

95 Tremont Street

Scope of Work

We will clean and repair three large monuments in the site (Hancock, Franklin's parents, Mosely family). We will conserve 100 gravestones in section A and clean and reset all of the gravestones in section A.

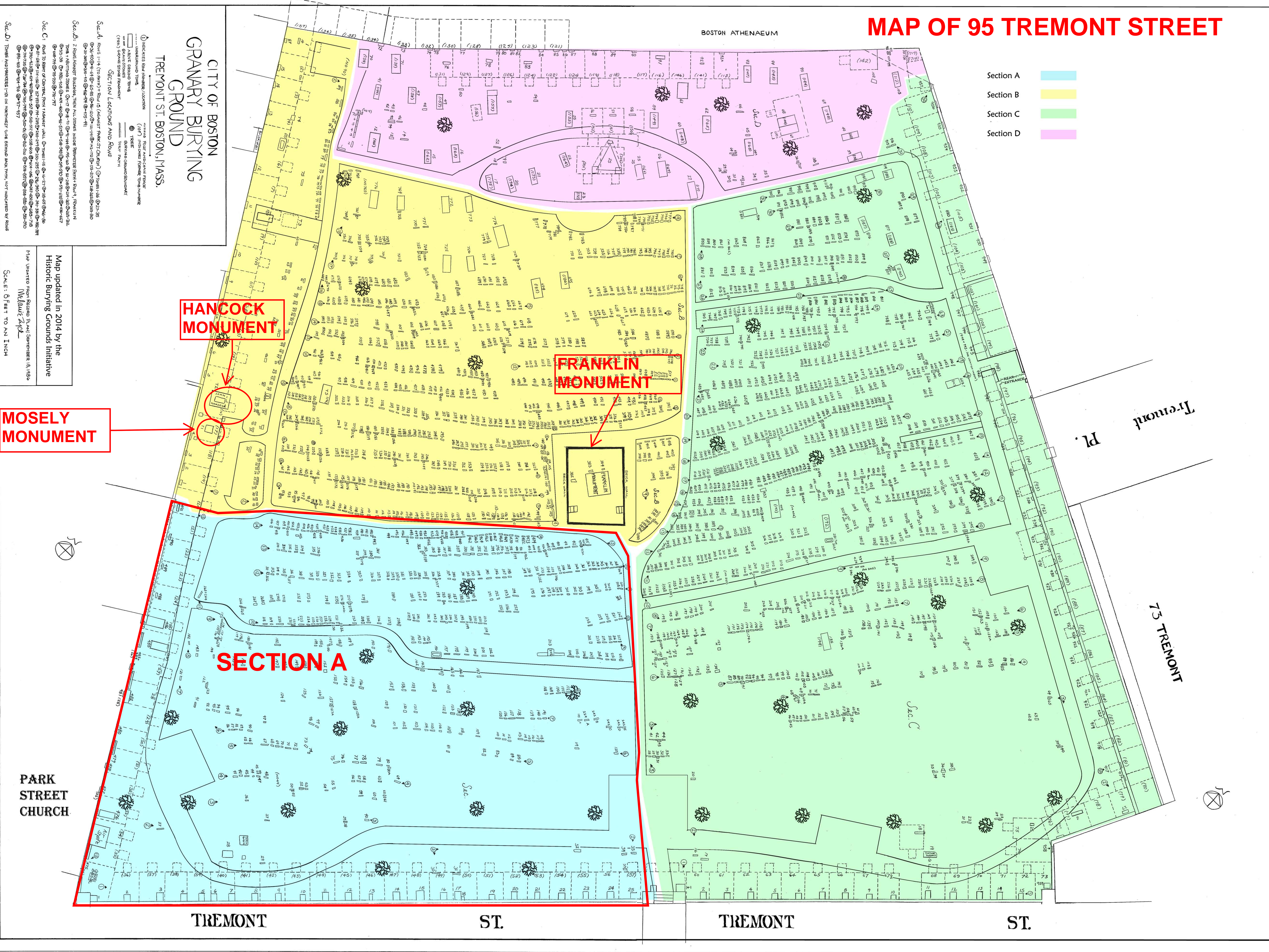
The Franklin monument and the John Hancock monument are defining features of the Granary Burying Ground. Due to their outdoor location, they are showing signs of soiling from climactic events, exposure to pollution, and biological growth. The rear corner of the plinth on the Moseley monument is broken. Work on these monuments will include cleaning, repairing the broken plinth, consolidation of marble, repointing of certain areas, and repatination of bronze plaques and lettering.

