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NATIONAL GRID

The Narragansett Electric Company E183W *Peer Review Evaluation*



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134776

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E183W
Peer Review Evaluation

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1 INTRODUCTION

The Narragansett Electric Company d/b/a National Grid (National Grid) retained POWER Engineers, Inc. (POWER) for engineering and design services to support the route verification, cost estimating, permitting, licensing and installation of a proposed underground 115 kV electric transmission line in Providence and East Providence, RI. The proposed line will be installed between National Grid's existing Franklin Square Substation and a proposed overhead to underground transition substation on Mauran Avenue in East Providence, RI. The new underground line will replace an existing overhead transmission line installed in the same vicinity.

The proposed transmission line will be approximately 1.2 miles in length and will be rated for 398 MVA (2000 Amps). The cable system will require multiple construction methods including open cut trenching, jack & bores, and horizontal directional drilling (HDD). Approximately 2,300 of the 6,330 foot route will be installed in trenchless installations including two (2) HDDs and one (1) jack & bore.

National Grid submitted POWER's estimate to the Rhode Island Energy Facilities Siting Board (RI EFSB) as part of ongoing siting hearings associated with the proposed relocation of the overhead line. Ferruci Russo P.C. representing the cities of Providence and East Providence retained Power Delivery Consultants (PDC) to review the estimates submitted by National Grid. PDC worked with Haley & Aldrich to review the design, estimate and supporting documentation. PDC's assessment was provided in a written report dated April 10, 2015.

At National Grid's request, POWER reviewed PDC's report and findings to answer questions raised in the report. This report outlines POWER's review of the PDC report.

2 ANALYSIS

After reviewing POWER's design, construction estimate and supporting documentation, PDC concluded that the project was aligned with standard industry practice. As part of the report, PDC outlined several questions on the proposed design and construction methodology. PDC also presented an alternate route alignment beneath the Providence River for consideration. This route alignment would consolidate the horizontal directional drill (HDD) crossing of the Providence River and the jack & bore crossing of Interstate 195 into a single HDD crossing.

POWER's review of these questions and alternate alignment are presented in the following sections.

2.1 Alternate Horizontal Directional Drill Alignment

As part of their review, PDC and Haley & Aldrich presented two alternative crossings of the Providence River and Interstate 195 (shown as Figure 1). These crossings would utilize a single horizontal directional drill from the Manchester Street station parking lot to an area in India Point park. This new alignment would increase the overall HDD length but eliminate the jack & bore and approximately 635 feet of open trench construction.

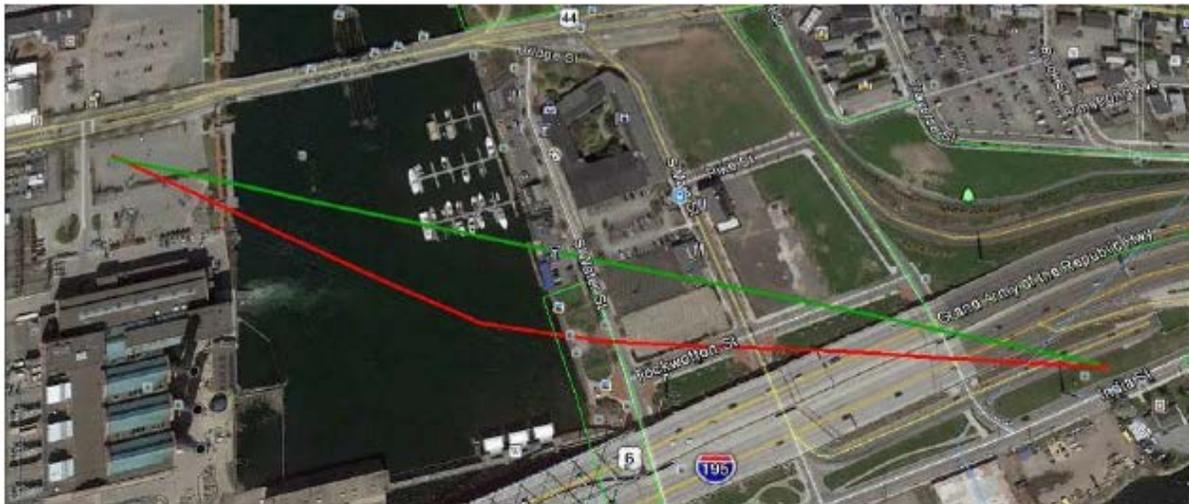


Figure 1: Alternate HDD Alignments from PDC Report

POWER's original scope of work did not include a review of this potential route. POWER has reviewed this proposed alignment and offers the following observations.

- The exit location of the HDD appears to be in close proximity to two sewer lines (50" and 60") located in India Street and India Point Park. The proposed HDD would most likely need to pass below these facilities and there appears to be insufficient space in the park to safely pass beneath these lines prior to reaching the water.
- The HDD alignment does not eliminate the need to obtain permits from the ACOE for passing through the Hurricane Barrier.
- Neither alignment eliminates the need for the acquisition of an easement on private property on South Water Street.
- The green alignment appears to pass beneath an occupied building on Bridge Street. It is POWER's opinion that crossing beneath the building poses additional construction risks and is generally considered unacceptable in the industry.

It is POWER's opinion that this alternate alignment as shown has similar if not increased risks for construction as compared to the current alignment.

