

Town of Newton, Massachusetts  
Conditions Assessment and Treatment Recommendations for Tomb Plaques,  
Table Top Tombs and Obelisk.

RECEIVED

DEC 28 2009

Structures North  
Consulting Engineers, Inc.

Ivan Myjer  
Building and Monument Conservation  
83 School Street  
Arlington, Ma 02476  
781 641-1603

December 23, 2009

John Wathne PE  
Structures North  
PO Box 01971-8560  
60 Washington Street Suite 401  
Salem, MA 01970-3517

Re: Letter of Report - Newton Burying Grounds - Stone Conservation

Dear John:

In December of 2009, we surveyed the cut stone components of the masonry tomb fronts as well as select table top tombs and obelisks in the East Parish, South Parish and North Parish Burying Grounds.

Our assessment was performed to supplement the assessment report completed by Structures North and should be read in conjunction with that report. The purpose of our assessment was to identify the conditions as well as the potential conservation treatments for the cut, carved or worked stone components of the tombs and monuments. We have distinguished between the cut, carved or otherwise worked, tooled or split units of stone and the natural fieldstones that were used to construct some of the tomb walls. Generally speaking, fieldstones or boulders do not receive conservation treatments outside of careful handling and careful removal of old mortars. The carved, inscribed, tooled otherwise "worked" stones are the principal focus of our survey.

There are five types of "worked" stone in the structures that we surveyed - inscribed slate plaques, inscribed and carved marble units, carved and shaped granite units, brownstone slabs, lintels and carved pedestal legs for tabletop tombs, and in one location, a bluestone slot base. The condition of the various types of units fabricated from the five types of stone varies considerably as do the recommended treatments. In all cases but two we have recommended retaining and conserving the original stone. The exceptions are two severely deteriorated table top legs and a lintel - all three of which were fabricated from Portland, Connecticut brownstone. This stone has several inherent vices that prevent severely deteriorated units from carrying any significant loads without running the risk of collapse.

We have identified all of the potential treatments for each of the structures that we surveyed but we do not necessary recommend completing all of the recommended treatments for every tomb. Most of the of the structures will require disassembly and rebuilding but a few could be

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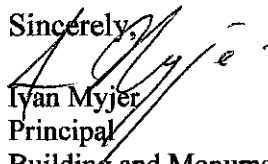
stabilized in place. The advantage to this approach is that rebuilding could be put off for several decades and available funds could be concentrated on the conservation of higher priority items.

We have included as an appendix to our report a first draft of the specifications for the conservation of the "worked" stone units. This specification section can be married into the overall masonry restoration specifications but we think that there are several good reasons for keeping it as a standalone section. The principal consideration is that the work in this section will have to be performed by conservators who will most likely be sub-contractors to the firms that perform the masonry removal and rebuilding. The advantage to keeping it as a standalone section is that it clarifies the responsibilities, scope and qualification requirements of the conservators.

We worked with John Wathne of Structures North to develop the budgets in their report and do not think that they need to be revised at this time. We will continue to work with Structures North to produce an integrated set of prioritized recommendations as well as comprehensive bid documents.

Please let us know if there are any questions regarding what we observed or our recommendations. We are very pleased to be part of the team completing the assessments of the structures in these three great burying grounds.

Sincerely,



Ivan Myjer  
Principal

Building and Monument Conservation

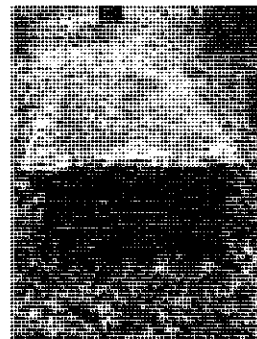
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**Newton Historic Burying Grounds  
East Parish, Centre Street Burying Ground**

**Tomb E- Tabletop 1**

**Conditions Assessment of Brownstone Top:**

- a) The Portland Connecticut brownstone top is partially covered with lichens. The stone is delaminating and scaling and has shallow areas of loss primarily at the eastern corners and along the eastern edge. (see attached sketch E-1 for locations)



**Treatment recommendations:**

1. Remove brownstone slab from brick base.
2. Clean biological growth from stone.
3. Reconstruct brick base using salvaged bricks as per the recommendations in the report by Structures North.
4. Inject and cap delamination and fill cracks and shallow areas of loss.
5. Reset brownstone slab on reconstructed brick base with mortar.



**Tomb E- Kendrick**

**Conditions Assessment of Marble Top and Granite Base:**

- a) No visible foundation- set directly on subterranean vault?
- b) Failing Portland cement mortar at marble to granite and granite to granite mortar joints.
- c) Spall at Northwest corner resulting from the corrosion and expansion of original iron cramp.
- d) Small losses at edges of granite blocks.



**Treatment recommendations:**

1. Remove marble slab from base (no additional treatment to marble slab required)
2. Remove failing mortar at top of granite.
3. Remove corroded iron cramp(s) (See attached sketch E- Kendrick)
4. Remove and reset upper course of granite- leave lower granite course in place.
5. Pin upper granite course to lower, or *install new stainless cramps (?)*
6. Reset marble slab on new mortar bed (no pin required between marble and granite)

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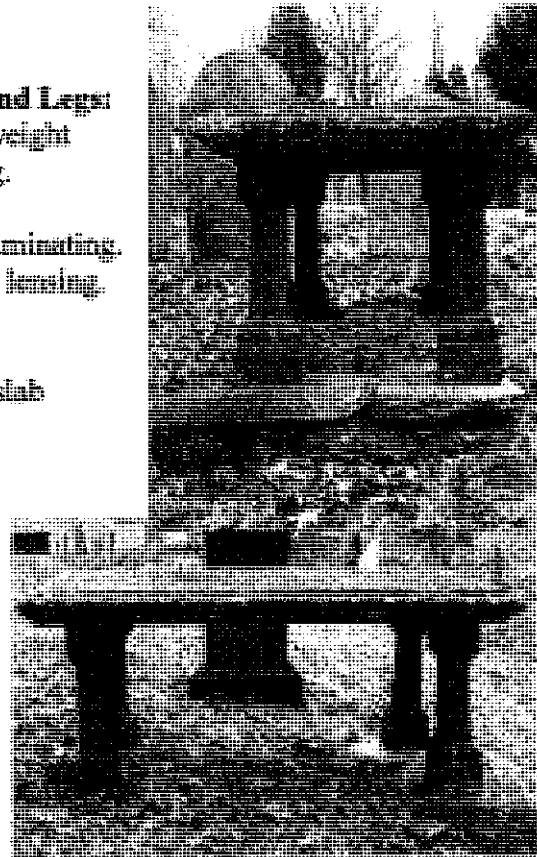
**Tomb E- Simon Jackson Tabletop Tomb**

**Conditions Assessment of Brownstone Top and Legs:**

- a) Brownstone legs 1 and 3 are bearing all the weight of the top slab. Legs 2 and 4 are freestanding.
- (See attached sketch Tomb E- Jackson)
- b) The underside of the brownstone slab is delaminating.
- c) The top surface has shallow losses from ice heaving.
- d) Heavy accumulation of biological growth on top and sides of slab.
- e) No setting mortar visible between legs and slab.
- f) Leg 1 delaminating at base
- g) Leg 2 beginning to delaminate
- h) Leg 3 has slight bowing.
- i) Leg 4 - severe delamination.

