% of Bare Cost + Overhead	$ 11,788.89
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 10,750.00
Reproduction			$ 200.00
Overnight Mail / Messenger			$ 200.00
Misc.			$ 200.00
TOTAL DIRECT EXPENSES			$ 11,350.00
TOTAL THIS TASK			$ 141,027.82

PHASE I

TASK : **2.2.1 - Power Plant Design** | **Rate escalation factor 1.033** | FIRM : **LTK**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
N. Willey	Rail Operations	284	$ 47.22	$ 13,411.20
				$ 13,411.20
TOTAL ESTIMATED HOURS		284		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 13,411.20
OVERHEAD	146.65%		$ 19,667.53
SUBTOTAL -- SALARY + OVERHEAD			$ 33,078.73
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,307.87
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 36,386.60

PHASE I

TASK : **2.2.2 - Electric Traction Power Facilities and Power Management System Design** **Rate escalation factor 1.033** **FIRM : GTS**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Voss	Project Manager	60	$ 65.08	$ 3,905.08
M. Zavyazkin	Project Surveyor	80	$ 36.16	$ 2,892.65
P. Herflicker	Survey Crew Chief	140	$ 28.93	$ 4,049.71
E. Murray	Instrument Operator	140	$ 24.79	$ 3,471.18
T. Madigan	CADD	592	$ 26.86	$ 15,901.32
				$ 30,219.95
TOTAL ESTIMATED HOURS		1,012		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 30,219.95
OVERHEAD	150.00%		$ 45,329.92
SUBTOTAL -- SALARY + OVERHEAD			$ 75,549.87
FIXED FEE	10%	% of Bare Cost + Overhead	$ 7,554.99
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 83,104.86

PHASE I

TASK : 2.2.4 - Subsurface Investigation

Rate escalation factor 1.030

FIRM : GTS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Voss	Project Manager	48	$ 64.89	$ 3,114.72
M. Zavyazkin	Project Surveyor	80	$ 36.05	$ 2,884.00
P. Herflicker	Survey Crew Chief	116	$ 28.84	$ 3,345.44
E. Murray	Instrument Operator	116	$ 24.72	$ 2,867.52
T. Madigan	CADD	80	$ 26.78	$ 2,142.40
				$ 14,354.08
TOTAL ESTIMATED HOURS		440		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 14,354.08
OVERHEAD	150.00%		$ 21,531.12
SUBTOTAL -- SALARY + OVERHEAD			$ 35,885.20
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,588.52
ESTIMATED DIRECT EXPENDITURES			
InfraMap Corp			$90,000
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 90,000.00
TOTAL THIS TASK			$ 129,473.72

PHASE I

TASK : 2.2.5 - Topographical Survey Reference NJDOT Survey StandaRate escalation factor 1.030

FIRM : GTS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Voss	Project Manager	120	$ 64.89	$ 7,786.80
M. Zavyazkin	Project Surveyor	160	$ 36.05	$ 5,768.00
P. Herflicker	Survey Crew Chief	460	$ 28.84	$ 13,266.40
E. Murray	Instrument Operator	460	$ 24.72	$ 11,371.20
T. Madigan	CADD	180	$ 26.78	$ 4,820.40
				$ 43,012.80
TOTAL ESTIMATED HOURS		1,380		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 43,012.80
OVERHEAD	150.00%		$ 64,519.20
SUBTOTAL -- SALARY + OVERHEAD			$ 107,532.00
FIXED FEE	10%	% of Bare Cost + Overhead	$ 10,753.20
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 118,285.20

PHASE I

TASK : 2.2.6 - Utility Engineering

Rate escalation factor 1.033

FIRM : GTS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Voss	Project Manager	60	$ 65.08	$ 3,905.08
M. Zavyazkin	Project Surveyor	96	$ 36.16	$ 3,471.18
P. Herflicker	Survey Crew Chief	120	$ 28.93	$ 3,471.18
E. Murray	Instrument Operator	120	$ 24.79	$ 2,975.30
T. Madigan	CADD	96	$ 26.86	$ 2,578.59
				$ 16,401.34
TOTAL ESTIMATED HOURS		492		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 16,401.34
OVERHEAD	150.00%		$ 24,602.01
SUBTOTAL -- SALARY + OVERHEAD			$ 41,003.34
FIXED FEE	10%	% of Bare Cost + Overhead	$ 4,100.33
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 45,103.68

PHASE I

TASK : 2.3 - Existing Right-of-Way (ROW) Rate escalation factor 1.033

FIRM : GTS

TECHNICAL STAFF					
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY		TOTAL SALARY
R. Voss	Project Manager	180	$ 65.08	$	11,715.24
M. Zavyazkin	Project Surveyor	240	$ 36.16	$	8,677.96
P. Herflicker	Survey Crew Chief	120	$ 28.93	$	3,471.18
E. Murray	Instrument Operator	120	$ 24.79	$	2,975.30
T. Madigan	CADD	144	$ 26.86	$	3,867.89
				$	30,707.57
TOTAL ESTIMATED HOURS		804			

SUPPORT STAFF					
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY		TOTAL SALARY
				$	-
				$	-
				$	-
				$	-
TOTAL ESTIMATED HOURS		0			

TOTAL SALARY (BARE COST)			$	30,707.57
OVERHEAD	150.00%		$	46,061.35
SUBTOTAL -- SALARY + OVERHEAD			$	76,768.92
FIXED FEE	10%	% of Bare Cost + Overhead	$	7,676.89
ESTIMATED DIRECT EXPENDITURES				
Travel Expenses			$	-
Reproduction				
Overnight Mail / Messenger				
Misc.			$	-
TOTAL DIRECT EXPENSES			$	-
TOTAL THIS TASK			$	84,445.81

PHASE I

TASK : 2.3.1 - Right-of-Way Research and Property Acquisition PrepaRation escalation factor 1.030

FIRM : GTS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Voss	Project Manager	260	$ 64.89	$ 16,871.40
M. Zavyazkin	Project Surveyor	308	$ 36.05	$ 11,103.40
T. Madigan	CADD	200	$ 26.78	$ 5,356.00
				$ 33,330.80
TOTAL ESTIMATED HOURS		768		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 33,330.80
OVERHEAD	150.00%		$ 49,996.20
SUBTOTAL -- SALARY + OVERHEAD			$ 83,327.00
FIXED FEE	10%	% of Bare Cost + Overhead	$ 8,332.70
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 91,659.70

PHASE I

TASK : **2.3.2 - Screening of Parcels and PAECE Process** Rate escalation factor 1.030

FIRM : GTS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Voss	Project Manager	40	$ 64.89	$ 2,595.60
				$ 2,595.60
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 2,595.60
OVERHEAD	150.00%		$ 3,893.40
SUBTOTAL -- SALARY + OVERHEAD			$ 6,489.00
FIXED FEE	10%	% of Bare Cost + Overhead	$ 648.90
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 7,137.90

PHASE I

TASK : 16 - As Directed by NJ TRANSIT

Rate escalation factor 1.033

FIRM : GTS

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
P. Herflicker	Survey Crew Chief	1,000	$ 28.93	$ 28,926.52
				$ 28,926.52
TOTAL ESTIMATED HOURS		1,000		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 28,926.52
OVERHEAD	150.00%		$ 43,389.78
SUBTOTAL -- SALARY + OVERHEAD			$ 72,316.30
FIXED FEE	10%	% of Bare Cost + Overhead	$ 7,231.63
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 79,547.93

PHASE I | FIRM :
TASK : 1.2.1 - Final Scoping / Prel. Engineering (PE) Schedule) Rate escalation factor 1.032 LKG

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
V. Hollis	Configuration Management	200	$ 42.29	$ 8,458.67
				$ 8,458.67
TOTAL ESTIMATED HOURS		200		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 8,458.67
OVERHEAD	111.46%		$ 9,428.03
SUBTOTAL -- SALARY + OVERHEAD			$ 17,886.70
FIXED FEE	10%	% of Bare Cost + Overhead	$ 1,788.67
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 19,675.37

PHASE I

TASK : 1.2.2 - Records Management Control System

Rate escalation factor 1.039

FIRM : LKG

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
A. Kudravitsky	Document Control	800	$ 41.12	$ 32,897.43
E. Harris	Document Control	600	$ 37.40	$ 22,441.40
				$ 55,338.83
TOTAL ESTIMATED HOURS		1,400		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 55,338.83
OVERHEAD	111.46%		$ 61,680.66
SUBTOTAL -- SALARY + OVERHEAD			$ 117,019.49
FIXED FEE	10%	% of Bare Cost + Overhead	$ 11,701.95
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 128,721.44