2.2 Original Horizontal Directional Drill Alignments

Haley & Aldrich reviewed the preliminary horizontal directional drill alignments and noted that the geotechnical data indicated a deep layer of soft organic silts and fine sand that would present some risks associated with the steering of the drill string and borehole stability for the drill. To mitigate these risks, Haley & Aldrich proposed the use of a conductor sleeve (also known as a casing) to a depth of 60 feet. This casing sleeve would increase the depth of the proposed drill to depths approaching 165 feet.

Haley & Aldrich noted that there is a high risk of encountering uncharted submerged pilings in the river associated with the remains of several bridges at this location. To mitigate these risks, Haley &

Aldrich recommended increasing the depth of the alignments to pass beneath these obstructions. Haley & Aldrich also noted that the completed geotechnical borings were only advanced to a depth of eight (80) feet and therefore do not provide any data at these recommended greater depths.

POWER agrees that the installation of a casing pipe would be beneficial due to the identified loose soils in this area. However POWER considers the use of a conductor sleeve to be a construction methodology consideration and not part of the engineering design. Construction methodology is typically addressed with the HDD contractor during the bidding phase of the project.

Similar to Haley & Aldrich's analysis, POWER also noted that the soft soils could present challenges with steering of the HDD in the loose soils as shown by the geotechnical data. As part of the feasibility review, POWER asked an HDD contractor review the geotechnical data and proposed alignment. Based on their review and comments, the alignments were considered feasible for construction.

POWER agrees that additional borings in this area to the recommended greater depths would be very beneficial to the overall design of the HDD. At the time of the borings, the maximum depth of the proposed HDD alignment (provided by J. D. Hair on behalf of National Grid) was 60 feet. The borings were advanced to a depth 20 feet below that mark to provide a reasonable soil profile for the HDD design and construction. The soft to medium stiff ground conditions were identified upon receipt of the draft geotechnical report. Unfortunately at that time, the drilling equipment had already demobilized from the site and there was no opportunity to advance the borings to greater depths.

Increasing the depth of installation may reduce some of the risks associated with the construction of the HDD portion of the project but will have a detrimental impact on the cable system. A cable system's ability to transmit power (also referred to as ampacity) is directly related to its ability to radiate heat generated by the cable. Installing the cables at a greater depth will increase the overall soil burden over the cable which will increase the overall soil thermal resistivity. Increasing the depth of installation may require a much larger conductor or additional conductors per phase for these crossings to achieve the desired capacity. Either condition would result in higher estimated costs.

2.3 Interstate 195 Crossing

The proposed underground alignment passes beneath the recently completed Interstate 195 highway. POWER's proposed construction in this area is a trenchless construction methodology known as a jack & bore. Jack & bores (sometimes referred to as Horizontal Auger Boring) consist of auguring a hole and hydraulically jacking a casing into the hole. The casing then serves as a path to install the power conduits beneath the highway. Haley & Aldrich objected to the use of a HOBAS™ pipe for this crossing. HOBAS™ is a centrifugally cast, glass-fiber-reinforced polymer mortar pipe (CCFRPM). POWER believes that HOBAS™ pipe can be used in this type of trenchless crossing. The HOBAS™ pipe is recommended as a possible casing material to eliminate the heating caused by eddy current & hysteresis losses in the steel casing. For this type of installation, a steel casing is pushed in front of the HOBAS™ pipe. The auger will be located in the steel casing. The cuttings will fall into the HOBAS™, and be transported to the jacking pit either by hand, steel casing sleeve, or with a smaller steel pipe that has an auger in it.

Haley & Aldrich also noted that this crossing would be subject to approval by the Army Corps of Engineers (ACOE) due to the presence of the Providence Hurricane Barrier. Haley & Aldrich did not

believe that the ACOE would approve of a crossing through the Hurricane Barrier using this construction methodology. At the beginning of the project, National Grid indicated to POWER that there are several examples of crossings in this area using this type of construction methodology. In particular, the gas lines supplying the Manchester Street power station were installed using a pipe-jacking method. Final design of this crossing would be completed after consultation with the ACOE.

2.4 Estimates

PDC reviewed the construction estimates provided by POWER to National Grid. PDC noted that POWER's estimates did not include environmental permitting and soil mitigation. Estimating these costs were not included as part of POWER's scope of work. POWER's estimates were only part of the overall total project costs. POWER's estimates only covered the direct construction related costs associated with the installation of the underground transmission cables. The other estimates including environmental permitting and soil mitigation were developed by others. POWER agrees that there is a potential for significant project cost increases due to unknown contaminants and mitigation requirements.

PDC developed a separate estimate for the proposed underground transmission cable. PDC's estimate appears to be consistent with POWER's estimate. There are variations between individual line items but this is most likely due to differences in estimating approaches (i.e. where / how to account for specific tasks). Overall POWER believes that PDC's estimate supports POWER's stated estimated costs for the project.

3 SUMMARY

POWER reviewed PDC's and Haley & Aldrich's peer review report on the proposed installation of an underground transmission line for the 115kV circuit, E-183. After reviewing PDC's assessment of the proposed design, POWER still believes that the proposed project is aligned with standard industry practice and is constructible. However as noted in PDC's report, there are several areas of potential high risk that could have a detrimental impact on project schedule and costs. In particular, the directional drill alignments are considered high risk installations due to the soil conditions and potential for unknown obstructions.

POWER has also reviewed the alternative HDD alignments presented by PDC and Haley & Aldrich. It is POWER's opinion that these alternate alignments will not reduce the construction risks nor the public impacts for this project. One alignment presents risks to the operation of an existing area restaurant and both alignments present risks to the recently installed sewer lines in the area. It is POWER's opinion that these alternative HDD alignments should not be pursued further.