There are approximately 500 slate gravestones in section A of the Granary (front left side, see map). In addition to suffering the weather and decomposition inherent in spending hundreds of years outside, they are located beneath a group of linden trees. The aphids that dwell in these trees secrete a sticky sap, which lands on the gravestones and creates a dark sticky mess. This biological soiling is compounded by a flourishing of lichen growth, rendering many gravestones illegible.

We have hired a stone conservation expert (Daedalus, Inc.) to help repair and clean these gravestones. We will select 100 hundred gravestones to receive conservation treatment to address common problems such as breaks, cracks, layer separation, and delamination. The conservation treatments will take place inside a studio over the winter months. The controlled atmosphere of the studio produces superior results to treatments conducted outside. Additionally, it allows the conservator to do the work over winter time, when visitation to the site is very low. The gravestones will be removed in late fall, treated over the winter, and placed back in the site in April 2026. The remainder of the gravestones in section A will be cleaned and reset to a straight and upright position at this time. Our experience of resetting all the gravestones section by section has yielded excellent results in our phased conservation/resetting program in Copp's Hill Burying Ground from 2018 to 2024.

MAP OF 95 TREMONT STREET

Section A
Section B
Section C
Section D



Map updated in 2014 by the
Historic Burying Grounds Initiative
McLaurie ZPC

SCALE: 6 FEET TO AN INCH

MOSELY MONUMENT

HANCOCK MONUMENT

FRANKLIN MONUMENT

SECTION A

PARK STREET CHURCH

SECTION 04 01 40: GRAVESTONE RESTORATION

PART 1-GENERAL

1.1 RELATED DOCUMENTS

- A. The General Documents, as listed on the Table of Contents, and applicable parts of Division 1, GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Contract Documents and all other Sections of the Specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

- A. The work of this Section consists of providing all labor, equipment, materials, incidental work, and construction methods necessary to prepare the site, complete, as indicated on the Contract Documents, as specified, and as follows:
 - 1. Gravestone cleaning
 - 2. Gravestone resetting
 - 3. Gravestone repair
 - 4. Marble gravestone consolidation
 - 5. Gravestone conditions assessment

1.3 QUALITY ASSURANCE

- A. Statement of Significance:
All work performed must comply with the United States Secretary of the Interior's Standards for Historic Preservation and the Guidelines for Treatment of Cultural Landscapes as well as the AIC Code of Ethics and Guidelines for Practice.
- B. Stone Conservation Contractor: Work shall be performed by firm(s) employing Grave Stone Conservators and Restoration Masons working under the guidance of a Lead Conservator. Contractor and lead Conservator must have no less than five years of experience with comparable stone conservation projects. The Contractor shall submit **with their bids** references for five successfully completed projects - at least three of which shall be National Register Listed Properties - and identify the scope of work for each project as per Section 1.5. Information supplied with the bid must document specific uses of the materials and methods identified in this specification. Bids that do not list specific examples of prior projects where markers have been conserved as well as photographs of those treatments will be considered incomplete.
- C. The contractor shall maintain a steady crew for the duration of the project
Employ a qualified foreman who is present on the job every day.
- D. The following treatments **shall not be** permitted:
 - 1) Sandblasting, grinding or otherwise abrading the surface of the markers,
 - 2) Covering sections of markers with thin applications of mortar, polymer modified mortars, bulked polymers, resins, bulked resins, thin-set, setting compounds etc. to fill areas of cracks and/or delamination
 - 3) Grinding the surfaces to remove excess, mortars, resins, polymers, latex.
 - 4) Leaving exposed areas of adhesives/resins etc on markers or bases.
 - 5) Honing of weathered surfaces
 - 6) Laminating historic markers to new pieces of stone.
 - 7) Bonding the individual pieces of multi-part markers to each other with epoxy or other polymer adhesives.
 - 8) Setting compounds in place of mortar.
 - 9) Replacement stone slot bases manufactured with open ends.
 - 10) The use of products or methods that have not been submitted in writing, and received written approval from the City of Boston's authorized representative.

