

June 25, 2010

**VIA HAND DELIVERY & ELECTRONIC MAIL**

Luly E. Massaro, Commission Clerk  
Rhode Island Public Utilities Commission  
89 Jefferson Boulevard  
Warwick, RI 02889

**RE: Docket 2509 – Storm Contingency Fund**  
**March 30 – April 1, 2010 Storm**

Dear Ms. Massaro:

In accordance with Order No. 15360 (August 19, 1997) in docket 2509 and paragraph 4(b) of the Settlement approved by the Commission in that docket, I have enclosed ten copies of National Grid's<sup>1</sup> summary of a storm that occurred on March 30 through April 1, 2010, which will likely qualify for inclusion in the Company's Storm Contingency Fund. Paragraph 4(b) of the Settlement requires the Company to file with the Commission within 90 days after the storm a report providing a description of the storm along with a summary of the extent of the damage to the Company's system, including the number of outages and length of the outages.

While the Company has not yet accumulated the total costs related to this storm, the incremental restoration costs caused by the storm are expected to exceed the storm fund threshold amount of \$728,000. A supplemental report detailing the incremental restoration costs caused by the storm will be submitted to the Commission once the total costs have been accumulated by the Company.

Thank you for your attention to this transmittal. If you have any questions, please feel free to contact me at (401) 784-7667.

Very truly yours,



Thomas R. Teehan

Enclosure

cc: Leo Wold, Esq.  
Steve Scialabba, Division

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<sup>1</sup> Filed by The Narragansett Electric Company d/b/a National Grid ("National Grid" or "the Company").

## **The Narragansett Electric Company Storm Fund Reporting March 30-April 1, 2010**

This report summarizes the impact, response, and accomplishments to substation and underground infrastructure following the flooding events in Rhode Island from March 30 - April 1, 2010. The impact of the weather is summarized below:

- Tuesday, 3/30 - Heavy Rain exceeding 9 inches affected much of Rhode Island through 3/31
- Major river flooding occurred at the following locations:
  - Pawtuxet River – Cranston, Warwick – 11 feet above historic record
  - Pawcatuck River – Westerly – Tidal flooding – 4 feet above flood stage
  - Blackstone River – Woonsocket – Near record flood stage – least impacted
- Eight substations were flooded and either locked out or switched offline. Water levels up to eight feet were recorded in the Westerly and Sockanosset Substations, with 2- 5 feet of water in the other 6 substations (Pawtuxet Sub, Hope Sub, Pontiac Sub, Hunt River Sub, Riverside Sub, Warwick Mall Sub).
- At peak, over 12,000 customers were affected. A total of 50,000 Rhode Island customers were impacted during the two week period due to issues resulting from the excess water.
- The majority of lost load was restored within hours, while a significant challenge remained on serving nearly 7,000 electrically-islanded customers in Westerly.
- Rolling blackouts were considered but not needed due to collaboration with National Grid Dispatch and Engineering.
- Schools, businesses and government offices shut down, along with two Rhode Island malls closing for the first time in 40 years with over 3 feet of water recorded in their premises.
- Sections of Interstate Route 95 totally impassable and closed due to flooding, creating significant logistics issues.
- Five underground cables faulted during the day, with a total of 13 faulted cables by the second week.

In response to the flooding, National Grid took the following actions:

- Over 400 resources were mobilized through the Providence E-Room (Emergency Room) representing: Electric Distribution Operations, Dispatch, Metering Services, O&M Services, Energy Solutions Services (“ESS”), Planning Engineering, Field Engineering, Fleet, Information Services (“IS”), Stores, Central Logistics Support, Clerical, Safety, Construction Services, Transmission Operations, Mutual Aid, Long Island (NY) Substation, Inspections Group, and Laboratory Services.
- Mobile Substation 9734 and a 5MVA step-down transformer were deployed and in-service in less than 48 hours to restore all Westerly load with the exception of those customers requiring municipal inspection.
- A new temporary Westerly office area was secured within 36 hours.