PHASE I
TASK : 1.2.3 - Monthly Progress Reporting — Rate escalation factor 1.032 — FIRM : LKG

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
V. Hollis	Configuration Management	200	$ 42.29	$ 8,458.67
A. Kudravitsky	Document Control	800	$ 40.83	$ 32,662.84
E. Harris	Document Control	600	$ 37.14	$ 22,281.37
				$ 63,402.88
TOTAL ESTIMATED HOURS		1,600		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 63,402.88
OVERHEAD	111.46%		$ 70,668.85
SUBTOTAL -- SALARY + OVERHEAD			$ 134,071.73
FIXED FEE	10%	% of Bare Cost + Overhead	$ 13,407.17
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 147,478.91

PHASE I

TASK : 1.5 - Configuration Management

Rate escalation factor 1.033

FIRM : LKG

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
V. Hollis	Configuration Management	1,200	$ 42.36	$ 50,828.03
				$ 50,828.03
TOTAL ESTIMATED HOURS		1,200		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 50,828.03
OVERHEAD	111.46%		$ 56,652.92
SUBTOTAL -- SALARY + OVERHEAD			$ 107,480.95
FIXED FEE	10%	% of Bare Cost + Overhead	$ 10,748.09
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 118,229.04

PHASE I

TASK : 1.7 - Payment Procedures

Rate escalation factor 1.094

FIRM : LKG

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Harris	Document Control	400	$ 39.37	$ 15,749.02
				$ 15,749.02
TOTAL ESTIMATED HOURS		400		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 15,749.02
OVERHEAD	111.46%		$ 17,553.86
SUBTOTAL -- SALARY + OVERHEAD			$ 33,302.88
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,330.29
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 36,633.17

PHASE I
TASK : 2.2 - Engineering and Design

Rate escalation factor 1.000

FIRM : LKG

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
V. Hollis	Configuration Management	0	$ 41.00	$ -
A. Kudravitsky	Document Control	0	$ 39.58	$ -
E. Harris	Document Control	0	$ 36.00	$ -
				$ -
TOTAL ESTIMATED HOURS		0		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ -
OVERHEAD	111.46%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ -
FIXED FEE	10%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			$ 101,010.00
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 101,010.00
TOTAL THIS TASK			$ 101,010.00

PHASE I

TASK : 2.2.3 - Civil, Structural, Geotechnical, & Hydraulic

Rate escalation factor 1.000

FIRM : Matrix

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
A. Raichle	Project Director	0	$ 105.07	$ -
P. Calabrese	Project Geotechnical Engineer/Manager	0	$ 99.03	$ -
C. Bassett	Senior Geotechnical Engineer	0	$ 56.94	$ -
R. Persaud	Geotechnical Engineer	0	$ 33.46	$ -
A. Riccio	Senior CADD Operator	0	$ 36.17	$ -
C. Zilske	Administrative Support	0	$ 17.30	$ -
				$ -
TOTAL ESTIMATED HOURS		0		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ -
OVERHEAD	160.33%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ -
FIXED FEE	10%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 15,000.00
Drilling Subcontractor			$ 595,000.00
Laboratory Subcontractor			$ 45,200.00
Reproduction			$ 500.00
TOTAL DIRECT EXPENSES			$ 655,700.00
TOTAL THIS TASK			$ 655,700.00

PHASE I

TASK : 2.2.4 - Subsurface Investigation Rate escalation factor 1.030 FIRM : Matrix

TECHNICAL STAFF					
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY		TOTAL SALARY
A. Raichle	Project Director	35	$ 108.22	$	3,787.77
P. Calabrese	Project Geotechnical Engineer/Manager	354	$ 102.00	$	36,108.32
C. Bassett	Senior Geotechnical Engineer	365	$ 58.65	$	21,406.59
R. Persaud	Geotechnical Engineer	2,354	$ 34.46	$	81,127.79
A. Riccio	Senior CADD Operator	40	$ 37.26	$	1,490.20
C. Zilske	Administrative Support	8	$ 17.82	$	142.55
				$	144,063.23
TOTAL ESTIMATED HOURS		3,156			

SUPPORT STAFF					
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY		TOTAL SALARY
				$	-
				$	-
				$	-
				$	-
TOTAL ESTIMATED HOURS		0			

TOTAL SALARY (BARE COST)			$	144,063.23
OVERHEAD	160.33%		$	230,976.57
SUBTOTAL -- SALARY + OVERHEAD			$	375,039.80
FIXED FEE	10%	% of Bare Cost + Overhead	$	37,503.98
ESTIMATED DIRECT EXPENDITURES				
Travel Expenses			$	-
Reproduction				
Overnight Mail / Messenger				
Misc.			$	-
TOTAL DIRECT EXPENSES			$	-
TOTAL THIS TASK			$	412,543.78

PHASE I

TASK : **16 - As Directed by NJ TRANSIT** **Rate escalation factor 1.033** FIRM : **Matrix**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Persaud	Geotechnical Engineer	484	$ 34.57	$ 16,747.69
				$ 16,747.69
TOTAL ESTIMATED HOURS		484		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 16,747.69
OVERHEAD	160.33%		$ 26,851.57
SUBTOTAL -- SALARY + OVERHEAD			$ 43,599.25
FIXED FEE	10%	% of Bare Cost + Overhead	$ 4,359.93
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 47,959.18

PHASE I

TASK : **2.2.4 - Subsurface Investigation** — **Rate escalation factor 1.030** — FIRM : **RGA**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
P. McEachen	Principal Senior Archaeologist	22	$ 43.26	$ 951.72
M. Gall	Sr. Archaeologist	222	$ 34.22	$ 7,596.09
A. Heinrich	Archaeologist	8	$ 26.52	$ 212.18
T. Erdreich	Lab Director	6	$ 21.63	$ 129.78
P. P. McEachen	Drafter	20	$ 25.17	$ 503.46
C. Smyrski	Editor	16	$ 24.82	$ 397.17
S. Grubb	Research Assistant	6	$ 17.51	$ 105.06
				$ 9,895.46
TOTAL ESTIMATED HOURS		300		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 9,895.46
OVERHEAD	147.11%		$ 14,557.21
SUBTOTAL -- SALARY + OVERHEAD			$ 24,452.66
FIXED FEE	10%	% of Bare Cost + Overhead	$ 2,445.27
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 62.50
Reproduction			$ 50.00
Overnight Mail / Messenger			$ 30.00
Misc. (Geomorphological Consultation-if necessary			$ 4,000.00
TOTAL DIRECT EXPENSES			$ 4,142.50
TOTAL THIS TASK			$ 31,040.43

PHASE I

TASK : **2.2.7 - Structures**

Rate escalation factor 1.033

FIRM : **SJH**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
TBD	Structural Design	1,524	$ 56.82	$ 86,601.63
				$ 86,601.63
TOTAL ESTIMATED HOURS		1,524		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 86,601.63
OVERHEAD	140.00%		$ 121,242.28
SUBTOTAL -- SALARY + OVERHEAD			$ 207,843.91
FIXED FEE	10%	% of Bare Cost + Overhead	$ 20,784.39
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 228,628.30

PHASE I

TASK : 3 - Cost Estimating

Rate escalation factor 1.033

FIRM : SJH

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
V. Tiruchirappalli	Cost Estimating	1,280	$ 45.46	$ 58,183.63
				$ 58,183.63
TOTAL ESTIMATED HOURS		1,280		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 58,183.63
OVERHEAD	140.00%		$ 81,457.08
SUBTOTAL -- SALARY + OVERHEAD			$ 139,640.71
FIXED FEE	10%	% of Bare Cost + Overhead	$ 13,964.07
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 460.00
Reproduction			$ 350.00
Overnight Mail / Messenger			$ 200.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 1,010.00
TOTAL THIS TASK			$ 154,614.78

PHASE I

TASK : 2.1 - Verification of Concept | Rate escalation factor 1.030 | FIRM : SSA

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	65	$ 89.24	$ 5,800.55
Staff 1 - TBD	Architect V	85	$ 41.43	$ 3,521.26
Staff 2 - TBD	Architect IV	85	$ 30.90	$ 2,626.50
Staff 3 - TBD	Architect III	120	$ 26.78	$ 3,213.60
				$ 15,161.91
TOTAL ESTIMATED HOURS		355		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 15,161.91
OVERHEAD	133.00%		$ 20,165.34
SUBTOTAL -- SALARY + OVERHEAD			$ 35,327.25
FIXED FEE	10%	% of Bare Cost + Overhead	$ 3,532.72
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 120.00
Reproduction			$ 50.00
Overnight Mail / Messenger			$ 50.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 220.00
TOTAL THIS TASK			$ 39,079.97