1.4 REFERENCES

A. The following standards shall apply to the work of this Section.

1. American Society for Testing and Materials (ASTM):

ASTM C 207, *Standard Specification for Hydrated Lime for Masonry Purposes*.

ASTM C 1713, *Standard Specification for Mortars for the Repair of Historic Masonry*.

ASTM C33, Aggregates for concrete:

ASTM C144, Mortar Sand

ASTM C216, Bricks

ASTM C270, Mortar

ASTM A276, Stainless Steel Threaded Rod

#48 Preservation Brief, *Preserving Grave Markers in Historic Cemeteries*, National Park Service

1.5 SUBMITTALS

A. Resumes and Qualifications: Contractor shall submit resumes and qualifications for each of the following individuals **with their bids**:

Conservator (s): The names of the proposed Lead Conservator(s), Assistant Conservators and masonry craftspersons shall be identified in the bid. Lead Conservators shall be defined as a professional with training, experience and education in one or more of the following fields: Grave stone conservation, architectural stone conservation and/or museum objects conservation. Lead Conservator shall have extensive experience in the documentation and treatment of historic and culturally significant structures or objects made from stone. Membership in one or more of the following organizations is not a requirement but it will help substantiate a long term commitment to the profession and knowledge of The Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscape.

Organizations: American Institute for Conservation, Association for Preservation Technology International. US Icomos, Icom. Training from product manufacturer's shall be counted as a qualification to use certain products but it will not be counted as an indication of broader training in the conservation of cultural and historically significant objects made from stone.

Contractor shall submit resume and a list of prior projects for Lead Conservator and any assisting conservators with the bid. Submittal of Lead Conservator's list of projects shall include at least five examples of projects similar in scope and importance to the work at Westerly Burying Ground. Demonstrate that the same materials and approach as outlined in this specification have been used on the five projects submitted. Project examples and references that include treatments prohibited in Section 1.03 D 1-9 in this specification shall be considered incomplete. Provide before, during and after photographs of representative markers from each of the five submitted projects. At least three of those projects must be National Register listed projects. Project references shall include name, location and date of execution of each project as well as the names and telephone numbers of references for each of the five projects. **Project references must be from a knowledgeable preservation professional and/or members of the local or state historical commission(s).**

In addition to the resumes and qualifications listed above, contractor shall include a list of prior projects completed by the firm. The list of contractor projects and Lead Conservator projects may overlap if the two firms worked together or if the Lead Conservator was a member of the staff of the Contractor at the time that the projects were completed. Contractor to include a brief paragraph for each of the projects submitted that identifies how the work completed, conforms to the standards set out in The Secretary of the Interior's Standards for the Treatment of Historic Properties and Guidelines for the Treatment of Cultural Landscape. Contractor project references for each of the five projects shall include name, location and date of execution of each project as well as the names and telephone numbers of references for each of the five projects. Project references must be from a knowledgeable preservation professional and/or members of the local or state historical commission(s).

B. Product Data: After the **award of the contract**, submit manufacturer's technical data for each product proposed in the treatment plan including recommendations for their application and use.

Include test reports and certifications substantiating that products comply with requirements.
Submit material safety data sheets for each product.