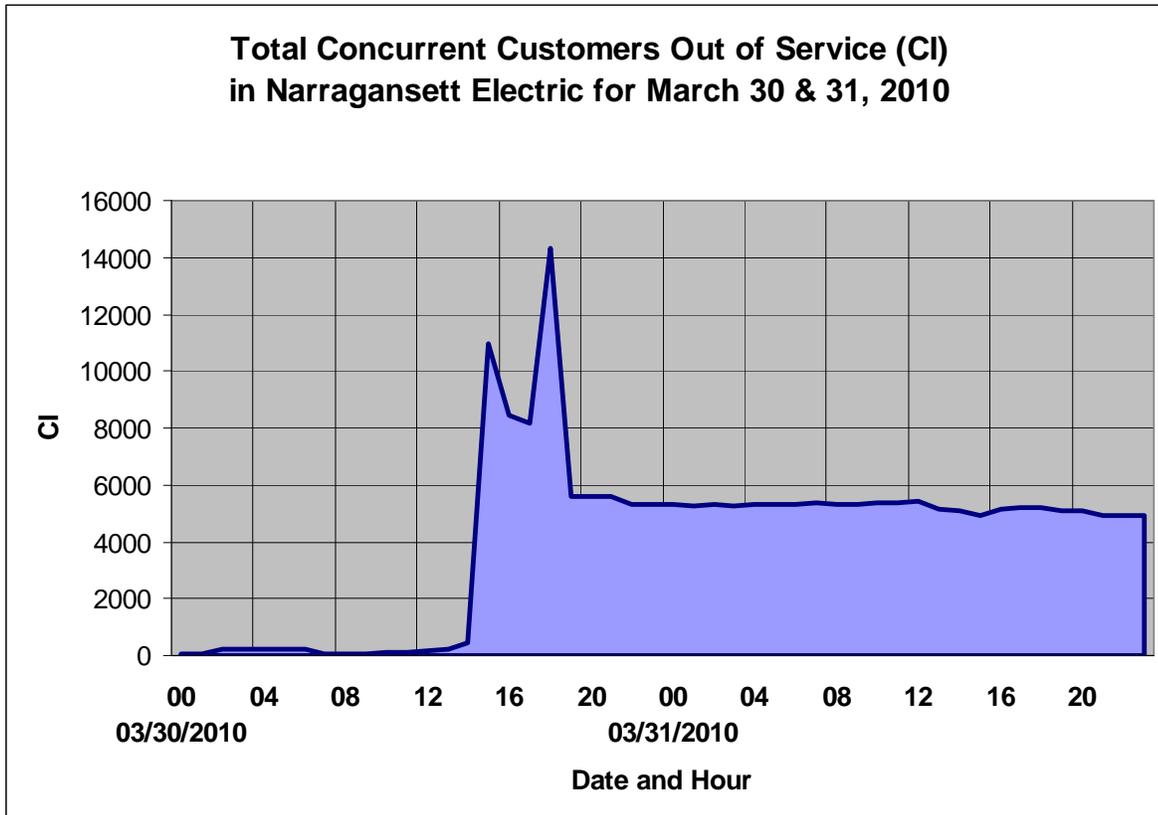
- Substation sanitization, drying and cleaning commenced, and within one week, 6 substations were nearly fully operational, while Westerly and Sockanosset Substations required significant equipment replacement.
- Significant underground replacement commenced on the Warwick Mall primary distribution system.
- Overhead, Underground and Substation departments worked 24 hours per day with 18 hour rotating shifts the first week, taking Easter Sunday off, and worked 12 hour shifts through April 15. Work continues in some of the impacted substations to make repairs.
- At least 65,000 total man-hours were expended through April 2, 2010.
- Westerly and Sockanosset Substations are being evaluated to determine possible relocation and flood mitigation measures.

High level accomplishments consisted of:

- 13 cable faults repaired, requiring 24 sections of cable pulled and complex splicing.
- Warwick Mall – 4 switchgears replaced, 4 pad mounted transformers replaced, 2 manholes replaced, 26 sections of cable removed, 5 unit substations removed, 30 sections of cable pulled, one additional manhole to install, 3 switchgear to install and 6 padmount transformers to install.
- Nearly 900 house services disconnected per order of fire inspectors, followed by a tedious reconnection process.
- Performed significant overhead switching in extremely adverse conditions and terrain.
- Removed 22 circuit breakers and installed 16 circuit breakers, replaced 6 regulators, 4 controls, and 2 circuit switcher motor mechanisms. In addition, 7 circuit breakers and 8 transformers were tested, and extensive ancillary equipment required replacement.
- Zero significant injuries were recorded.
- Safety support on working in abnormal conditions.
- Infrared patrols prevented 6 outages on heavily loaded feeders that were carrying load from flooded substations.
- Overall team activities included arranging centralized lodging support and dispatch.
- The use of blast calls was utilized requesting conservation on loaded feeders, followed by re-energization information.