PHASE I

TASK : 2.2.1 - Power Plant Design

Rate escalation factor 1.033

FIRM : SSA

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	280	$ 89.51	$ 25,061.94
Staff 1 - TBD	Architect V	671	$ 41.55	$ 27,881.89
Staff 2 - TBD	Architect IV	320	$ 30.99	$ 9,917.66
Staff 3 - TBD	Architect III	530	$ 26.86	$ 14,235.98
				$ 77,097.47
TOTAL ESTIMATED HOURS		1,801		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 77,097.47
OVERHEAD	133.00%		$ 102,539.63
SUBTOTAL -- SALARY + OVERHEAD			$ 179,637.10
FIXED FEE	10%	% of Bare Cost + Overhead	$ 17,963.71
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 750.00
Reproduction			$ 1,500.00
Overnight Mail / Messenger			$ 250.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,500.00
TOTAL THIS TASK			$ 200,100.81

PHASE I

TASK : 2.2.2.1 - Amtrak Electric Traction Power / Overhead Catenary System Sub 41 (Kearny Substation)

Rate escalation factor 1.033

FIRM : SSA

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	100	$ 89.51	$ 8,950.69
Staff 1 - TBD	Architect V	88	$ 41.55	$ 3,656.48
Staff 2 - TBD	Architect IV	88	$ 30.99	$ 2,727.36
Staff 3 - TBD	Architect III	224	$ 26.86	$ 6,016.72
				$ 21,351.24
TOTAL ESTIMATED HOURS		500		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 21,351.24
OVERHEAD	133.00%		$ 28,397.15
SUBTOTAL -- SALARY + OVERHEAD			$ 49,748.40
FIXED FEE	10%	% of Bare Cost + Overhead	$ 4,974.84
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 300.00
Reproduction			$ 1,000.00
Overnight Mail / Messenger			$ 150.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 1,450.00
TOTAL THIS TASK			$ 56,173.24

PHASE I

TASK : 9 - Public Involvement and Agency Coordination

Rate escalation factor 1.033

FIRM : SSA

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	14	$ 89.51	$ 1,253.10
Staff 1 - TBD	Architect V	22	$ 41.55	$ 914.12
Staff 2 - TBD	Architect IV	20	$ 30.99	$ 619.85
Staff 3 - TBD	Architect III	24	$ 26.86	$ 644.65
				$ 3,431.72
TOTAL ESTIMATED HOURS		80		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 3,431.72
OVERHEAD	133.00%		$ 4,564.19
SUBTOTAL -- SALARY + OVERHEAD			$ 7,995.90
FIXED FEE	10%	% of Bare Cost + Overhead	$ 799.59
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 120.00
Reproduction			$ 500.00
Overnight Mail / Messenger			$ 100.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 720.00
TOTAL THIS TASK			$ 9,515.49

PHASE I

TASK : 9.1 - Open Houses and Meetings

Rate escalation factor 1.033

FIRM : SSA

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	14	$ 89.51	$ 1,253.10
Staff 1 - TBD	Architect V	22	$ 41.55	$ 914.12
Staff 2 - TBD	Architect IV	20	$ 30.99	$ 619.85
Staff 3 - TBD	Architect III	24	$ 26.86	$ 644.65
				$ 3,431.72
TOTAL ESTIMATED HOURS		80		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 3,431.72
OVERHEAD	133.00%		$ 4,564.19
SUBTOTAL -- SALARY + OVERHEAD			$ 7,995.90
FIXED FEE	10%	% of Bare Cost + Overhead	$ 799.59
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 120.00
Reproduction			$ 500.00
Overnight Mail / Messenger			$ 100.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 720.00
TOTAL THIS TASK			$ 9,515.49

PHASE I

TASK : **11 - Value Engineering**

Rate escalation factor 1.030

FIRM : **SSA**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	2	$ 89.24	$ 178.48
Staff 1 - TBD	Architect V	38	$ 41.43	$ 1,574.21
				$ 1,752.69
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 1,752.69
OVERHEAD	133.00%		$ 2,331.08
SUBTOTAL -- SALARY + OVERHEAD			$ 4,083.77
FIXED FEE	10%	% of Bare Cost + Overhead	$ 408.38
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 350.00
Reproduction			$ 100.00
Overnight Mail / Messenger			$ 100.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 550.00
TOTAL THIS TASK			$ 5,042.14

PHASE I

TASK : 12 - Constructability Reviews

Rate escalation factor 1.033

FIRM : SSA

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
R. Sullivan	Architecture	2	$ 89.51	$ 179.01
Staff 1 - TBD	Architect V	38	$ 41.55	$ 1,578.93
				$ 1,757.95
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 1,757.95
OVERHEAD	133.00%		$ 2,338.07
SUBTOTAL -- SALARY + OVERHEAD			$ 4,096.02
FIXED FEE	10%	% of Bare Cost + Overhead	$ 409.60
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 350.00
Reproduction			$ 100.00
Overnight Mail / Messenger			$ 100.00
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 550.00
TOTAL THIS TASK			$ 5,055.62

PHASE I

TASK : 15 - Analysis of Ancillary Services Market Revenue Ops. Rate escalation factor 1.030

FIRM : SCC

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
J. Graham	FERC-Legal	80	$ 396.55	$ 31,724.00
				$ 31,724.00
TOTAL ESTIMATED HOURS		80		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 31,724.00
OVERHEAD	37.00%		$ 11,737.88
SUBTOTAL -- SALARY + OVERHEAD			$ 43,461.88
FIXED FEE	5%	% of Bare Cost + Overhead	$ 2,173.09
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 3,000.00
Reproduction			$ 250.00
Overnight Mail / Messenger			$ 100.00
Misc.			$ 1,000.00
TOTAL DIRECT EXPENSES			$ 4,350.00
TOTAL THIS TASK			$ 49,984.97

PHASE 1

TASK : 1.1 - Project Management Plan

Rate escalation factor 1.030

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	24	$ 360.50	$ 8,652.00
				$ 8,652.00
TOTAL ESTIMATED HOURS		24		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 8,652.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 8,652.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 10,652.00

PHASE I **FIRM :**

TASK : **1.2 -Project Control** **Rate escalation factor 1.078** **Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	16	$ 377.22	$ 6,035.46
				$ 6,035.46
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,035.46
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 6,035.46
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 6,035.46

PHASE I

TASK : 1.2.1 - Final Scoping / Prel. Engineering (PE) Schedule) Rate escalation factor 1.032

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	24	$ 361.04	$ 8,664.98
				$ 8,664.98
TOTAL ESTIMATED HOURS		24		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 8,664.98
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 8,664.98
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 10,664.98

PHASE I

TASK : **1.2.2 - Records Management Control System** **Rate escalation factor 1.039** **FIRM : Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	4	$ 363.63	$ 1,454.54
				$ 1,454.54
TOTAL ESTIMATED HOURS		4		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 1,454.54
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 1,454.54
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 1,454.54

PHASE I

TASK : 1.2.3 - Monthly Progress Reporting — Rate escalation factor 1.032 — FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	16	$ 361.04	$ 5,776.65
				$ 5,776.65
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,776.65
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,776.65
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 7,776.65

PHASE I

TASK : **1.3 - Quality Control** **Rate escalation factor 1.032** **FIRM : Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	16	$ 361.04	$ 5,776.65
				$ 5,776.65
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,776.65
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,776.65
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 5,776.65

PHASE I

TASK : **1.3.2 - Quality Management Plan Requirements** **Rate escalation factor 1.030** FIRM : **Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	16	$ 360.50	$ 5,768.00
				$ 5,768.00
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,768.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,768.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 7,768.00

PHASE I | **FIRM :**

TASK : **1.3.5 - Design Control** **Rate escalation factor 1.032** **Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	4	$ 361.04	$ 1,444.16
				$ 1,444.16
TOTAL ESTIMATED HOURS		4		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 1,444.16
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 1,444.16
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 3,444.16

PHASE I

TASK : **1.3.7 - Internal Quality Audits** **Rate escalation factor 1.033** FIRM : **Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	16	$ 361.58	$ 5,785.30
				$ 5,785.30
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,785.30
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,785.30
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 7,785.30