**Treatment recommendations:**

1. Remove brownstone slab from legs and clean biological growths.
2. Inject and cap cracks and fissures in slab.
3. Remove legs for treatment and evaluate footings.
4. Grout and cap delamination at legs.
5. Reset legs on existing footings with pins and grout.
6. Reset slab with pins and slight slope for drainage.
7. No treatment for delamination on underside of slab.
8. Alternate: Provide new footings.



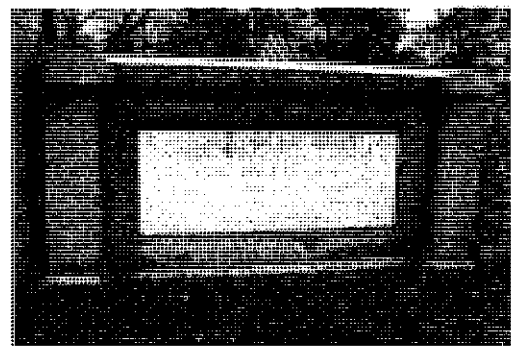
**Tomb E- C**

**Conditions Assessment of Marble Plaque:**

- a) light biological growth on marble plaque.
- b) Fissures at edges of marble plaque.

**Treatment recommendations:**

1. Remove and reset stone units as recommended by Structures North.
2. Clean marble plaque and grout fissures prior to resetting.



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**Tomb E- 1113**

**Conditions Assessment of Brownstone Top and Legs:**

- a) Extensive delamination on top surface of slab.
- b) Four brownstone legs are set in concrete pads.
- c) legs 2 and 4 (See attached sketch Tomb E-1113) are supporting the top.
- d) Three of the four legs have been extensively repaired with adhesive and cement patches.
- e) Prior repairs on all four legs are failing but legs 2 and 4 which are bearing all of the weight of the top are vulnerable to failure.



**Treatment recommendations:**

1. Remove brownstone slab and clean biological growth on slab surface
2. Inject hollow areas and fill recesses on top of slab.
3. Remove scaling from underside of slab and fill loss with tinted patching material.
4. Remove cement pads from all four legs.
5. Remove prior repairs from legs 2-4 and evaluate stone for structural integrity.
6. Reattach fragments with epoxy and stainless steel pins and fill areas of loss.
7. **Alternate:** Replace legs 2,3 and 4 with new Portland Brownstone legs carved to match the existing.



**Tomb E- 1344 and 1346**

**Conditions Assessment of Stone Plaque:**

- a) Biological growth present on both slate plaques embedded in brick wall.
- b) Plaque at north end of tomb is broken into at least 3 fragments.

**Treatment recommendations:**

1. Remove and rebuild brick front as per recommendations in the report by Structures North.
2. Remove cement mortar by hand from slate plaques.
3. Repair cracked plaque at North side with epoxy and tinted repair mortar.



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**Tomb E- A**

**Conditions Assessment for Marble Plaque and  
Brownstone Lintel:**

- a) Light biological growth on marble plaque.
- b) Fissures at edges of marble plaque and losses to upper North corner.
- c) Brownstone lintel below marble plaque is broken in tow places.



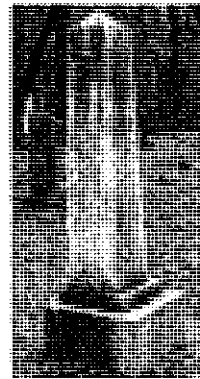
**Treatment recommendations:**

1. Follow recommendations in report by Structures North for taking down and rebuilding front wall.
2. Salvage marble plaque, remove old mortar by hand and clean to remove biological growths.
3. Fill area of loss at upper left corner with composite mortar.
4. Replace cracked brownstone lintel with new Portland Brownstone lintel.

**Tomb E- Rogers**

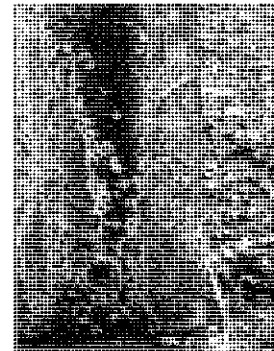
**Conditions Assessment for Multipart Marble and  
Granite Obelisk:**

- a) The two marble units are pinned to each other but not to the granite base.
- b) The marble units have shifted off center probably as a result of the settling of the rubble stone footing.
- c) The upper marble unit has surface cracks on the northeast corner.



**Treatment recommendations:**

1. Clean all 3 units to remove biological growths
2. Fill cracks at the northeast corner of upper unit.
3. Remove all three units.
4. Re-level footing and reset all three units with a stainless steel pin between the lower marble unit and the granite base.



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**Tomb E- 220**

**Conditions Assessment of Brownstone Top:**

- a) Biological growth on the brownstone slab overall
- b) Brownstone slab has shifted 4+ inches to the south

**Treatment recommendations:**

- 1. Remove brownstone slab and rebuild brick base as per recommendations in Structures North report.
- 2. Clean brownstone to remove biological growths.
- 3. Reset slab on new/repared brick walls with mortar bed and mortar keys— Pins between brick and slab are not required.



**Tomb E- 211**

**Conditions Assessment of Marble Slab:**

- a) Marble slab bowed, cracked and broken into 3 pieces
- b) The marble slab was reset in the 20<sup>th</sup> century on a rebuilt brick base and thick and a thick mortar bed that conforms to the bowing of the slab
- c) Heavy biological growth on marble slab.
- d) Extensive sugaring and at the edges of cracks and edges of the fragments.



**Treatment recommendations:**

- 1. Carefully remove marble slab for conservation treatments and to facilitate rebuilding of the brick base as per the recommendations in the Structures North report.
- 2. Pre-consolidate and then clean marble slab.
- 4. Consolidate marble with OH100
- 5. Reattach the small fragment to largest with epoxy, but do not reattach lower piece to top.
- 6. Fill small areas of loss in marble, but not the top north corner.
- 7. Reset marble slab in two pieces on reconstructed brick base without pins.
- 8. Grout seam between upper and lower pieces of marble slab. (See sketch E- 211)



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**Tomb E- 1047**

**Conditions Assessment of Bluestone Slot-Base:**

- a) The bluestone slot base, which supports the slate marker at the top of the tomb is broken, lengthwise, into two pieces. The fragments are held in place by the cement mortar between the top of the front tomb wall and the bluestone.

**Treatment recommendations:**

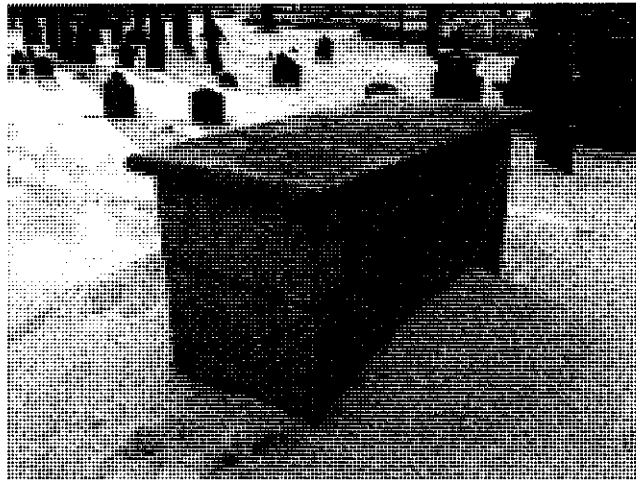
1. Remove upper piece of slate and set aside.
2. Re-attach fragments of slot base with epoxy and grout seams with tinted mortar.
3. Re-set slate and fill slot with sloped mortar.