- C. Written Description: After the **award of the contract**, submit written program for each phase of conservation including schedule and phasing. Include items for coordination with the client and indication of how surrounding graves, grave markers, monuments and vital plantings will be protected. Describe materials and equipment to be used on site. Describe safety measures that will be taken to protect visitors while the work is underway and to protect the stones from damage while they are out of the ground.
- D. Alternate Methods: If, after the contract is awarded, alternate methods and materials to those indicated in the bid specifications are proposed for any phase of the conservation or resetting work, the contractor shall provide a written description, including evidence of successful use on other comparable projects along with the standard product submittals outlined above. Written approval from the Project Consultant is required prior to substituting any materials or methods. Work completed using substitute materials that does not have the written approval of the Project Consultant shall be rejected as well as any claims for payment until the materials are removed and the work is completed with the approved materials.
- E. Submit manufacturer's product data for the following:
 - 1. Masonry cleaning products
 - 2. Epoxy for repairing broken gravestones
 - 3. Mortar mixes
 - 4. Seed mix

1.6 MOCK UPS

- A. After the award of the contract the Contractor shall submit for approval the following mock ups. No treatment work may proceed unless all of the mock-ups listed below have been approved by Boston Parks and Recreation.
- B. Sample of workmanship for stone stabilization with B-72 or water soluble adhesives and tissue paper or cloth.
- C. Sample cleaning of one marble marker, one slate marker, and one granite marker. Approved cleaning samples to be used as standards for all other grave marker cleaning in this project.
- D. Contractor to submit one sample of new stone to stone adhesive joints for approval prior to proceeding with balance of repairs. Sample to be evaluated for alignment of fragments, width of joint and absence of any epoxy on the visible surfaces of the stone.
- E. Contractor to submit one completed treatment cycle of a marker that has been removed from the ground, cleaned, treated and reset.
- F. Contractor shall submit a sample of a representative conditions assessment and treatment documentation survey sheet prior to starting work.

PART 2-PRODUCTS

2.01 MATERIALS GENERAL

- A. Comply with referenced standards and other requirements indicated applicable to each type of material required.
- B. Reference in the specifications to materials by trade name is to establish a standard of quality. It is not intended to exclude other manufacturers whose materials that, in the judgement of the project conservator are equivalent to those named based on sample panels.

2.02 MORTAR MATERIALS FOR FILLS, REBUILDING AREAS OF LOSS and MORTAR CAPS

- A Composite Repair Mortars

- a) Non-Polymer Modified Composite Repair Mortars for filling areas of loss in Slate or Marble : Jahn M-70, Jahn M-120, M-160 from Cathedral Stone Products. 8332 Bristol Court, #107, Jessup, Maryland 20794 (800) 684-0901
- b) Polymer Modified Composite Repair Mortars for Mortar Caps and Seam fills on Slate Markers : Edison Custom System 45 from Edison Chemical Systems, Inc. 25 Grant Street, Waterbury, CT 06704, tel. (203) 597-8044
- c) Hydraulic Lime Based Repair Mortar for Filling Seams and areas of loss: Lithomix from St Astier available from LimeWorks.us, tel. 215-536-6706

2.03 GROUT MATERIALS

- A. Acryloid B-72 (Ethyl Methacrylate Copolymer) dissolved in solvent. Concentrations to vary depending on the depth and width of the crack or void to be filled. Large voids to be filled with B-72 bulked with an inert material such as fine silica sand, ceramic micro-balloons and pigment . Exact proportions to be determined by conservator in the field based on the size of the area to be filled and other requirements such as the ability of the mix to flow evenly through the area.
- B. Hydraulic lime Injection Grout and Crack Filler as manufactured by VoidSpan www.voidspan.com, or approved equal.
- D Jahn M-60 and M-100 Crack grouts as manufactured by Cathedral Stone Products, or approved equal. Cathedral Stone Products. 8332 Bristol Court, #107, Jessup, Maryland 20794 (800) 684-0901

2.04 MATERIALS FOR THE STABILIZATION OF LOOSE FRAGMENTS PRIOR TO REMOVAL OR OTHER TREATMENTS.

- A. Acrylic Resin B-72 and Japanese tissue paper or fine cloth such as silk CrepeLine applied to the surface of the friable or loose stone. B-72 to be dissolved in solvent such as acetone. Percentage of solids to solvent to be field tested. Approximately 5% . For situations where a water soluble adhesive is appropriate: Methyl Cellulose or Polyvinyl Alcohol can be used to lay down the tissue paper or cloth.