PHASE I

TASK : 1.4 - Peer Review of Design

Rate escalation factor 1.045

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	40	$ 365.91	$ 14,636.30
				$ 14,636.30
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 14,636.30
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 14,636.30
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 16,636.30

PHASE I

TASK : 1.5 - Configuration Management

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	16	$ 361.58	$ 5,785.30
				$ 5,785.30
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,785.30
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,785.30
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 7,785.30

PHASE I

TASK : 1.6 - Project Meetings

Rate escalation factor 1.094

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	40	$ 382.79	$ 15,311.55
				$ 15,311.55
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 15,311.55
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 15,311.55
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 17,311.55

PHASE I		FIRM :
TASK :	1.7 - Payment Procedures	Rate escalation factor 1.094	Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	16	$ 382.79	$ 6,124.62
				$ 6,124.62
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 6,124.62
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 6,124.62
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 6,124.62

PHASE I **FIRM :**

TASK : **2.1 - Verification of Concept** **Rate escalation factor 1.030** **Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybersecurity	40	$ 360.50	$ 14,420.00
				$ 14,420.00
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 14,420.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 14,420.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 16,420.00

PHASE I

TASK : 2.2 - Engineering and Design

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	16	$ 361.58	$ 5,785.30
				$ 5,785.30
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,785.30
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,785.30
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 7,785.30

PHASE I
TASK : 2.2.1 - Power Plant Design

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	80	$ 361.58	$ 28,926.52
				$ 28,926.52
TOTAL ESTIMATED HOURS		80		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 28,926.52
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 28,926.52
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 3,800.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 3,800.00
TOTAL THIS TASK			$ 32,726.52

PHASE I

TASK : 2.2.2 - Electric Traction Power Facilities and Power Management System Design

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	80	$ 361.58	$ 28,926.52
				$ 28,926.52
TOTAL ESTIMATED HOURS		80		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 28,926.52
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 28,926.52
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 3,800.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 3,800.00
TOTAL THIS TASK			$ 32,726.52

PHASE I

TASK : 2.2.2.1 - Amtrak Electric Traction Power / Overhead Catenary System Sub 41 (Kearny Substation)

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	110	$ 361.58	$ 39,773.97
				$ 39,773.97
TOTAL ESTIMATED HOURS		110		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 39,773.97
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 39,773.97
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 3,800.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 3,800.00
TOTAL THIS TASK			$ 43,573.97

PHASE I

TASK : 2.2.7 - Structures

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	32	$ 361.58	$ 11,570.61
				$ 11,570.61
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,570.61
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,570.61
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 13,570.61

PHASE I

TASK : **2.2.8 - Communications Systems and Power Management Communications** **Rate escalation factor 1.033** **FIRM : Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	120	$ 361.58	$ 43,389.78
				$ 43,389.78
TOTAL ESTIMATED HOURS		120		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 43,389.78
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 43,389.78
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 5,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 5,000.00
TOTAL THIS TASK			$ 48,389.78

PHASE I

TASK : 2.2.9 - Signals / Train Control Architecture   Rate escalation factor 1.033   FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	110	$ 361.58	$ 39,773.97
				$ 39,773.97
TOTAL ESTIMATED HOURS		110		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 39,773.97
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 39,773.97
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 4,500.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 4,500.00
TOTAL THIS TASK			$ 44,273.97

PHASE I

TASK : 2.2.10 - Concept of Operations

Rate escalation factor 1.036

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	32	$ 362.66	$ 11,605.22
				$ 11,605.22
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,605.22
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,605.22
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 13,605.22

PHASE I

TASK : 3 - Cost Estimating

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	80	$ 361.58	$ 28,926.52
				$ 28,926.52
TOTAL ESTIMATED HOURS		80		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 28,926.52
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 28,926.52
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 28,926.52

PHASE I

TASK : 7 -Risk Management

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	24	$ 361.58	$ 8,677.96
				$ 8,677.96
TOTAL ESTIMATED HOURS		24		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 8,677.96
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 8,677.96
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 10,677.96

PHASE I **FIRM :**
TASK : **8 - System Safety and Security Management** **Rate escalation factor 1.000** **Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	0	$ 350.00	$ -
				$ -
TOTAL ESTIMATED HOURS		0		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ -
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ -
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 3,800.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 3,800.00
TOTAL THIS TASK			$ 3,800.00

PHASE I

TASK : 8.1 - Safety and Security Management Plan

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	40	$ 361.58	$ 14,463.26
				$ 14,463.26
TOTAL ESTIMATED HOURS		40		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 14,463.26
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 14,463.26
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 14,463.26

PHASE I

TASK : 9 - Public Involvement and Agency Coordination

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	32	$ 361.58	$ 11,570.61
				$ 11,570.61
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,570.61
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,570.61
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 11,570.61

PHASE I

TASK : 9.1 - Open Houses and Meetings

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	32	$ 361.58	$ 11,570.61
				$ 11,570.61
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,570.61
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,570.61
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 13,570.61

PHASE I

TASK : 10 - Integration and Interface | Rate escalation factor 1.033 | FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	16	$ 361.58	$ 5,785.30
				$ 5,785.30
TOTAL ESTIMATED HOURS		16		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 5,785.30
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 5,785.30
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ -
Reproduction			
Overnight Mail / Messenger			
Misc.			$ -
TOTAL DIRECT EXPENSES			$ -
TOTAL THIS TASK			$ 5,785.30

PHASE I

TASK : 12 - Constructability Reviews

Rate escalation factor 1.033

FIRM : Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cyberecurity	32	$ 361.58	$ 11,570.61
				$ 11,570.61
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,570.61
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,570.61
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 13,570.61

PHASE I **FIRM :**

TASK : 14 - Preparation of Subsequent Support of Contract Bid Documents and Bidding Process — Rate escalation factor 1.049 — Exida

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	32	$ 366.99	$ 11,743.65
				$ 11,743.65
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,743.65
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,743.65
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 13,743.65

PHASE I

TASK : **15 - Analysis of Ancillary Services Market Revenue Ops.** **Rate escalation factor 1.030** **FIRM : Exida**

TECHNICAL STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
E. Persson	Cybercurity	32	$ 360.50	$ 11,536.00
				$ 11,536.00
TOTAL ESTIMATED HOURS		32		

SUPPORT STAFF				
STAFF PERSON/ CLASSIFICATION	PROJECT TITLE OR DISCIPLINE	ESTIMATED HOURS	HOURLY	TOTAL SALARY
				$ -
				$ -
				$ -
				$ -
TOTAL ESTIMATED HOURS		0		

TOTAL SALARY (BARE COST)			$ 11,536.00
OVERHEAD	0.00%		$ -
SUBTOTAL -- SALARY + OVERHEAD			$ 11,536.00
FIXED FEE	0%	% of Bare Cost + Overhead	$ -
ESTIMATED DIRECT EXPENDITURES			
Travel Expenses			$ 2,000.00
Reproduction			$ -
Overnight Mail / Messenger			$ -
Misc.			$ -
TOTAL DIRECT EXPENSES			$ 2,000.00
TOTAL THIS TASK			$ 13,536.00

Cost Proposal for NJ TRANSIT RFP NO. 15-031 - Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project

FIRM/TASK	TASK 1 - PROJECT MANAGEMENT AND ADMINISTRATION																	
	1.1	1.2	1.2.1	1.2.2	1.2.3	1.3	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.4	1.5	1.6	1.7	Subtotal Task 1
JACOBS	$ 72,187.89	$ 253,709.78	$ 171,822.86	$ 58,594.14	$ 184,378.54	$ 217,884.72	$ 28,709.24	$ 2,284.22	$ 4,680.30	$ 30,652.42	$ 199,181.85	$ 37,193.46	$ 59,700.90	$ 180,184.88	$ 26,568.13	$ 742,547.53	$ 45,146.45	$ 2,314,407.29
Burns	$ -	$ -	$ -	$ -	$ -	$ 21,629.54	$ 18,102.39	$ 18,102.39	$ 18,102.39	$ 18,129.54	$ 18,129.54	$ 18,129.54	$ 18,156.69	$ -	$ -	$ -	$ -	$ 148,482.02
Levitan	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,312.71	$ -	$ 78,312.71
LTK	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,281.10	$ -	$ -	$ -	$ -	$ 36,281.10
GTS	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
LKG	$ -	$ -	$ 19,676.37	$ 128,721.44	$ 147,478.91	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 118,229.04	$ -	$ 36,633.17	$ 450,737.92
Matrix	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
RGA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SJH	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SSA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SCC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Exida	$ 10,632.00	$ 5,035.46	$ 10,664.98	$ 1,454.54	$ 7,776.65	$ 6,776.65	$ -	$ 7,768.00	$ -	$ -	$ 3,444.16	$ -	$ 7,785.30	$ 16,636.30	$ 7,785.30	$ 17,311.55	$ 6,124.62	$ 109,216.62
Total	$ 82,819.89	$ 258,745.24	$ 202,163.20	$ 188,770.11	$ 339,634.10	$ 246,290.91	$ 46,811.63	$ 28,154.61	$ 22,782.69	$ 48,781.96	$ 220,755.55	$ 55,323.00	$ 121,924.00	$ 196,821.18	$ 152,582.48	$ 838,171.79	$ 87,904.23	$ 3,137,436.67