**Tomb E- T. Jackson**

**Conditions Assessment - Granite Base and Marble Top**

- a) Marble top is in good condition with only small fissures at the edges.
- b) Mortar joints at granite base are open and failing.
- c) One granite unit is cracked and one has shifted out of plane.



**Treatment Recommendations**

1. Treatment of this tomb is not as urgent as the other tombs
2. Removal and resetting of top and base stones is optional.
3. Repointing the mortar joints and grouting the fissures in the marble would stabilize the tomb for several decades.



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**Tomb E- B**

Stone conservation treatments are not required beyond the rebuilding proposed by Structures North.

**Tomb E- I**

Stone conservation treatments are not required beyond the rebuilding proposed by Structures North.

**Tomb E- G + H**

Stone conservation treatments are not required beyond the rebuilding proposed by Structures North.

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Conditions Assessment and Treatment Recommendations for Tomb Plaques,  
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**South Burying Ground, Winchester St.**

**Tombs S-A to S-H**

**Assessment of Marble and  
Brownstone Tomb Plaques:**

a) As a result of the collapse of the center portion of the front wall of these connected tombs, at least three marble plaques have been displaced and one of those is fragmented. Additional plaques or fragments may be buried in the rubble.



b) The remaining marble plaque has moved forward out of the wall.

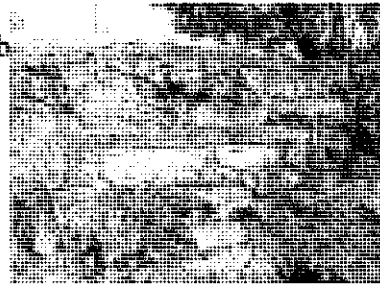
c) All of the plaques are soiled and covered with biological growths.

d) The inscribed brownstone plaque or lintel at the southern end of the wall is in stable condition with some yellow biological growth on the surface.



**Treatment recommendations:**

1. Number coping stones prior to disassembly of the tomb walls. In addition, document end to end orientation.
2. Document location and placement of marble plaques. So that they can go back in the same location in the reconstructed wall.
3. Clean marble and brownstone.
4. Scour wreckage for plaque fragments.
5. Remove mortar from around plaques by hand.
6. Reset coping stone and plaques in their original position.



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**West Parish Burying Ground, River and Cotton Streets**

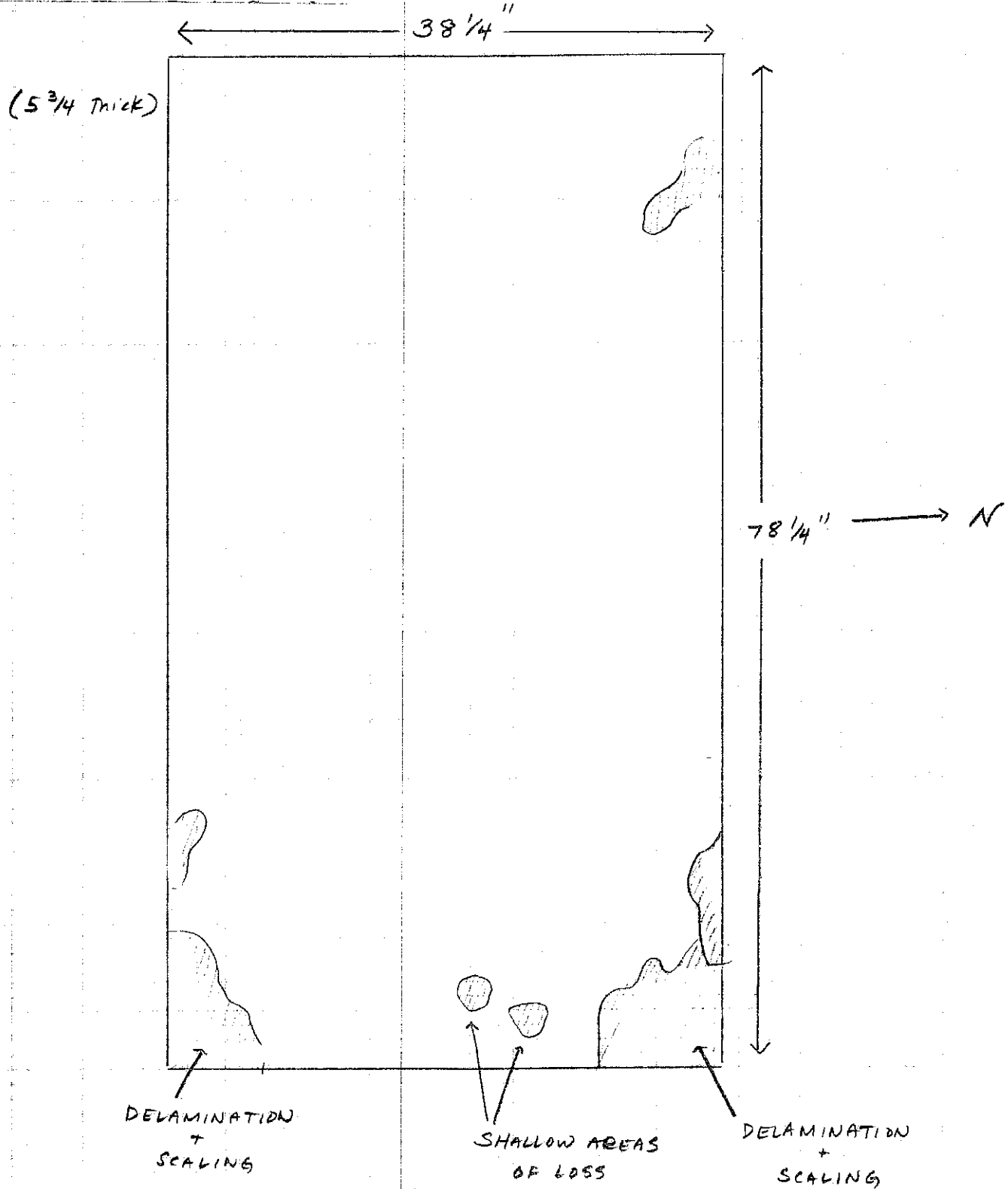
**Tomb W- A-K**

Stone conservation treatments are not required beyond the rebuilding proposed by Structures North. Number all stones and document position prior to disassembly.