2.05 STONE ADHESIVES FOR NON-STRUCTURAL REPAIRS AND LAYING DOWN OF STONE FLAKES, AND VERY SHALLOW AREAS OF EXFOLIATION.

- A. Paraloid Acrylic Resin B-72 (100%) dissolved in solvent such as acetone. Percentage of solids to solvent to be field tested. Tubes of 10% paraloid B-72 in acetone can be obtained from Talas, 330 Morgan Ave., Brooklyn, NY 11211 12 219-0770 www.talasonline.com or other conservation supply companies.

2.06 STONE ADHESIVE FOR STRUCTURAL REPAIRS AND PINNING

- A. Exterior grade flowable and paste epoxies that are moisture tolerant and specifically manufactured for the structural repair of stone and masonry. Akemi Akepox 2000, 2010, 2030, 5000, 5010 from Akemi North America (877) 462-5364 available from Stone Boss Industries, 26-04 Borough Place, Woodside, NY 11377 (718)278-2677 Fax (718) 267-1997 or approved equal.

2.07 CLEANING AGENTS FOR REMOVING SOILING PRIOR TO ADHESIVE REPAIRS

- A. Water: All water shall be clean potable water. If potable water is not available at jobsite contractor must provide clean potable water.
- B. Non-Ionic Detergents: Triton X 100 available from Talas, 568 Broadway, New York, NY 10012 (212) 219-0770
- C. Concentrated Soap: Vulpex Soap available from Talas, 568 Broadway, New York, NY 10012 (212) 219-0770

- D. Synthetic Anionic Detergent: Orvus WA Paste available from Talas, 568 Broadway, New York, NY 10012 (212) 219-0770

2.08 CLEANING AGENTS FOR REMOVING BIOLOGICAL GROWTHS

- A. D2 Biological Cleaner by D/2 Biological Solutions, Inc PO Box 3746 Westport, MA d2bio.com

2.09 TOPICAL COLORING AGENT FOR COLOR MATCHING OF MORTAR PATCHES, SEAMS AND CRACK FILLS ON SLATE MARKERS

- A. Kiem Purktistalat silicate paints available from Kiem Mineral Systems, #62 Port Lewes, Lewes, and Delaware 19958 (302) 644-1007 Fax (302) 644-0866
- B. Silin Stain from Cathedral Stone Products. 8332 Bristol Court, #107, Jessup, Maryland 20794 (800) 684-0901

2.10 PINS FOR STRUCTURAL REPAIR OF FRAGMENTS

- A. Stainless steel Threaded rod grade 304 or better.

2.11 SOLVENTS FOR FLUSHING CRACKS AND FISSURES AND FOR PREPARING MATING SURFACES PRIOR TO GROUTING OR ADHESIVE REPAIRS.

- A. Acetone (CH₃) C0
- B. Ethanol-D6 Anhydrous - May be mixed with water.

2.12 SOIL MATERIALS

- A. Structural Fill: Provide gravel, sandy gravel, or gravelly sand free from organic material. Loam, trash, snow, ice, frozen soil and other objectionable materials and well graded within the following limits.

Sieve Size Passing Through	Percent Finer by Weight
6 inches	100
No. 4	30-90
No. 40	10-50
No. 200	0-8

- B. Crushed Stone: Provide clean, washed crushed stone free of fine materials and graded within the following limits:

Sieve Size Passing Through	Percent Finer by Weight
6 inches	100
¾ inch	90-100
½ inch	20-30
No. 4	0-5
No. 40	0-5
No. 200	0-5

2.13 PINS FOR STONE TO STONE PINNING

- A. Replace all existing steel pins with grade 304 or better stainless steel threaded rod matching the existing diameters and cut to the necessary lengths.
- B. For two and three piece markers and monuments that were not previously pinned, utilize two 5/8" diameter grade 304 or better stainless steel pins cut to length from threaded rod.