FIRM/TASK	TASK 2 - ENGINEERING																
	2.1	2.2	2.2.1	2.2.2	2.2.2.1	2.2.3	2.2.4	2.2.5	2.2.6	2.2.7	2.2.8	2.2.9	2.2.10	2.3	2.3.1	2.3.2	Subtotal Task 2
JACOBS	$ 285,056.67	$ 876,107.42	$ 1,187,811.04	$ 717,104.10	$ 107,934.77	$ 870,307.94	$ 4,368.30	$ 34,201.65	$ 207,009.06	$ 116,135.87	$ 145,440.34	$ 48,105.82	$ 264,325.74	$ 12,424.85	$ 63,539.14	$ 34,664.11	$ 4,974,636.82
Burns	$ 148,147.26	$ -	$ -	$ 888,031.29	$ 1,544,068.33	$ -	$ -	$ -	$ -	$ -	$ 354,469.30	$ 140,491.78	$ 149,016.16	$ -	$ -	$ -	$ 3,224,223.11
Levitan	$ 342,600.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,200.00	$ -	$ -	$ -	$ 395,800.00
LTK	$ 141,027.82	$ -	$ 36,386.60	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 177,414.42
GTS	$ -	$ -	$ -	$ 83,104.86	$ -	$ -	$ 129,473.72	$ 118,285.20	$ 45,103.68	$ -	$ -	$ -	$ -	$ 84,445.81	$ 91,659.70	$ 7,137.90	$ 559,210.86
LKG	$ -	$ 101,010.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 101,010.00
Matrix	$ -	$ -	$ -	$ -	$ -	$ 655,700.00	$ 412,543.78	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,068,243.78
RGA	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,040.43	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,040.43
SJH	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 228,628.30	$ -	$ -	$ -	$ -	$ -	$ -	$ 228,628.30
SSA	$ 39,079.97	$ -	$ 200,100.81	$ -	$ 56,173.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 295,354.02
SCC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Exida	$ 16,420.00	$ 7,785.30	$ 32,726.52	$ 32,726.52	$ 43,573.97	$ -	$ -	$ -	$ -	$ 13,570.61	$ 48,389.78	$ 44,273.97	$ 13,606.22	$ -	$ -	$ -	$ 253,071.36
Total	$ 972,331.72	$ 984,902.72	$ 1,457,024.98	$ 1,720,966.77	$ 1,751,750.31	$ 1,526,007.94	$ 577,426.23	$ 152,486.85	$ 252,112.74	$ 358,334.77	$ 548,299.42	$ 232,871.57	$ 480,148.10	$ 96,870.66	$ 155,198.84	$ 41,802.01	$ 11,308,533.82

FIRM/TASK	TASK 3	TASK 4	TASK 5	TASK 6	TASK 7	TASK 8	TASK 8.1	TASK 9	TASK 9.1	TASK 10	TASK 11	TASK 12	TASK 13	TASK 14	TASK 15	TASK 16	
	3	4	5	6	7	8	8.1	9	9.1	10	11	12	13	14	15	16	Subtotal Task 3-16
JACOBS	$ 303,968.60	$ 183,033.37	$ 168,739.83	$ 8,252.25	$ 163,736.37	$ 126,475.78	$ 27,213.45	$ 116,732.09	$ 70,348.96	$ 106,380.16	$ 169,795.53	$ 285,052.19	$ 125,065.31	$ 228,765.84	$ 70,476.97	$ -	$ 2,156,036.75
Burns	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Levitan	$ -	$ -	$ -	$ -	$ 47,495.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 57,600.00	$ -	$ 105,095.00
LTK	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
GTS	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 79,547.93	$ 79,547.93
LKG	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Matrix	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 47,959.18	$ 47,959.18
RGA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SJH	$ 154,614.78	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 154,614.78
SSA	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,515.49	$ 9,515.49	$ -	$ 5,042.14	$ 6,055.62	$ -	$ -	$ -	$ -	$ 30,128.74
SCC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 49,984.97	$ -	$ 49,984.97
Exida	$ 28,926.52	$ -	$ -	$ -	$ 10,677.96	$ 3,800.00	$ 14,463.26	$ 11,570.61	$ 13,570.61	$ 5,785.30	$ -	$ 13,570.61	$ -	$ 13,743.65	$ 13,536.00	$ -	$ 129,644.51
Total	$ 487,509.90	$ 183,033.37	$ 168,739.83	$ 8,252.25	$ 221,909.33	$ 130,275.78	$ 41,676.71	$ 137,818.19	$ 93,435.06	$ 112,165.47	$ 174,837.67	$ 304,678.42	$ 125,065.31	$ 242,509.49	$ 191,597.94	$ 127,507.11	$ 2,751,011.87

FIRM/TASK	GRAND TOTAL PHASE I	DBE Participation
JACOBS (see Notes 1)	$ 9,443,980.85	
Burns	$ 3,372,705.13	
Levitan	$ 579,207.71	
LTK	$ 213,695.53	
GTS	$ 638,758.79	3.71%
LKG (see Note 2)	$ 551,747.92	3.21%
Matrix	$ 1,116,202.96	6.49%
RGA	$ 31,040.43	0.18%
SJH	$ 383,243.08	2.23%
SSA	$ 324,482.77	1.89%
SCC	$ 49,984.97	0.29%
Exida	$ 491,931.81	
Total	$ 17,196,982.08	18.00%

Notes:

1. Jacobs NAI labor rates effective 1/2/2016

2. $101,010 to be subcontracted to Esteban (DBE) for reproduction expenses

Cost Proposal for NJ TRANSIT RFP NO. 15-031 - Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project