## **RELIABILITY**

The severe extraordinary nature of this storm resulted in the governor declaring a state emergency in Rhode Island. The Company responded to a total of 40 interruptions that affected 27,465 customers for 27,503,924 customer minutes of interruption. On average, these interruptions resulted in 0.06 SAIFI, 57.45 minutes of SAIDI and 4,254 minutes of interruption per customer affected. As shown in the following chart, 14,341 customers were interrupted at peak, which occurred at 6:00 pm on March 30, 2010.



## SUBSTATION IMPACT

Substations listed below were impacted by the flood waters. Water levels reached between 3 feet and 8 feet in these locations. Flood waters from the Pawtuxet, Blackstone and Pawcutuck Rivers were brackish, contained raw sewage and other contaminants such as oil and gasoline which are detrimental to the safety of personnel as well as the many mechanical components which comprise circuit breaker operating mechanisms, electro-mechanical relays, circuit switcher operators, and transformers controls. Most of these devices also utilize microprocessor and solid state relays and circuitry. Substation control houses containing substation batteries, relays (electro-mechanical and microprocessor based), remote terminal units, and AC and DC circuit breaker panels were also exposed to flood waters.

Prior to work on equipment and components by personnel within each substation, Moran Environmental was contracted to provide remediation and disinfecting services for equipment exposed to the flood waters due to the contaminated quality of the flood waters. Damage assessments were conducted at each location between on Friday, April 2 and Saturday, April 3, after which restoration at each location began.

Substation Name	Substation Address	Voltage	Impact River
Pontiac Sub	14 Ross Simon Dr - Cranston	115kV-12.47kV	Pawtuxet
Sockanosett Sub	19 Electronic Dr - Warwick	115kV-23kV	Pawtuxet
Westerly Sub	69 Canal St - Westerly	34kV-12.47kV	Pawcatuck
Hope Sub	15 Hope Furnace Rd - Scituate	23kV-12.47kV	Pawtuxet
Pawtuxet Sub	70 Bellows St - Warwick	23kV-4.16kV	Pawtuxet
Warwick Mall Sub	400 Bald Hill Rd - Warwick	23kV-12.47kV	Pawtuxet
Hunt River Sub	5890 Post Rd - Warwick	34kV-12.47kV	
Riverside Sub	1000 Florence Dr Extension - Woonsocket	115kV-13.8kV	Blackstone

### Pontiac Substation

Pontiac Substation is a 115-12.47kV substation with two 115-12.47kV 24/32/40 MVA transformers which supply six feeders. On Wednesday, March 31, flood waters from the Pawtuxet River had reached levels of approximately 5 feet at Pontiac Substation, evidenced by water line marks on the equipment after personnel accessed the substation. By late afternoon on March 31, the decision was made to de-energize the Pontiac Substation due to the height of the flood waters. Distribution circuits normally supplied from the Pontiac Substation were reconfigured to be supplied from alternate substations not affected by the flood. Flood waters within Pontiac Substation submerged the substation's 125VDC battery and lower sections of control panels, covering relays and equipment controls for approximately 36 hours. Operating mechanism cabinets of several circuit breakers and circuit switchers as well as the microprocessor-based controls for several reclosers were submerged. A portion of the driveway leading into the Pontiac Substation was washed away by the flood waters, making it impassable. Repair of this driveway was necessary before work could begin. The #1 and #2 115kV-12.47kV transformer cabinets were submerged as well as the motors required to operate the Load Tap Changer and the motors on several cooling fans mounted below water level.

Flood waters had receded at Pontiac Substation to the point where the substation could be accessed at approximately 8:00PM Thursday April 1.