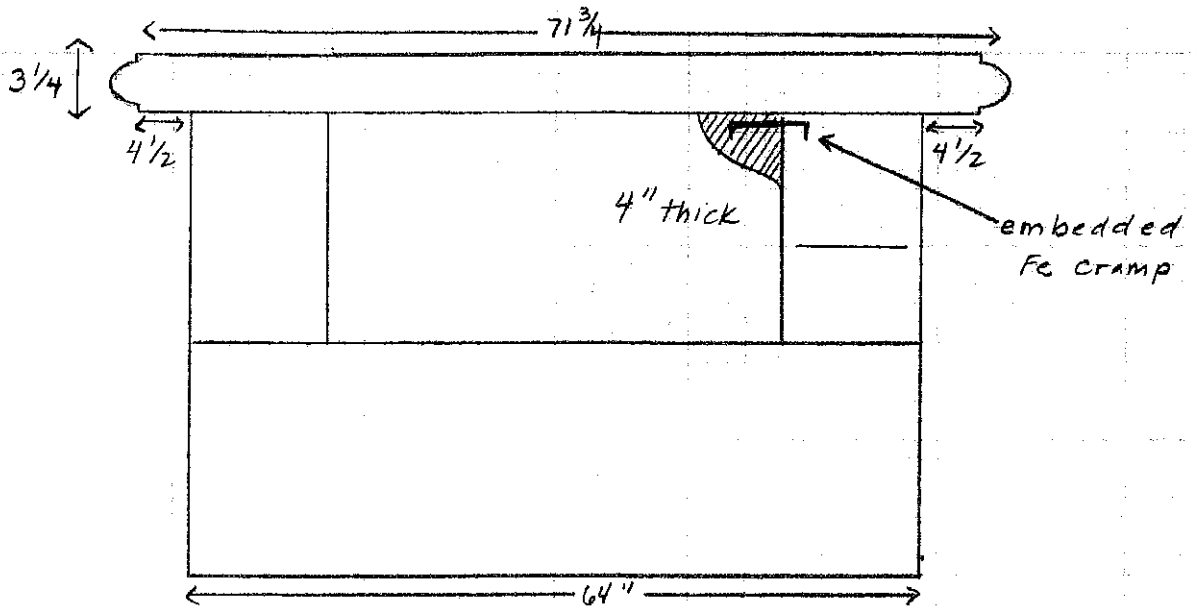
Newton Historic Burying Grounds  
East Parish, Centre St. Burying Ground  
Tomb E- Tabletop 1

Ivan Myjer  
Building and Monument Conservation



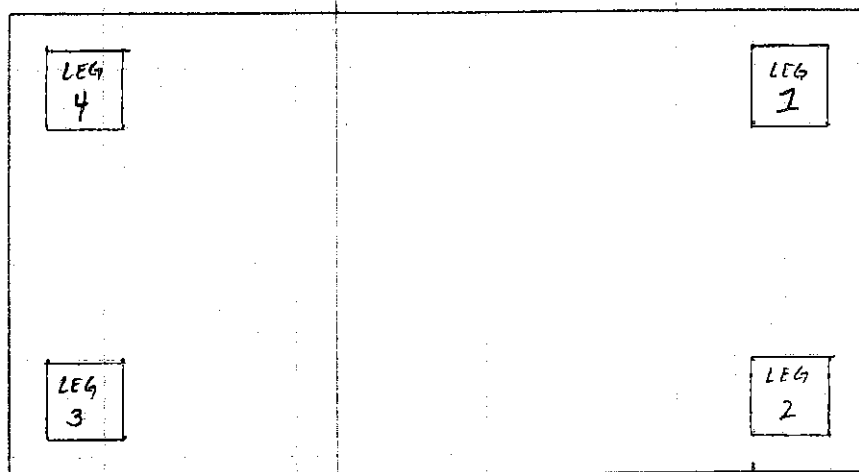
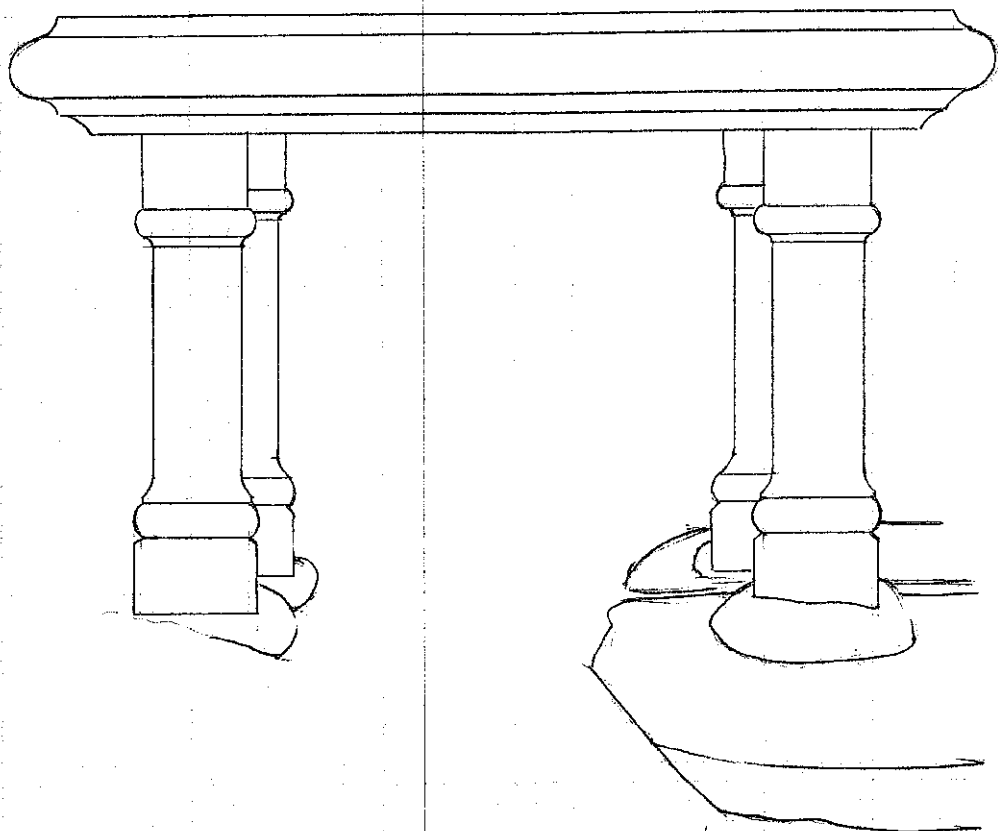
Newton Historic Burying Grounds  
East Parish, Centre St. Burying Ground  
Tomb E- Kendrick