2.14 CEMENTITIOUS GROUT FOR SETTING STAINLESS STEEL PINS OR SETTING UPRIGHT MARKERS IN SLOT BASES

- A. Mortar for setting pins and setting stones in slot bases shall be: A soft mortar that is durable but can be reversed in the future containing either Type I/II White or Light Gray Portland Cement and Type S lime and aggregate, or Naturally Hydraulic Lime (NHL 3.5) and aggregate, or Type S Dolomitic lime plus additives to make the mortar hydraulic. Ratio of binder to aggregate shall not be less than 1:2.5 or greater than 1:7

2.15 REPLACEMENT STONE: (For Extending Broken Stones)

- A. Slate: New or Salvaged slate to match color and texture of historic material. Portland Munson Slate available from Sheldon Slate Products, 38 Farm Quarry Road, Monson, ME 04464 207-997-3615, or approved equal.

2.16 GRAVEL

- A. Construction grade gravel ranging in size from 1/4" to 1" as required.

2.17 CAST CONCRETE MIX FOR NEW SLOT BASES TO BE USED FOR RESETTING MARKERS THAT ARE TOO SHORT TO BE PLACED IN THE GROUND.

- A. Cast concrete shall be made from cast stone mix containing Type I/II White or Gray Portland Cement and graded aggregate. Hardened and cured mix shall reach a minimum compressive strength of 6,000 psi after 28 days.
- B. Cast concrete bases shall contain a custom made slot that allows the marker to be inserted into the slot and a weak grout to be placed between the marker and the sides of the slot in the base. Concrete base shall hold the marker in place securely but allow for drainage of water out of the slot.

2.18 CAST CONCRETE MIX FOR EXTENDING MARKERS THAT ARE TOO SHORT TO BE PLACED IN THE GROUND.

- A. Cast concrete shall be made from cast stone mix containing Type I/II White or Gray Portland Cement and graded aggregate. Hardened and cured mix shall reach a minimum compressive strength of 6,000 psi after 28 days.

2.19 MARBLE CONSOLIDANT

- A. Basis of design: Conservare® H100, manufactured by ProSoCo.
- B. Consolidant is a combination consolidation/water repellent treatment. This ethyl silicate treatment, modified with a silane water repellent, replaces the natural binding materials while protecting the treated surface from water-related deterioration.
- C. Technical Data
FORM: clear, colorless to slight yellow liquid with alcohol odor
SPECIFIC GRAVITY: 0.936
pH: not applicable
WEIGHT/GALLON: 7.79 pounds
ACTIVE CONTENT: 100 percent
TOTAL SOLIDS: 47 percent ASTM D5095
FLASH POINT: 110 degrees F (43 degrees C)
FREEZE POINT: <-22 degrees F (<-30 degrees C)
SHELF LIFE: 1 year in tightly sealed, unopened container
VOC CONTENT: >400 grams per Liter. Manufactured and marketed in compliance with USEPA AIM VOC regulations (40 CFR 59.403).
PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: CustomerCare@prosoco.com

2.20 TOPSOIL AND SEED

- A. Topsoil shall be a sandy loam or fine sandy loam, screened through a 1/2" screen.
- B. Seed shall be 50% Creeping Red Fescue, 25% Kentucky Bluegrass and 25% Perennial Rye.
- C. Seeding mulch shall be pelletized seeding mulch with integral starter fertilizer (10-20-5).

2.21 WATER

- A. The Contractor shall be responsible to furnish his own supply of water to the site at no extra cost. If possible, the Owner shall furnish the Contractor upon request with an adequate source and supply of water at no charge. However, if the Owner's water supply is not available or not functioning, the Contractor shall be responsible to furnish adequate supplies at his own cost.