After equipment and the control house were dried out and the necessary equipment replaced, but before energization, all control cables were tested (megger) to ensure insulation resistance met operating requirements. All exposed electrical equipment necessary to reenergize the #2 bus section of Pontiac Substation was tested by Substation Operations and functional tests were performed on control and protection schemes by the Protection group. The #2 bus was ready for service at Pontiac Substation at approximately 10:00 PM on Saturday April 3, with load placed on the substation at approximately 4:00 AM Sunday April 4. All exposed electrical equipment necessary to reenergize the #1 bus section of Pontiac Substation was tested by Substation Operations and functional tests were performed on control and protection schemes by the Protection group. Load was placed on the #1 Bus and Pontiac Substation was made normal on Saturday April 10, 2010.

## Westerly Substation

Westerly Substation is a 34.5-12.47kV Substation with two 34.5-12.47kV 12/16/20 MVA transformers which supply four feeders on a site which also includes a service center. Flood levels reached 6.5 feet within Westerly Substation, submerging the substation's 125VDC battery and charger, control house relays, and equipment controls for approximately 72 hours. The Pawcatuck River at this location was at an extreme level, flooding all roads leading to Westerly Substation and washing out major parts of the roadway.

Accessibility to the substation was not possible until late day Friday, April 1.

The operating mechanism cabinets of all eight circuit breakers as well as the microprocessor-based controls for 12 single phase voltage regulators were submerged. Flood waters from the Pawcatuck River were brackish, contained raw sewage and other contaminants which are detrimental to the many mechanical components necessary for circuit breaker operating mechanisms and electro-mechanical relays. Microprocessor and solid state printed circuit boards used for relays and controls were also exposed to flood waters, making their replacement necessary. The #1 and #2 34.5kV-12.47kV transformer cabinets were submerged as well as the motors required to operate the Load Tap Changers, motors on cooling fans, and oil pumps mounted below the flood level. Essentially all electrical equipment and controls (including wiring) were determined to be unusable in any restoration of service efforts.

Mobile Substation 9734 was sited and energized on April 1, 2010 on Perkins Avenue in Westerly in order to pick up customer load. Additional load was restored through the use of feeder ties and emergency step-down padmount transformers placed in available property underneath 34.5kV and 12.47kV feeder crossings. In order to reinforce Westerly area loading requirements, a plan was developed to re-energize the #2 12.47kV bus with the 16F2 and 16F4 feeders being placed into temporary service, energized on May 11, 2010, and remaining operational until a long term plan can be developed. After the #2 bus is temporarily energized and 16F2 and 16F4 feeders restored, Mobile Substation 9734 will be moved off Perkins Avenue and installed inside the fenced area of Westerly Substation and connected to the 16F1 feeder position allowing use of station regulators. All exposed electrical equipment was removed so that temporary breakers and wiring could be installed.

Portions of the 34.5-12.47kV Westerly Substation were placed back in service in mid May 2010, with additional portions of the Westerly Substation anticipated to be placed in service through the June-July timeframe.

## Pawtuxet Substation

Pawtuxet Substation is a 23-4.16kV substation with 3 single phase 22.9-4.16kV, 1 MVA transformers which supply two feeders. Flood levels reached 6 feet within Pawtuxet Substation, submerging the substation, all equipment controls, and partially submerging primary compartments for approximately 48 hours.

The operating mechanism cabinets of both circuit reclosers and six single phase voltage regulators and their microprocessor-based controls were submerged.

Flood waters from the Pawtuxet River were brackish, contained raw sewage and other contaminants which are detrimental to the many mechanical components necessary for recloser operating mechanisms and electro-mechanical relays. Microprocessor and solid state printed circuit boards used for relays and controls were also exposed to flood waters, making their replacement necessary. After all other station equipment was dried out and necessary equipment replaced, but before energization, control cables were tested (megger) to ensure insulation resistance met operating requirements. All exposed electrical equipment was tested and functional tests were performed on control and protection schemes at Pawtuxet Substation.

#### Warwick Mall Substation

Warwick Mall Substation is a 23-12.47kV substation with two 3 phase 22.9-12.47kV, 5/6.25 MVA transformers which supply two feeders. Flood levels reached 5 feet within Warwick Mall Substation, partially submerging the substation and equipment controls for approximately 60 hours.

The lower compartments of the vacuum circuit reclosers operating mechanism cabinets of both circuit reclosers, and the first house protection controls on three single phase voltage regulators were submerged.