		TASK 1 - PROJECT MANAGEMENT AND ADMINISTRATION Tasks																	
FIRM	Title	1.1	1.2	1.2.1	1.2.2	1.2.3	1.3	1.3.1	1.3.2	1.3.3	1.3.4	1.3.5	1.3.6	1.3.7	1.4	1.5	1.6	1.7	Subtotal Task 1
JACOBS	Person Hours	374	1,568	1,040	348	1,105	1,240	152	8	23	145	808	171	284	850	140	2,580	228	11,162
	Salary	$ 31,735.92	$ 111,083.52	$ 74,830.73	$ 25,611.88	$ 81,609.69	$ 97,730.96	$ 12,465.96	$ 991.39	$ 2,031.33	$ 13,380.67	$ 86,936.03	$ 16,322.34	$ 25,168.34	$ 78,958.56	$ 11,716.84	$ 212,117.08	$ 20,036.97	$ 903,748.31
	Overhead	$ 33,871.25	$ 118,652.64	$ 81,371.87	$ 27,655.52	$ 86,007.16	$ 100,346.06	$ 13,613.33	$ 1,085.17	$ 2,223.49	$ 14,465.17	$ 94,138.38	$ 17,489.90	$ 29,105.20	$ 84,845.88	$ 12,435.81	$ 221,476.66	$ 21,005.26	$ 958,858.85
	Subtotal	$ 65,607.17	$ 229,736.16	$ 156,202.60	$ 53,267.40	$ 167,616.85	$ 198,077.02	$ 26,099.31	$ 2,076.56	$ 4,254.82	$ 27,845.84	$ 181,074.41	$ 33,812.24	$ 54,273.54	$ 163,804.44	$ 24,152.65	$ 433,593.74	$ 41,042.23	$ 1,862,597.16
	Fixed Fee	$ 6,560.72	$ 22,973.62	$ 15,620.26	$ 5,326.74	$ 16,761.69	$ 19,807.70	$ 2,609.93	$ 207.66	$ 425.48	$ 2,786.58	$ 18,107.44	$ 3,381.22	$ 5,427.35	$ 16,380.44	$ 2,415.26	$ 43,359.37	$ 4,104.22	$ 186,259.72
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 265,594.41	$ -	$ 265,594.41
	TOTAL	$ 72,167.89	$ 252,709.78	$ 171,822.86	$ 58,594.14	$ 184,378.54	$ 217,884.72	$ 28,709.24	$ 2,284.22	$ 4,680.30	$ 30,632.42	$ 199,181.85	$ 37,193.46	$ 59,700.90	$ 180,184.88	$ 26,568.13	$ 742,547.53	$ 45,146.45	$ 2,314,451.29
Burns	Person Hours	0	0	0	0	0	75	75	75	75	75	75	75	75	0	0	0	0	600
	Salary	$ -	$ -	$ -	$ -	$ -	$ 6,628.71	$ 6,618.78	$ 6,618.78	$ 6,618.78	$ 6,628.71	$ 6,628.71	$ 6,628.71	$ 6,638.64	$ -	$ -	$ -	$ -	$ 53,009.81
	Overhead	$ -	$ -	$ -	$ -	$ -	$ 9,852.69	$ 9,837.94	$ 9,837.94	$ 9,837.94	$ 9,852.69	$ 9,852.69	$ 9,852.69	$ 9,867.45	$ -	$ -	$ -	$ -	$ 78,792.03
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ 16,481.40	$ 16,456.72	$ 16,456.72	$ 16,456.72	$ 16,481.40	$ 16,481.40	$ 16,481.40	$ 16,506.09	$ -	$ -	$ -	$ -	$ 131,801.84
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ 1,648.14	$ 1,645.67	$ 1,645.67	$ 1,645.67	$ 1,648.14	$ 1,648.14	$ 1,648.14	$ 1,650.61	$ -	$ -	$ -	$ -	$ 13,180.18
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ 3,500.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,500.00
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ 21,629.54	$ 18,102.39	$ 18,102.39	$ 18,102.39	$ 18,129.54	$ 18,129.54	$ 18,129.54	$ 18,156.69	$ -	$ -	$ -	$ -	$ 148,482.03
Lawton	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	265	0	265
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,312.71	$ -	$ 78,312.71
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,312.71	$ -	$ 78,312.71
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 78,312.71	$ -	$ 78,312.71
LTK	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	160	0	0	0	0	160
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,372.32	$ -	$ -	$ -	$ -	$ 13,372.32
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,610.50	$ -	$ -	$ -	$ -	$ 19,610.50
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 32,982.82	$ -	$ -	$ -	$ -	$ 32,982.82
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,298.28	$ -	$ -	$ -	$ -	$ 3,298.28
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36,281.10	$ -	$ -	$ -	$ -	$ 36,281.10
GTS	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
LKG	Person Hours	0	0	200	1,405	1,603	0	0	0	0	0	0	0	0	0	1,250	0	400	4,855
	Salary	$ -	$ -	$ 8,458.67	$ 55,338.83	$ 63,402.66	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 50,828.03	$ -	$ 15,749.03	$ 193,777.43
	Overhead	$ -	$ -	$ 9,428.03	$ 61,680.66	$ 70,668.85	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 56,652.92	$ -	$ 17,553.66	$ 215,984.33
	Subtotal	$ -	$ -	$ 17,886.70	$ 117,019.49	$ 134,071.73	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,480.95	$ -	$ 33,302.69	$ 409,761.76
	Fixed Fee	$ -	$ -	$ 1,788.67	$ 11,701.95	$ 13,407.17	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,748.09	$ -	$ 3,330.29	$ 40,976.17
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ 19,675.37	$ 128,721.44	$ 147,478.91	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 118,229.04	$ -	$ 36,633.17	$ 450,737.93
Matrix	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
RGA	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SJH	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SSA	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SCC	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
[illegible]	Person Hours	24	16	24	4	16	16	0	16	0	0	4	0	16	40	16	40	16	248
	Salary	$ 8,652.00	$ 8,035.46	$ 8,664.98	$ 1,454.54	$ 5,776.65	$ 5,776.65	$ -	$ 5,768.00	$ -	$ -	$ 1,444.16	$ -	$ 5,785.30	$ 14,636.30	$ 5,785.30	$ 15,311.55	$ 6,124.62	$ 91,215.53
	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	$ 8,652.00	$ 8,035.46	$ 8,664.98	$ 1,454.54	$ 5,776.65	$ 5,776.65	$ -	$ 5,768.00	$ -	$ -	$ 1,444.16	$ -	$ 5,785.30	$ 14,636.30	$ 5,785.30	$ 15,311.55	$ 6,124.62	$ 91,215.53
	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	$ 2,000.00	$ -	$ 2,000.00	$ -	$ 2,000.00	$ -	$ -	$ 2,000.00	$ -	$ -	$ 2,000.00	$ -	$ 2,000.00	$ 2,000.00	$ 2,000.00	$ 2,000.00	$ -	$ 18,000.00
	TOTAL	$ 10,652.00	$ 8,035.46	$ 10,664.98	$ 1,454.54	$ 7,776.65	$ 5,776.65	$ -	$ 7,768.00	$ -	$ -	$ 3,444.16	$ -	$ 7,785.30	$ 16,636.30	$ 7,785.30	$ 17,311.55	$ 6,124.62	$ 109,215.53
	Total	$ 82,819.89	$ 258,745.24	$ 202,163.20	$ 188,770.11	$ 339,634.10	$ 245,290.91	$ 46,811.63	$ 28,154.61	$ 22,782.69	$ 48,761.96	$ 220,755.56	$ 55,323.00	$ 121,934.00	$ 196,821.18	$ 152,582.48	$ 838,171.79	$ 87,904.23	$ 3,157,436.37

Cost Proposal for NJ TRANSIT RFP NO. 15-031 - Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project