Ivan Myjer  
Building and Monument Conservation



**Newton Historic Burying Grounds**  
East Parish, Centre St. Burying Ground  
Tomb E- 1113

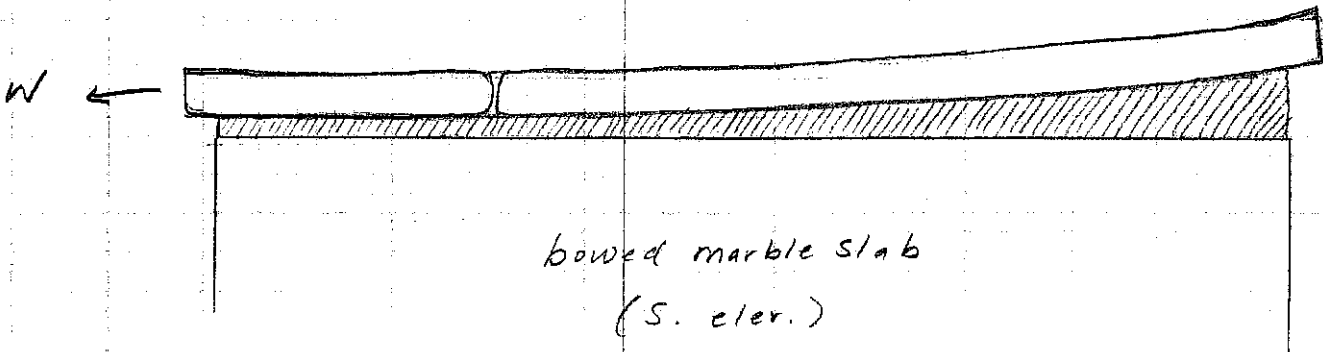
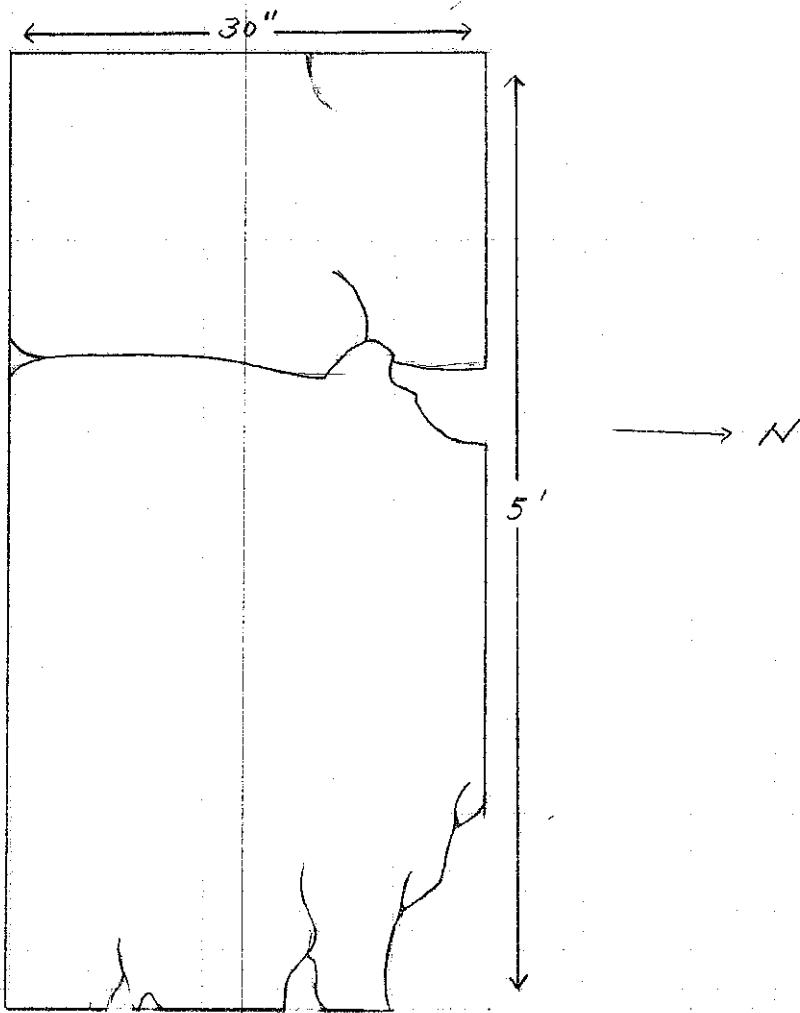
**Ivan Myjer**  
**Building and Monument Conservation**



Newton Historic Burying Grounds  
East Parish, Centre St. Burying Ground  
Tomb E- 211

Ivan Myjer  
Building and Monument Conservation

W (CENTRE ST.)



7 January 2010

Laura Costello  
Historic Newton  
527 Washington Street  
Newton, MA 02458

Reference: Newton's Historical Burying Grounds Condition Report

Dear Laura:

On November 13 and 23, 2009 we performed a visual investigation of tombs at the West Parish, East Parish and South Burying Grounds in Newton, MA. All tombs of the tombs covered in this investigation were selected by the City from previous condition reports except for tombs 1344 and 1346 in the Centre Street Cemetery which we have substituted for a tomb at the north end of the cemetery which appears to be in stable condition. The tombs are called out by their tomb number as stated on the master plans or by the family name if the number is not given or illegible preceded by a W, E or S for the burying ground, see attached plans SK-A, SK-B, and SK-C.

### **General Description**

#### **East Parish Burying Ground**

The East Parish Burying Ground, also known as the Centre Street Cemetery, is located on the corner of Centre and Cotton Streets. The majority of the burial plots are marked with a headstone as well as some table top monuments and mound tombs. The project focus includes a combination of 17 stone and brick tombs and monuments as described below.

#### **South Burying Ground**

The South Burying Ground is located on Winchester Street and is composed of mostly stone grave markers. Within the southern half of the burying ground there is a set of 8 mound tombs built in 1806 with a brick wall as front elevation for 7 of these. In 1827 a brick arched tomb with a stone front wall was added to the south end. It is this row of tombs that are included within the scope of this project.

#### **West Parish Burying Ground**

At the northeast corner of the West Parish Burying Ground, which is located at the corner of River and Cherry Streets, there is a row of mound tombs and a separate tomb with three stone masonry sides which are incorporated in this project. Some of the tombs included in the row along the outer fence have stone fronts; a couple of others are only mounds with no markers. Presumably these tombs are constructed of brick arches with the rear wall



along the small stone wall below the fence and the bases of the tombs being at the level of the sidewalk along Cherry Street. The separate tomb has a finished stone masonry front at the west wall; the south and east walls are stone rubble with the north side of the tomb being a grass covered berm that continues over the top.

### **Repetitive Conditions**

In our survey we found many repetitive conditions for which we will attempt to standardize our recommendations where appropriate.

#### ***Masonry Damage-***

Most of the above-grade mass masonry elements were found to be in an extreme case of disrepair, having suffered from the effects of water infiltration and freezing and thawing cycles that have failed mortar joints between the masonry units and caused structures to weaken and shift. The noted shifting has been caused by freeze-thaw jacking as well as structural soil loads (please see below).

The same is true for above-grade stacked elements, such as open table tombs and obelisks where the mortar bedding between the elements has failed and the elements themselves have moved. As a result, virtually all of the above-grade masonry will need to be reconstructed.

From our experience, subsurface masonry vaults and foundations are usually materially in good condition beyond a certain distance from the ground surface, due mostly to the protective effects of the overlying soil.

#### ***Failed Mortar Joints and Structural Separation-***

Mortar joints between stone units are intended to act sacrificially under weathering conditions and structural movements, so as not to damage the stones or bricks, which should generally be stronger. Originally, mortar would have been comprised of lime and sand, with later alterations and repairs using increasing amounts of Portland cement, making them stronger and less pervious and in rare cases, causing damage to the stone or brick units that they attach.

Nearly all of the above grade exposed mass masonry construction has undergone mortar joint failure and needs to be dismantled and reconstructed. Typically we find that the subsurface masonry is in considerable better condition due to the protection that the covering grade provides.

#### ***Earth Pressure Effects-***

Most of the mound tomb vaults have varying amounts of soil over them. While this soil protects them and to some extent insulates them from freezing temperatures, it pushes

down on the vaults (resisted by their curved shape) and pushes outward on the front walls and any walls that surround them.