PART 3-EXECUTION

3.01 CONSERVATION REPORT

- A. Document the condition of each grave marker scheduled to receive conservation treatments under this contract with a survey sheet, and digital photographs prior to proceeding with any work. Stones that require resetting and no further treatment can be photographed when they are out of the ground and lying flat. Markers that require resetting only do not require a survey sheet unless, upon removal from the ground, the marker requires additional treatment.
- B. Some of the markers listed in these Specifications are identified in the Conditions Assessment Reports as fragmented/broken. In addition, some of the markers that are scheduled for treatment and/or resetting may turn out to be incomplete when they are removed from the ground. It is the contractor's responsibility to make every attempt to find and rejoin separated fragments. In the cases where fragments cannot be located, it is the contractor's responsibility to either extend the length of the stone or, supply a custom made case concrete base.
- C. Submit conservation treatment plan to the Project Consultant for approval prior to proceeding with any work.
- D. Complete specified conservation treatments for each marker.
- E. Survey Sheet: Each marker that is treated under this contract shall have an individual survey and treatment sheet. The survey sheet shall record the plot number of the marker as indicated on the existing survey, the name of deceased, (where legible) and the year of death. The survey sheet shall contain an outline sketch of the marker and/or a photograph. All conditions and treatment must be noted on the sketch or photograph. The type of material and the rough dimensions of the marker shall also be recorded on the survey sheet. A sample survey sheet shall be submitted at the start of the contract. 1 set of completed survey and treatment sheets shall be placed in archival sleeves and turned over to Boston Parks and Recreation in binders with the balance of the project documentation when the project has been completed. The project binder shall contain all survey and treatment documentation sheets plus hard copies of the manufacturer's data sheets and MSDS sheets for all products used in the treatments. In addition, all before, during and after digital photographs as well as digital copies of the survey and treatment sheets shall be placed on an external thumbdrive and presented to the client. Provide a thumb drive with the complete documentation.
- F. Photo-documentation: Each marker that is treated under this contract shall have at least 2 views photographed with a digital camera that records images in not less than 6 megapixels. The views shall show the markers from the front and back or top or side depending on the scope of the treatments. There shall be at least 1 view taken before treatment and one view after treatment for a minimum of 2 photographs per marker. Additional images shall be provided where they are necessary to convey all the pertinent information about the treatments. All photographs of the before treatment phase are to be reviewed prior to starting treatments. Dark or unreadable photographs should be redone. All photographs are to be labeled electronically with the map identification number and name of the deceased and submitted with the documentation binders on an external thumb drive as per the above paragraph.
- G. Document all treatments with digital photographs and notes on treatment documentation sheets during conservation work. Photo documentation shall consist of before and after photographs as well as "during" photographs for markers that were broken, cracked or fragmented.
- H. Thoroughly document condition of gravestone or footstone after conservation work is complete with digital photographs as well as marked sketches and/or annotated photographs that indicate the locations of individual treatments.
- I. Provide Boston Parks and Recreation with two complete project binders at the end of the project containing the following: Copies of all survey sheets with proposed treatments, copies of final treatment reports plus any field reports, and project correspondence. Include material safety data sheets, and manufacturer's cut sheets for all products. In addition, provide a thumb drive of all of the above plus before, during and after treatment photographs organized by the name(s) of the deceased and the map id numbers assigned to the markers on the map of Westerly Burial Ground.

3.02 TESTING OF CLEANERS AND STRIPPERS

- A. Prior to large scale application of cleaners, the Contractor shall test the materials in 1'x1' test areas to determine the best products and techniques.

3.03 REMOVAL OF ORGANIC STAINING ON MASONRY

- A. When using chemical cleaners, follow the manufacturer's instructions, in general, and specifically related to mixing, dwell time, and removal.
- B. As required by the manufacturer's instructions, pre-wet the gravestone prior to cleaning. Stone is very porous and requires this pre-wetting so the cleaner stays on the surface.
- C. Keep the stone wet during cleaning and rinse afterwards. Do not allow the cleaner to dry on the stone. Evenly apply the cleaner with a low-pressure sprayer to saturate the surface.
- D. No high pressure water spraying is allowed.
- E. Agitate the stone surface with a soft bristle brush.
- F. Thoroughly rinse the stone with water to remove all debris and cleaner residue.