FIRM	Title	Title	2.1	2.2	2.2.1	2.2.2	2.2.2.1	2.2.3	2.2.4	2.2.5	2.2.6	2.2.7	2.2.8	2.2.9	2.2.10	2.3	2.3.1	2.3.2	Subtotal Task 2
			TASK 2 - ENGINEERING Tasks																
JACOBS	Person Hours	Person Hours	1,728	6,985	6,210	3,308	549	5,710	38	210	1,210	970	608	228	1,420	64	420	182	31,963
	Salary	Salary	$ 128,349.40	$ 393,435.24	$ 536,621.11	$ 313,611.54	$ 47,901.35	$ 377,727.99	$ 1,934.46	$ 14,974.90	$ 69,976.56	$ 52,340.70	$ 63,723.84	$ 21,032.98	$ 116,942.62	$ 5,500.61	$ 27,592.45	$ 15,060.21	$ 2,206,734.36
	Overhead	Overhead	$ 130,793.02	$ 403,026.05	$ 543,207.11	$ 338,301.28	$ 50,221.17	$ 413,461.05	$ 2,036.73	$ 16,117.51	$ 96,213.50	$ 53,237.30	$ 68,494.61	$ 22,699.54	$ 123,353.51	$ 5,794.71	$ 30,170.40	$ 16,452.62	$ 2,316,980.30
	Subtotal	Subtotal	$ 259,142.42	$ 796,461.29	$ 1,079,828.22	$ 651,912.82	$ 98,122.52	$ 791,189.04	$ 3,971.19	$ 31,092.41	$ 166,190.06	$ 105,578.00	$ 132,218.46	$ 43,732.37	$ 240,296.13	$ 11,295.32	$ 57,762.85	$ 31,512.83	$ 4,523,[illegible]
	Fixed Fee	Fixed Fee	$ 25,914.24	$ 79,646.13	$ 107,982.82	$ 65,191.28	$ 9,812.25	$ 79,118.90	$ 397.12	$ 3,109.24	$ 16,819.01	$ 10,557.81	$ 13,221.85	$ 4,373.26	$ 24,029.61	$ 1,129.53	$ 5,776.29	$ 3,151.28	$ 452,[illegible]
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	TOTAL	$ 285,056.67	$ 876,107.42	$ 1,187,811.04	$ 717,104.10	$ 107,934.77	$ 870,307.94	$ 4,368.30	$ 34,201.65	$ 207,009.06	$ 116,135.87	$ 145,440.34	$ 48,105.62	$ 264,325.74	$ 12,424.85	$ 63,539.14	$ 34,664.11	$ 4,976,[illegible]
Burns	Person Hours	Person Hours	700	0	0	6,220	6,350	0	0	0	0	0	2,600	800	700	0	0	0	20,550
	Salary	Salary	$ 52,687.41	$ -	$ -	$ 316,464.39	$ 556,331.38	$ -	$ -	$ -	$ -	$ -	$ 127,045.29	$ 50,068.34	$ 53,204.73	$ -	$ -	$ -	$ 1,156,021.51
	Overhead	Overhead	$ 78,610.10	$ -	$ -	$ 470,382.23	$ 826,912.56	$ -	$ -	$ -	$ -	$ -	$ 188,835.91	$ 74,449.65	$ 79,081.78	$ -	$ -	$ -	$ 1,718,271.23
	Subtotal	Subtotal	$ 131,427.51	$ -	$ -	$ 786,846.62	$ 1,383,243.94	$ -	$ -	$ -	$ -	$ -	$ 315,881.18	$ 124,537.98	$ 132,286.50	$ -	$ -	$ -	$ 2,874,293.74
	Fixed Fee	Fixed Fee	$ 13,142.75	$ -	$ -	$ 78,684.66	$ 138,324.39	$ -	$ -	$ -	$ -	$ -	$ 31,588.12	$ 12,453.80	$ 13,228.65	$ -	$ -	$ -	$ 287,429.37
	Direct Expenses	Direct Expenses	$ 3,500.00	$ -	$ -	$ 22,500.00	$ 22,500.00	$ -	$ -	$ -	$ -	$ -	$ 7,000.00	$ 3,500.00	$ 3,500.00	$ -	$ -	$ -	$ 62,500.00
	TOTAL	TOTAL	$ 148,147.26	$ -	$ -	$ 888,031.29	$ 1,544,068.33	$ -	$ -	$ -	$ -	$ -	$ 354,469.30	$ 140,491.78	$ 149,015.15	$ -	$ -	$ -	$ 3,224,223.11
Levitan	Person Hours	Person Hours	1,410	0	0	0	0	0	0	0	0	0	0	0	280	0	0	0	1,690
	Salary	Salary	$ 342,600.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,200.00	$ -	$ -	$ -	$ 395,800.00
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	Subtotal	$ 342,600.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,200.00	$ -	$ -	$ -	$ 395,800.00
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	TOTAL	$ 342,600.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53,200.00	$ -	$ -	$ -	$ 395,800.00
LTK	Person Hours	Person Hours	428	0	264	0	0	0	0	0	0	0	0	0	0	0	0	0	692
	Salary	Salary	$ 47,796.04	$ -	$ 13,411.20	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 61,207.24
	Overhead	Overhead	$ 70,052.89	$ -	$ 19,667.53	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 89,720.42
	Subtotal	Subtotal	$ 117,848.93	$ -	$ 33,078.73	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 150,927.66
	Fixed Fee	Fixed Fee	$ 11,784.89	$ -	$ 3,307.87	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,092.77
	Direct Expenses	Direct Expenses	$ 11,350.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,350.00
	TOTAL	TOTAL	$ 141,027.82	$ -	$ 36,386.60	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 177,414.42
GTS	Person Hours	Person Hours	0	0	0	1,012	0	0	440	1,360	492	0	0	0	0	804	768	40	4,916
	Salary	Salary	$ -	$ -	$ -	$ 30,219.95	$ -	$ -	$ 14,354.38	$ 43,012.80	$ 16,401.34	$ -	$ -	$ -	$ -	$ 30,707.57	$ 33,330.80	$ 2,595.60	$ 170,622.13
	Overhead	Overhead	$ -	$ -	$ -	$ 45,328.92	$ -	$ -	$ 21,531.12	$ 64,519.20	$ 24,602.01	$ -	$ -	$ -	$ -	$ 46,061.35	$ 49,996.20	$ 3,893.40	$ 255,933.20
	Subtotal	Subtotal	$ -	$ -	$ -	$ 75,548.87	$ -	$ -	$ 35,885.50	$ 107,532.00	$ 41,003.34	$ -	$ -	$ -	$ -	$ 76,768.92	$ 83,327.00	$ 6,489.00	$ 426,555.33
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ 7,554.99	$ -	$ -	$ 3,588.53	$ 10,753.20	$ 4,100.33	$ -	$ -	$ -	$ -	$ 7,676.89	$ 8,332.70	$ 648.90	$ 42,655.53
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ 90,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 90,000.00
	TOTAL	TOTAL	$ -	$ -	$ -	$ 83,104.86	$ -	$ -	$ 129,473.82	$ 118,285.20	$ 45,103.68	$ -	$ -	$ -	$ -	$ 84,445.81	$ 91,659.70	$ 7,137.90	$ 559,210.86
LNG	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	Direct Expenses	$ -	$ 101,010.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 101,010.00
	TOTAL	TOTAL	$ -	$ 101,010.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 101,010.00
Matyus	Person Hours	Person Hours	0	0	0	0	0	0	3,156	0	0	0	0	0	0	0	0	0	3,156
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ 144,063.23	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 144,063.23
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ 230,976.57	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 230,976.57
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ 375,039.80	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 375,039.80
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ 37,503.98	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 37,503.98
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ 655,700.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 655,700.00
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ 655,700.00	$ 412,543.78	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,068,243.78
RGA	Person Hours	Person Hours	0	0	0	0	0	0	300	0	0	0	0	0	0	0	0	0	300
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,895.46	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,895.46
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,557.21	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 14,557.21
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,452.68	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,452.68
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,445.27	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,445.27
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,142.50	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,142.50
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,040.43	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,040.43
SJH	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	1,524	0	0	0	0	0	0	1,524
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 86,601.63	$ -	$ -	$ -	$ -	$ -	$ -	$ 86,601.63
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 121,242.28	$ -	$ -	$ -	$ -	$ -	$ -	$ 121,242.28
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 207,843.91	$ -	$ -	$ -	$ -	$ -	$ -	$ 207,843.91
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,784.39	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,784.39
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 228,628.30	$ -	$ -	$ -	$ -	$ -	$ -	$ 228,628.30
SSA	Person Hours	Person Hours	355	0	1,801	0	500	0	0	0	0	0	0	0	0	0	0	0	2,656
	Salary	Salary	$ 15,161.91	$ -	$ 77,097.47	$ -	$ 21,351.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 113,610.62
	Overhead	Overhead	$ 20,165.34	$ -	$ 102,539.63	$ -	$ 28,397.15	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 151,102.13
	Subtotal	Subtotal	$ 35,327.25	$ -	$ 179,637.10	$ -	$ 49,748.40	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 264,712.74
	Fixed Fee	Fixed Fee	$ 3,532.72	$ -	$ 17,963.71	$ -	$ 4,974.84	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 26,471.27
	Direct Expenses	Direct Expenses	$ 220.00	$ -	$ 2,500.00	$ -	$ 1,450.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,170.00
	TOTAL	TOTAL	$ 39,079.97	$ -	$ 200,100.81	$ -	$ 56,173.24	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 295,354.02
SCC	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Emda	Person Hours	Person Hours	40	16	40	40	110	0	0	0	0	32	120	110	32	0	0	0	420
	Salary	Salary	$ 14,420.00	$ 5,785.30	$ 28,926.52	$ 28,926.52	$ 39,773.97	$ -	$ -	$ -	$ -	$ 11,570.81	$ 43,389.78	$ 39,773.97	$ 11,606.22	$ -	$ -	$ -	$ 224,171.88
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Subtotal	Subtotal	$ 14,420.00	$ 5,785.30	$ 28,926.52	$ 28,926.52	$ 39,773.97	$ -	$ -	$ -	$ -	$ 11,570.81	$ 43,389.78	$ 39,773.97	$ 11,606.22	$ -	$ -	$ -	$ 224,171.88
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Direct Expenses	Direct Expenses	$ 2,000.00	$ 2,000.00	$ 3,800.00	$ 3,800.00	$ 3,800.00	$ -	$ -	$ -	$ -	$ 2,000.00	$ 5,000.00	$ 4,500.00	$ 2,000.00	$ -	$ -	$ -	$ 28,900.00
	TOTAL	TOTAL	$ 16,420.00	$ 7,785.30	$ 32,726.52	$ 32,726.52	$ 43,573.97	$ -	$ -	$ -	$ -	$ 13,570.81	$ 48,389.78	$ 44,273.97	$ 13,606.22	$ -	$ -	$ -	$ 253,071.88
Total			$ 872,331.72	$ 984,902.72	$ 1,457,024.90	$ 1,720,966.77	$ 1,751,750.31	$ 1,526,007.94	$ 877,436.23	$ 152,486.85	$ 292,112.74	$ 358,334.77	$ 848,299.42	$ 232,871.57	$ 480,146.10	$ 96,870.66	$ 135,198.84	$ 41,802.01	$ 11,368,533.62

Cost Proposal for NJ TRANSIT RFP NO. 15-031 - Design, Engineering, Construction Assistance, and Other Technical Services for the NJ TRANSITGrid Project