Because of the angular difference in coursing between the curved vault construction and the mostly horizontal coursing of the wall construction, it is geometrically impossible (or at least very difficult) for there to be any continuity in construct between the upper portions of the vaults and the walls, meaning that the headwalls that run across the fronts of the vaults are structurally free-standing and at most only leaning against the vaults.

Because of this, the soil pressure that exerts its force against the headwall tends to peel them away from the vaults and displace them forward, causing gaps to form between the vaults and the walls. Water gets into these gaps and deteriorates not only the wall construction, but often the ends of the vaults, resulting in the type of failure that has become pervasive throughout the three burying grounds covered in this report. We have also seen the same effects at the ends of casemate vaults in fortresses, which are basically of similar construction but on a larger scale.

### **General Recommendations**

We recommend that all above-grade masonry be dismantled and reconstructed, and that tops of the tomb vaults be exposed and assessed, along with the first 18" depth of the buried portions of all elements below grade.

#### Mortar Options

Reconstruction should be done using and equally or at least almost as sacrificial formulation of mortar. Pure lime and sand mortars take extremely long periods to cure, probably too long for present-day construction funding and scheduling needs in this relatively harsh climate (uncured mortar does not do well against severe weather). For compatibility sake, we will probably specify a mortar consisting of mostly lime and sand but with traces of cement where appropriate in order to speed the construction time and increase durability where needed. Other options are hydraulic lime or pozzolanic additives with non hydraulic lime.

#### Re-setting Options

Stonework and brickwork that has undergone joint and bond failure, often shifting out of their original positions, should be dismantled and reconstructed. Brick and un-coursed stone construction, and in most cases coursed stone construction, should be laid in the same manner as it was originally, and fully bedded and bonded together with mortar.

In coursed stone construction (where horizontal joints are flat and align) there are instances where we will recommend pins between stone units where they would be helpful in keeping stone units aligned, such as where the potential structural and environmental loads are likely to exceed the bond capacity of the mortar alone. In order to ensure reversibility, we will typically specify stainless steel pins that are adhesive bonded to the stone on one side and then loosely set with sealant into the stone on the other, allowing the structure to be

disassembled without causing damage to the actual stones. In weaker materials such as marble, we will recommend using fiberglass pins instead of stainless steel so that they can be cut if necessary, and in upright applications these will be adhesive-bonded on both ends where their actual tension strengths are critical.

### Wall Tie Options

As part of the re-setting work, we recommend that all of the tomb headwalls be positively tied back to the vaults in order to provide a direct path of resistance against soil pressure. The method of tying will consist of stainless steel rods that are embedded in the reconstructed wall construction and run back across the tops of the vaults to either terminated into the vault roofs or into concrete thrust blocks buried beyond far ends of the vaults, depending upon depth of soil, slope of grade and the condition of the specific vault.

### Vault Capping Options

While the tops of the vaults are usually in good condition, occasionally they are not. In addition, there are instances, such as in the West Burying Ground "Tomb #W-K", where the vaults are singular and surrounded by retaining walls on all sides. In such cases there can be structural damage such as unraveling due to water infiltration or spreading due to sloughing of the retaining soil. In such cases the damaged masonry is repaired, cracks injected and/or re-toothed, and sometimes cross-ties are installed within the vaults to stop the spreading. In addition, the vaults can be capped with a compatible mortar parging or flowable fill. Such actions can allow the flow of water to be directly channeled and the soil pressures to be reduced or even eliminated. During the design phase we will perform test pits at several of the vault locations to try to determine whether such measures will be necessary.

### Stone Column and Base Options Options

Stacked stone elements such as the obelisk or the small columns that support the raised table tombs should be pinned back together in such a way that they will not continue to walk. This can be achieved by providing multiple short-embedment pins, rather than single pins.

In addition, some of their displacements may be due to lack of proper foundations. In such cases we would recommend the addition of small 12" to 18" thick concrete footings buried beneath them, onto which they can be pinned and rest.

### Stone Conservation Measures

Individual stone units and assemblies have also been materially evaluated for their conservation needs by Ivan Myjer of Building and Monument Conservation (B/MC), who has submitted a parallel report. References have been made in this text to the B/MC report and allowances have been made for conservation interventions in our cost estimates.

### **Tomb-Specific Conditions/ Recommendations**

The following is a description of noted conditions on a tomb-by-tomb basis, along with our recommendations for treatment.

#### ***East Parish Burying Ground***

##### **Tomb E-A**

###### ***Masonry Conditions:***

The mound tomb located at the southwest corner of the burying ground. The front elevation is constructed with large granite stones with brick backup, a white marble marker and a brownstone lintel over the door opening (which may have had a metal door but has since been removed and the opening filled with brick). The tomb vault is presumably a brick arch which is the typical construction.



Vegetation has grown between the stone tomb front and the brick backup, and along with water intrusion and freeze-thaw jacking have pushed the two apart. There is moss growing in the mortar joints indicating that water is present within the masonry. Although it is no longer a structural element, the brownstone lintel has cracked.

###### ***Recommendations:***

The front wall of the elevation should be taken apart and rebuilt including the brick backup. The area should be cleaned of all trees and bushes prior to rebuilding the wall. When the interior of the tomb is exposed, it should be examined and any repointing and rebuilding of the vaulted completed. The brick infill should be replaced with a cast iron door or slate slab. The front end of the brick vault may need to be re-knitted against the head wall and the two structures should be pinned together with stainless steel ties. The vault top should be exposed and re-covered to relieve soil pressure from the front wall (please see "Wall Tie Options" and "Vault Capping Options", under "General Recommendations" above).

Please also reference the *B/MC* report for stone conservation recommendations.

Estimated Cost = \$11,200 to \$19,000 (*including stone conservation*).

##### **Tomb E-B**

###### ***Masonry Conditions:***

The front of this tomb is missing and because of the slope of the grade, it is likely that at least the front part of the tomb vault has collapsed. Some "curb" stones have been



placed at the base of the slope as an indication of the tomb location. Two of the three stones have shifted.

*Recommendations:*

A test pit should be dug in front of the tomb and above it to determine what remains of the tomb and if there is enough evidence of its original construction to rebuild it. If the tomb is not going to be rebuilt, the front stones should be re-set and a buried geogrid installed better stabilize the slope.

Estimated Cost = \$2,900 to \$4,900.

*Tomb E-C*

*Masonry Conditions:*

This mound tomb has a dressed stone front with a large white marble marker; the south side of the tomb is rubble stone masonry with another tomb on sharing the north wall. As is common with partially buried tombs, the interior is most likely accessed by a set of stairs below the front wall and covered with flat stone slabs and soil.

The granite on the front elevation has shifted over time leaving enlarged open mortar joints for grass and other vegetation to grow through. The south side wall has shifted outward from soil pressure on its back side.



*Recommendations:*

The stones of the front wall should be dismantled and re-set and the partially exposed side wall straightened and rebuilt. The top of the vault should be exposed and examined and the front edge re-knitted against the headwall assuming it has deteriorated. The walls should be tied to the vault and the vault re-covered (please see “Wall Tie Options” and “Vault Capping Options”, under “General Recommendations” above).

Please also reference the *B/MC* report for conservation recommendations.

Estimated Cost = \$7,900 to \$12,750.