Flood waters from the Pawtuxet River were brackish, contained raw sewage and other contaminants which are detrimental to the many mechanical components necessary for recloser operating mechanisms and electro-mechanical relays. Microprocessor and solid state printed circuit boards used for relays and controls were also exposed to flood waters making their replacement necessary. After all other station equipment was dried out and necessary equipment replaced, but before energization, control cables were tested (megger) to ensure insulation resistance met operating requirements. All exposed electrical equipment was tested and functional tests were performed on control and protection schemes at Pawtuxet Substation.

#### Hunt River Substation

Hunt River Substation is a 34.5-12.47kV substation with one 3 phase 22.9-12.47kV, 12/16 MVA transformer which supply one feeder. Flood levels reached 3 feet within Hunt River Substation, partially submerging the substation and equipment controls for approximately 36 hours.

The lower compartment of the oil circuit recloser operating mechanism cabinet was partially submerged.

The flood waters from overflow and being a low lying area were only slightly brackish and contained other contaminants which are detrimental to the many mechanical components necessary for recloser operating mechanisms and electro-mechanical relays. The control handle and the ground cutout switch were both replaced. Relays were tested as a precaution and the breaker was functionally tested.

## Sockonosett Substation

Sockonosett Substation is a 115-23kV substation with two 115-23kV 24/32/40 MVA transformers which supply two 23kV feeders which in turn supply several 23-4.16kV substations and customers. On Wednesday, March 31, flood waters from the Pawtuxet River had reached levels of approximately 6.5 feet at Sockonosett Substation as evidenced by water line marks on the equipment after access was gained. Attempts by Substation crews to sandbag the perimeter of the control house on Tuesday March 30 were unsuccessful. Sockonosett Substation was also flooded with 2 feet of water the week of March 15 due to water levels over flood stage on the Pawtuxet River. Late afternoon on March 31, the Company decided to de-energize the Sockonosett Substation because of the height of the water. The 23kV circuits normally supplied from Sockonosett Substation were supplied radially from Drumrock Substation, which was not affected by the flood. Sockonosett Substation was not accessible until Friday morning, April 2, due to flood waters, and although flood waters had receded within the substation, the access road and driveway were still submerged by approximately 2 feet of water. Attempts to access the substation by boat were made on Thursday, April 1, but current from the Pawtuxet River prevented safe access. On Friday, crews gained access via a "Trac" vehicle.

A condition assessment of Sockonosett Substation upon access revealed flood waters had submerged the substation's 125VDC Battery and two-thirds of the control panels with relays and equipment controls located on them for approximately 48 hours. Operating mechanism cabinets of all 23kV circuit breakers and 115kV circuit switchers had been submerged and silt had collected inside control cabinets and on mechanism parts. The substation fence collapsed in its entirety, pulling the fence mesh from its support posts, snapping support posts, and undermining fence posts due to the forces of the current from the river. The #1 and #2 115kV-23kV transformer cabinets were submerged and also covered with silt from the water, as were the motors on approximately twelve (12) cooling fans mounted below the flood level. Damage to equipment within the control house and equipment in the switchyard was extensive due to the height of the water, length of time equipment was submerged, and forces of the current due to proximity to the Pawtuxet River.

Flood waters from the Pawtuxet River were brackish, contained raw sewage and other contaminants such as oil and gasoline which are detrimental to the safety of personnel as well as the many mechanical components which comprise circuit breaker operating mechanisms, electro-mechanical relays, and circuit switcher operators. Microprocessor and solid state printed circuit boards used for relays and controls were also exposed to flood waters.

After equipment and the control house were dried out and necessary equipment replaced and temporary repairs made, all control cables were tested (megger) to ensure insulation resistance met operating requirements. All exposed electrical equipment necessary to reenergize the Sockonosett Substation was tested by Substation Operations and functional tests were performed on control and protection schemes by the Protection group. On Friday April 16, the equipment was ready for service at Sockonosett Substation, with load placed on the substation at approximately 8:00 AM Saturday, April 17.

### Hope Substation

Hope Substation is a 23-12.47kV substation with two 3 phase 22.9-12.47kV, 7.5/9/375 MVA transformers which supply 12.47kV two feeders. Flood levels reached 3 feet within Hope Substation, partially submerging the substation and equipment controls for approximately 12 hours. Water never entered the circuit breaker mechanism cabinets, however the station battery was partially submerged as well as several relays in the control house.