			TASK 3	TASK 4	TASK 5	TASK 6	TASK 7	TASK 8	TASK 8.1	TASK 9	TASK 9.1	TASK 10	TASK 11	TASK 12	TASK 13	TASK 14	TASK 15	TASK 16				
			Tasks																			
FIRM	Title	Title	3 See Note 1 on Summary Sheet	4	5	6	7	8	8.1	9	9.1	10	11	12	13	14	15	16	Subtotal Task 3-16	GRAND TOTAL PHASE I	Title	FIRM
JACOBS	Person Hours	Person Hours	1,760	960	1,130	40	838	784	137	660	315	664	882	1,320	652	1,208	370	0	11,760	[illegible]	Person Hours	JACOBS
	Salary	Salary	$ 133,293.44	$ 79,524.49	$ 73,359.71	$ 3,628.30	$ 72,003.54	$ 55,031.82	$ 11,811.09	$ 61,231.59	$ 30,551.89	$ 46,450.05	$ 74,834.45	$ 125,920.88	$ 54,926.85	$ 100,690.08	$ 31,046.11	$ -	$ [illegible]	$ [illegible]	Salary	
	Overhead	Overhead	$ 143,041.65	$ 86,859.48	$ 80,040.19	$ 3,873.75	$ 76,847.71	$ 59,946.17	$ 12,928.41	$ 54,888.49	$ 33,401.71	$ 50,259.19	$ 79,525.12	$ 134,126.57	$ 58,768.88	$ 107,274.86	$ 33,023.86	$ -	$ [illegible]	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ 276,335.09	$ 166,383.97	$ 153,399.90	$ 7,502.04	$ 148,851.25	$ 114,977.99	$ 24,739.50	$ 106,120.08	$ 63,953.60	$ 96,709.24	$ 154,359.57	$ 260,047.45	$ 113,695.73	$ 207,964.95	$ 64,069.97	$ -	$ [illegible]	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ 27,633.51	$ 16,639.40	$ 15,339.99	$ 750.20	$ 14,885.12	$ 11,497.80	$ 2,473.95	$ 10,612.01	$ 6,395.36	$ 9,670.92	$ 15,435.96	$ 26,004.74	$ 11,369.57	$ 20,796.49	$ 6,407.00	$ -	$ [illegible]	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ 303,968.60	$ 183,033.37	$ 168,739.89	$ 8,252.25	$ 163,736.37	$ 126,475.78	$ 27,213.45	$ 116,732.09	$ 70,348.96	$ 106,380.16	$ 169,795.53	$ 286,052.19	$ 125,065.31	$ 228,765.84	$ 70,476.96	$ -	$ [illegible]	$ [illegible]	TOTAL	
Burns	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	Person Hours	Burns
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	TOTAL	
Levitan	Person Hours	Person Hours	0	0	0	0	161	0	0	0	0	0	0	0	0	0	200	0	361	[illegible]	Person Hours	Levitan
	Salary	Salary	$ -	$ -	$ -	$ -	$ 47,495.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 57,600.00	$ -	$ 105,095.00	$ 879,207.71	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ 47,495.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 57,600.00	$ -	$ 105,095.00	$ 879,207.71	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ 47,495.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 57,600.00	$ -	$ 105,095.00	$ 879,207.71	TOTAL	
LTK	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	Person Hours	LTK
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	TOTAL	
OTS	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,000	1,000	[illegible]	Person Hours	OTS
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 28,926.52	$ 28,926.52	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 43,389.78	$ 43,389.78	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 72,316.30	$ 72,316.30	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,231.63	$ 7,231.63	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 79,547.93	$ 79,547.93	$ [illegible]	TOTAL	
LKG	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,800	Person Hours	LKG
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	TOTAL	
Matrix	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	464	464	[illegible]	Person Hours	Matrix
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,747.68	$ 16,747.68	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 26,851.57	$ 26,851.57	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 43,599.25	$ 43,599.25	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,359.93	$ 4,359.93	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 47,959.18	$ 47,959.18	$ [illegible]	TOTAL	
RGA	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	300	Person Hours	RGA
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,142.50	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ [illegible]	TOTAL	
SJH	Person Hours	Person Hours	1,280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,280	[illegible]	Person Hours	SJH
	Salary	Salary	$ 58,183.63	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 58,183.63	$ [illegible]	Salary	
	Overhead	Overhead	$ 81,457.08	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 81,457.08	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ 139,640.71	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 139,640.71	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ 13,964.07	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,964.07	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ 1,010.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,010.00	$ 1,010.00	Direct Expenses	
	TOTAL	TOTAL	$ 154,614.78	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 154,614.78	$ [illegible]	TOTAL	
SSA	Person Hours	Person Hours	0	0	0	0	0	0	0	40	40	0	40	40	0	0	0	0	240	[illegible]	Person Hours	SSA
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,431.72	$ 3,431.72	$ -	$ 1,752.69	$ 1,757.95	$ -	$ -	$ -	$ -	$ [illegible]	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,564.19	$ 4,564.19	$ -	$ 2,331.08	$ 2,338.07	$ -	$ -	$ -	$ -	$ [illegible]	$ [illegible]	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,995.90	$ 7,995.90	$ -	$ 4,083.77	$ 4,096.02	$ -	$ -	$ -	$ -	$ [illegible]	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 799.59	$ 799.59	$ -	$ 408.38	$ 409.60	$ -	$ -	$ -	$ -	$ [illegible]	$ [illegible]	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 720.00	$ 720.00	$ -	$ 550.00	$ 550.00	$ -	$ -	$ -	$ -	$ 2,540.00	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,515.49	$ 9,515.49	$ -	$ 5,042.14	$ 5,055.62	$ -	$ -	$ -	$ -	$ [illegible]	$ [illegible]	TOTAL	
SCC	Person Hours	Person Hours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	60	60	Person Hours	SCC
	Salary	Salary	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,724.00	$ -	$ 31,724.00	$ 31,724.00	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,737.88	$ -	$ 11,737.88	$ 11,737.88	Overhead	
	Subtotal	Subtotal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 43,461.88	$ -	$ 43,461.88	$ 43,461.88	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,173.09	$ -	$ 2,173.09	$ 2,173.09	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,350.00	$ -	$ 4,350.00	$ 4,350.00	Direct Expenses	
	TOTAL	TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 49,984.97	$ -	$ 49,984.97	$ 49,984.97	TOTAL	
Ewing	Person Hours	Person Hours	80	0	0	0	24	0	40	32	32	16	0	32	0	32	32	0	320	1,184	Person Hours	Ewing
	Salary	Salary	$ 28,926.52	$ -	$ -	$ -	$ 8,677.96	$ -	$ 14,463.26	$ 11,570.61	$ 11,570.61	$ 5,785.30	$ -	$ 11,570.61	$ -	$ 11,743.65	$ 11,536.00	$ -	$ [illegible]	$ [illegible]	Salary	
	Overhead	Overhead	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Overhead	
	Subtotal	Subtotal	$ 28,926.52	$ -	$ -	$ -	$ 8,677.96	$ -	$ 14,463.26	$ 11,570.61	$ 11,570.61	$ 5,785.30	$ -	$ 11,570.61	$ -	$ 11,743.65	$ 11,536.00	$ -	$ [illegible]	$ [illegible]	Subtotal	
	Fixed Fee	Fixed Fee	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Fixed Fee	
	Direct Expenses	Direct Expenses	$ -	$ -	$ -	$ -	$ 2,000.00	$ 3,800.00	$ -	$ -	$ 2,000.00	$ -	$ -	$ 2,000.00	$ -	$ 2,000.00	$ 2,000.00	$ -	$ [illegible]	$ [illegible]	Direct Expenses	
	TOTAL	TOTAL	$ 28,926.52	$ -	$ -	$ -	$ 10,677.96	$ 3,800.00	$ 14,463.26	$ 11,570.61	$ 13,570.61	$ 5,785.30	$ -	$ 13,570.61	$ -	$ 13,743.65	$ 13,536.00	$ -	$ [illegible]	$ [illegible]	TOTAL	
Total			$ 487,509.90	$ 183,033.37	$ 168,739.89	$ 8,252.25	$ 221,909.33	$ 130,275.78	$ 41,676.71	$ 137,818.19	$ 93,435.06	$ 112,165.47	$ 174,837.67	$ 304,678.42	$ 125,065.31	$ 242,509.49	$ 191,587.94	$ 127,507.11	$ 2,751,011.87	$ 17,196,962.06		