*Tomb E-G and E-H*

*Masonry Conditions:*

These tombs share a front rubble stone wall with no markers. There is little mortar between the stones with moss and vegetation taking its place. Some of the stones have shifted.



*Recommendations:*

All shifted stones should be removed and re-set and the wall repointed with a compatible mortar. Weep holes should be introduced in the wall by omitting mortar from selected head joints between stones.

Estimated Cost = \$3,500 to \$5,000 at E-G.

Estimated Cost = \$3,500 to \$5,000 at E-H.

Tomb E-1

*Masonry Conditions:*

The front of this mound tomb is constructed of rock faced coursed granite with the center stone honed and engraved as a marker. The stones covering the entrance steps in front of the tomb have broken or fallen, opening the tomb interior for view. The vault is comprised of a brick arch and rear wall at the top half which sit on stone foundation walls.



From the visibility allowed without entering the tomb, the interior masonry appears to be in good condition. The exterior mortar joints contain some moss and there has been some minor shifting of the upper stones.

*Recommendations:*

Any shifted stones should be re-set and all mortar joints repointed. The tomb interior should be examined, the masonry repaired as needed, and the stone stair cover replaced. The top of the vault should be exposed and re-covered (please see "Wall Tie Options" and "Vault Capping Options", under "General Recommendations", above).

Estimated Cost = \$5,700 to \$9,500.

Tomb E-211

*Masonry Conditions:*

An engraved white marble slab covers the top of this brick table top monument. The top stone has been broken at a couple locations thought it appears some repair attempts have been made. During the repairs to the marble the upper course of brick was adjusted to make up for the slope of the top slab so the existing brick walls are not level. Within the brick masonry there are some open mortar joints and a crack through the bricks



at one end.

*Recommendations:*

The marble slab should be lifted and conserved and the brick base dismantled and reconstructed, but with two withes of brick which would be more stable.

Please also reference the *B/MC* report for stone conservation recommendations.

Estimated Cost = \$6,900 to \$11,500 (*including stone conservation*).

*Tomb E-220*

*Masonry Conditions:*

The brick table top monument is topped with an engraved piece of brownstone which has moved and is no longer centered on the brick walls below. Within the brick walls there are some cracked and open mortar joints and a brick is missing at one end.



*Recommendations:*

The brick walls should be rebuilt with two withes and the brownstone cover re-set.

Estimated Cost = \$3,500 to \$5,800.

*Tomb E-1047*

*Masonry Conditions:*

The front wall of this mound tomb is built of stone with the door having been bricked in, most likely to replace a broken slate door. There are open mortar joints within the stone front and rodent holes all around the tomb. There is a short entranceway in front of the tomb door with small sidewalls; presently blocked by a large tree. On top of the wall is a slate marker that sits on a cracked stone base (please see "Wall Tie Options" and "Vault Capping Options" under "General Recommendations", above).



*Recommendations:*

The tree should be removed, the front of the tomb shored and the root ball excavated and the hole filled. All shifted stones should be dismantled and re-set and the brick door infill replaced with a slate slab or cast iron door, and the cracked headstone support should be repaired. The top of the vault should be exposed and restored if needed. The interface between the headwall and the vault should also be checked, however the soil loads here are rather small so supplemental tying should be minimal if needed at all (please see

“Wall Tie Options” and “Vault Capping Options” under “General Recommendations”, above).

Estimated Cost = \$4,000 to \$6,600.

### Tomb E-1113

#### *Masonry Conditions:*

This brick arch mound tomb has a front elevation of granite with an engraved white marble door. Above the tomb is a brownstone table top monument very similar to the one at the E-S Jackson tomb.

The granite tomb headwall has shifted forward exposing the end of the brick vault, being under an unusually high amount of lateral earth pressure with the upward sloping grade above it. On top, three of the brownstone table legs are cracked and all have moved. The top surface of the table slab is covered with moss and lichen and the bottom side is spalling.



#### *Recommendations:*

The table top monument should be re-set, the cracks and spalls repaired and the moss removed from the top slab (Please see “Stone Column and Base Options” above). The tomb front should be removed and re-set and any needed repairs made to the exposed brick arch vault (please see “Stone Column and Base Options”, “Wall Tie Options” and “Vault Capping Options” under “General Recommendations”, above).

Please also reference the *B/MC* report for conservation recommendations.

Estimated Cost = \$12,600 to \$21,000 (*including stone conservation*).

### Tombs E-1344 and E-1346

#### *Masonry Conditions:*

These tombs were not included in the original scope of the project but have deteriorated severely since the previous reports had been completed. The tombs’ front walls are brick masonry with slate markers.

The masonry is cracked and shifted, particularly at E-1344. The slate marker of E-1346 has cracked.





*Recommendations:*

The front wall should be removed and rebuilt and any cracked stones repaired. The tops of the vaults should be exposed and re-covered (please see "Vault Capping Options", under "General Recommendations", above).

Please also reference the *B/MC* report for conservation recommendations.

Estimated Cost = \$3,500 to \$5,600 at E-1344.

Estimated Cost = \$4,000 to \$5,800 at A-1346 (*including stone conservation*).

*Tomb E-Table Top 1*

*Masonry Conditions:*

The brick table top monument is topped with an engraved brownstone slab. At the lower brick portion, the mortar is missing and large sections of masonry have shifted out of place causing some bricks to fall. The missing bricks allow for the interior of the monument to be viewed, showing that the bottom side of the brownstone slab is spalling, the exterior surfaces of with are partially covered with vegetation.



*Recommendations:*

The table top monument should be taken apart and rebuilt with two wythes of brick below to provide better stability, perhaps with a new base or foundation. The top should be conserved and re-set.

Please also reference the *B/MC* report for stone conservation recommendations.

Estimated Cost = \$5,600 to \$8,600 (*including stone conservation measures*).

*Tomb E-Kendrick*

*Masonry Conditions:*

The table top monument is built of granite blocks, one of which is cracked with an engraved marble top. The mortar joints between the stones have eroded.

*Recommendations:*

The stones should be re-set and the broken corner repaired. The re-setting should include the insertion of metal cramp ties to restrain the stones from future movement and pins from the top to the base (please see "Stone Pinning Options" under "General Recommendations", above).



Please reference the *B/MC* report for stone conservation recommendations.  
Estimated Cost = \$4,500 to \$7,600 (*including stone conservation measures*).

*Tomb E-Simon Jackson*

*Masonry Conditions:*

The brownstone table top monument located at this tomb is construction of four legs and a top slab. The legs have rotated and moved out of their original locations. Although the engraving on the top surface of the top slab is in good condition, the bottom side is spalling.



*Recommendations:*

The top slab should be removed and conserved. The legs and supporting stones should be removed and re-set on buried stable bases and the top slab put back into place (please also see “Stone Column and Base Options” under “General Recommendations”, above).

Please also reference the *B/MC* report for stone conservation recommendations.  
Estimated Cost = \$9,600 to \$15,900 (*including stone conservation measures*).

*Tomb E-T. Jackson*

*Masonry Conditions:*

The table top monument is made of granite stone blocks with a marble engraved top. At the sides there are some open mortar joints and a couple stones have slightly shifted out of place.