At Hope Substation, Westinghouse IRD relays and a plunger style test switch were replaced. The replacement relays were set and tested. All current circuits were meggered and tested with current injection. All potential circuits were meggered and tested with voltage injection. All breakers and control circuits were functionally tested. The substation was fully in-service by Friday evening, April 2.

### Riverside Substation

Riverside Substation is a 115-13.8kV substation with two 115-13.8kV 40MVA transformers which supply eight feeders. At Riverside Substation, the only device with any potential flooding issue was the 878 115kV circuit breaker. AC and DC control circuits were functionally tested and the breaker was placed back in-service on Thursday, April 1. Some erosion did take place on the access road to the substation.

## **UNDERGROUND IMPACTS**

### Warwick Mall

In addition to the Warwick Mall 23-12.47kV Substation, National Grid provides 12.47kV underground to the Warwick Mall facilities through an underground cable system and associated padmounted transformers, switchgear, and associated equipment. Flood waters from the Pawtuxet River resulted in water damage to the transformers and switchgear not designed for operation in submersible conditions. One-for-one replacement of failed equipment within the mall was not an option due to original equipment design resulting in a change in electrical configuration and construction of additional facilities such as manholes to accommodate new equipment.

Underground Facility Description	Major Work Completed
Warwick Mall	<ul style="list-style-type: none"> <li>• Installed new transformer Food court</li> <li>• Installed new transformer Truck Port 3</li> <li>• Installed new transformer Truck Port 2</li> <li>• Installed new transformer Truck Port 6</li> <li>• Installed 3 new PMH 9 Switch gears;</li> <li>• Installed new transformer in truck port 4</li> <li>• Removed 4 Switch gear/transformer combinations from Truck port 2,3 &amp; 4</li> <li>• Installed new transformer for JC Penney</li> <li>• Installed 900' of 500cu 15kv cable &amp; 750' of #2cu 15kv cable</li> <li>• Removed 3-way vacuum switch from MH 6011 28F2 FDR</li> <li>• Installed 600' of 500 mcm cu 15kv cable &amp; 400' of #2cu 15kv cable</li> <li>• Removed 4 PMH 9 Switch Gears and Replaced with 4 new PMH 9 switchgears</li> <li>• Installed 3 new switch gear manholes</li> <li>• Installed 126ft x 6 of 5" PVC pipe</li> <li>• Installed 75ft x 6 of 5" galvanized steel conduit; and 20 10ft/6" galvanized pipe for bollards</li> </ul>

In addition to work required at the Warwick Mall, the following list of underground cables sustained circuit lockouts as a result of the Flood Events of March 30 - April 1. Work necessary to restore the affected cables to service is also noted below. Water levels in manholes and cable overload conditions as a result of circuit reconfiguration accounted for the cable failures below. In some cases, asset condition and obsolescence resulted in substantial rework to restore cables to service.

Underground Facility Description	Major Work Completed
2260 feeder	Installed approximately 250 feet of 4/0 25 KV EPR CU cable.
38K23	Installed approximately 300 feet of 4/0 25 KV EPR CU cable.
13F6	MH2549 to MH 2550, Charles St, Providence RI, Replace: <ul style="list-style-type: none"> <li>• 300 feet, 1000 kcmil, 15 KV copper, EPR</li> <li>• MH2549- 3 T-body terminations for 1000 kcmil</li> <li>• MH2550- 3 T-body terminations for 1000 kcmil</li> </ul>

Underground Facility Description	Major Work Completed
13F8	MH 2646, Gaspee St., Providence, RI – Replace: <ul style="list-style-type: none"><li>• 1 vacuum switch, 2 - way 600A, 25KV</li><li>• 6 T-Body Terminations in MH2646 for 1000 kcmil cable</li></ul>
13F8	MH 2614, Park St, Providence, RI,- Replace: <ul style="list-style-type: none"><li>• 200 Feet, 1000 kc mil, 15 KV copper, EPR insulation, MH 2614 to MH 2615</li><li>• MH 2614 -3 T - Body terminations for 1000 kcmil cable</li><li>• MH2615 - 3 T - Body terminations for 1000 kcmil cable</li></ul>
1134 CABLE	1134 circuit. 500 KCMIL 3/c 15KV cable installed, total length about 140' from MH 212 Westminster St. Prov. to MH 1707 Cranston St. Prov.