*Recommendations:*

The cap should be lifted off and all shifted stones pinned and re-set and then the cap reinstalled (please see “Stone Pinning Options” under “General Recommendations”, above).

Please also reference the *B/MC* report for stone conservation recommendations.  
Estimated Cost = \$5,400 to \$8,700 (*including stone conservation measures*).

Tomb E-Rogers

*Masonry Conditions:*

This obelisk monument in the northern portion of the burying ground is made of white granite. The obelisk has shifted on its base and it appears that the base stone has rotated.

*Recommendations:*

The monument should be dismantled and reassembled on a new concrete footing below the base (please see "Stone Column and Base Options" under "General Recommendations", above).

Please also reference the *B/MC* report for stone conservation recommendations.

Estimated Cost = \$6,000 to \$8,500 (*including stone conservation*).



Total Estimated Cost of Repairs at East Burying Ground = \$100,300 to \$161,650

**South Burying Ground**

Tomb S-A to S-G

*Masonry Conditions:*

These mound tombs were all constructed at the same time. They consist of a brick wall front with granite wall capstones. The tombs themselves are presumably brick arch vaults.

Trees have grown in the soil directly behind the front wall with the root systems stretching along the wall pushing it outward and causing it to collapse or become close to falling apart. There are two tombs which have not been as greatly affected by the vegetation growth but there is moss growing in the mortar joints, some cracking and the capstones have shifted.



Presumably the tomb vaults would have been accessed by stairs in front of the tombs. Although they are not visible and there are no holes in the ground indicating that the slab stone covers have broken or shifted, there is some tree growth at base of the front wall that might damage the stair covers, if they haven't done so already.

*Recommendations:*

The front wall should be completely rebuilt and all trees, bushes and roots removed then the vaults should be exposed and inspected. The front walls should be documented and dismantled and reconstructed to match their original configuration. A positive tie should be introduced between the vaults and the front wall to resist soil pressure. Any stair covers that exist should also be uncovered, examined and all broken stones replaced (please see “Wall Tie Options” and “Vault Capping Options” under “General Recommendations”, above).

Please also reference the *B/MC* report for stone conservation recommendations.

Estimated Cost = \$48,000 to \$79,000 for the line of tombs (*including stone conservation measures*).

*Tomb S-H*

*Masonry Conditions:*

The end tomb appears to have been constructed at a later date than the rest of the tombs in this line, using a stone head wall. Along the top and end of the wall there are open mortar joints and some shifted stones which may be partially caused by the tree growing next to the tomb. There is a stone slab over the stairs leading into the front of the tomb, with a hole along the edge that allows viewing access into the tom. By probing through the hole, we found the accessible portion of the tomb’s interior to be in good condition.



*Recommendations:*

The shifted stones should be reset, the stair cover exposed and re-positioned or replaced and the brick vault exposed, thoroughly examined and repaired as needed (please see “Wall Tie Options” and “Vault Capping Options” under “General Recommendations”, above).

Please also reference the *B/MC* report for stone conservation recommendations.

Estimated Cost = \$8,000 to \$12,750 (*including stone conservation measures*).

*Total Estimated Cost of Repairs at East Burying Ground = \$56,000 to \$91,750.*

## West Parish Burying Ground

### Tomb W-A to W-D

#### *Masonry Conditions:*

The fronts of these four mound tombs consist of large dressed granite curbstones at the top of a grass berm over slanted tomb stair covers, one of which is presently exposed at tomb W-D. All of the granite have shifted in some way. At tomb W-A the front wall has moved forward and the rest have rotated out of line by approximately 3 inches.



#### *Recommendations:*

The granite curbstones should be re-set and any shifted backup masonry rebuilt. The tops of the vaults should be exposed and restored if needed and positively tied to the curbstone and headwall construction (please see “Wall Tie Options” and “Vault Capping Options” under “General Recommendations”, above).

Estimated Cost = \$4,000 to \$6,500 at W-A

Estimated Cost = \$4,000 to \$6,500 at W-B

Estimated Cost = \$4,000 to \$6,500 at W-C

Estimated Cost = \$4,000 to \$6,500 at W-D

### Tomb W-E

#### *Masonry Conditions:*

The stone front, most likely similar to tomb W-A, has collapsed leaving a rubble pile of bricks and stones and the stone tomb marker lying on the ground.



#### *Recommendations:*

The tomb's front wall should be reconstructed to match the neighboring tombs. The area should be probed for missing or buried stone elements that were once part of this tomb. The vault should also be exposed, restored if needed, and positively tied to the reconstructed head wall (please see “Wall Tie Options” and “Vault Capping Options” under “General Recommendations”, above).

Estimated Cost = \$5,000 to \$8,500 (depending upon availability of missing elements).

Tomb W-F to W-I

*Masonry Conditions:*

These mound tombs do not have any stone markers and only consist of grass.

*Recommendations:*

None; unless the original tomb marker where found or replaced.



Tomb W-J

*Masonry Conditions:*

In similar fashion of the other mound tombs in this row, there is a granite curbstone marking the tomb, which has shifted, at the top of a slope which contains the covered tomb entrance. Some bushes have grown next to the granite curbstone and are the most likely cause of the movement noted. The rear of the brick arch vault is exposed showing some eroded mortar joints.



*Recommendations:*

The bushes should be removed and the stone marker reset. At the rear of the tomb, the area surrounding the exposed masonry should be uncovered, along with the top of the vault and the conditions examined. All open mortar joints should be repointed and loose masonry rebuilt, along with providing a tie-in between the headwall and the vault construction (please see "Wall Tie Options" and "Vault Capping Options" under "General Recommendations", above).

Estimated Cost = \$6,000 to \$8,500.

Tomb W-K

*Masonry Conditions:*

The tomb has three stone walls and one soil and grass wall with a grass top. The front entrance is a dressed granite stone wall with an opening at the top which may have been the location of a tomb marker stone; a raised area of soil at the base of the wall may indicate the buried missing stone or a covered entrance stairway. All of the stone walls have moved outward slightly, particularly the front wall this is most likely cause by soil pressure from the top of the tomb. The random rubble side and rear stone walls are missing mortar from the joints and there is a large variety of vegetation growing from these open joints



*Recommendations:*

All shifted stones should be dismantled and re-set, the masonry should be repointed and all roots and vines removed. The area should be investigated in front of the tomb to look for the possible missing stone and to check the condition of the stone stair cover if present. The soil on the top of the tomb should be excavated to expose the top of the vault, and a positive restraint system should be incorporated on all sides to eliminate the damaging lateral earth pressure on the reconstructed perimeter walls. When the tomb is open the interior should be examined and any necessary repairs carried out.

Estimated Cost = \$22,000 to \$30,000.

Total Estimated Cost of Repairs at East Burying Ground = \$49,000 to \$73,000.

**Total Estimated Range of Cost for All Work at 3 BGs = \$205,300 to \$326,400.**

Thank you for the opportunity to survey these important historical resources. Following a sit-down with you and review of this report, we will submit a final draft and will have commenced production of the contract documents for the repairs. Please note that the Estimated Costs shown in this report will be re-checked after we have completed test pits and have reached a 75 percent completion point in our design.

Please contact us if you have any questions or comments.

Respectfully Yours,  
Structures North Consulting Engineers, Inc.

Stephanie Moomey, EIT

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