3.04 PRE CONSOLIDATION/STABILIZATION PRIOR TO TREATMENTS

- A. The goal of pre consolidation shall be to secure all loose, semi-detached or friable areas against loss during other conservation treatments including pointing and cleaning. Contractor will be held responsible for losses on the stone that take place during conservation treatments therefore the extent of pre-consolidation shall be that which is in the contractor's judgment sufficient to secure against losses. Submittal shall be for materials and methodology not extent of pre-consolidation.
- B. Acrylic Resin B-72 dissolved in a solvent such as acetone approximately 5% solids shall be applied with a brush to areas requiring pre-consolidation. Japanese tissue paper shall be applied to wetted areas. Additional solution of B-72 may be applied over tissue paper. Where conditions permit, water soluble adhesives may be substituted for B-72

3.05 REMOVAL OF PRIOR MORTAR FILLS AND COMPOSITE MORTAR REPAIRS

- A. Pre-consolidation as described above shall precede all raking out of joints, removal of mortar caps and prior composite mortar or adhesive repairs. It is the conservator's responsibility to preconsolidate all loose and friable areas of stone prior to starting other treatments.
- B. Surface tension and bond of prior repairs may be broken using power tools such as small diamond cutting wheels, Dremmel Tools and small pneumatic chisels. All other removal to be performed by skilled craftsmen using hand tools. Use of hand held grinders or other power tools shall be only after demonstrated proficiency by each craftsman/conservation technician on selected control areas. Cutting wheel shall not be brought in proximity with stone surface or edges. Cutting wheels shall be used only to break the bonds to create entry points for hand tools. Every precaution shall be taken not to damage, nick, scar or abrade the stone.

3.06 MORTAR FILLS AND MORTAR CAPS -GENERAL

- A. The goal of mortar fills and caps is create the maximum water shedding fill, joint or seam for each particular configuration of stone.
- B. Surface of fill shall be tooled and slicked to conform to the contours of the edge of the stone in order to achieve maximum water shedding.
- C. Mix mortar to specified proportions and in conformance with the color and texture of approved samples.
- D. Apply mortar to stone that has been properly prepared and is free of dirt, soiling and any loose or friable material or surface accretions that may have a detrimental effect on the bond. Wet stone to avoid excess absorption of moisture from mortar.
- E. Apply mortar in consecutive lifts where required to avoid excessive shrinkage.
- F. Moist cure mortar for a minimum of seven days or until mortar is properly cured.
- G. When mortar has cured, tint surface of mortar with approved product.

3.07 MORTAR APPLICATION FOR FILLS AND MORTAR CAPS

- A. First layer to create a uniform depth for later applications and to be thoroughly compacted into cavities: apply mortar to a maximum thickness of 3/8"
- B. After voids have been filled to a uniform depth, apply remaining mortar in successive 1/4" thick layers: fully compact each layer and allow to dry to thumbprint hardness before applying next layer.
- C. When final layer is thumbprint hard, tool to match approved sample.
- D. Avoid feather-edging of mortar joint.
- E. If existing stonework has rounded edges from wear, recess slightly the mortar from face of stone surface.
- F. Immediately after completion, remove excess mortar by light brushing with a natural bristle brush. Do not leave encrusted matter.
- G. Keep mortar damp for 48 hours after pointing to permit proper hardening of mortar. Cover masonry temporarily with burlap, which is moistened periodically. Cover wall with plastic sheets temporarily to prevent evaporation. Continue to Moisten for up to seven days if required because of high temperatures or high winds. Protect mortar from overnight rain.
- H For proprietary mortars; follow manufacturer's directions for applying and curing mortars.

3.08 CLEANING AFTER MORTAR FILLS OR PATCHING OR GROUTING

- A. The face of all stonework shall be thoroughly cleaned after completion of the pointing and other work liable to soil the stone. The stonework shall be gone over and any mortar splashes or smears shall be carefully removed from the surface with scrapers.
- B. The cleaning shall be done with clean water applied vigorously with fiber brushes. After cleaning with brushes the stone shall be thoroughly rinsed with clear water. Proprietary cleaning compounds containing caustic agents, intended for removing mortar smears shall not be used. The goal is to remove all smears before they set so that caustic agents are not required.

3.09 CLEANING OF MARKERS

- A. The goal of the stone cleaning is to produce a surface that is free of organic growths and general soiling prior to adhesion, grouting or application of repair mortars. This includes removal of surface dirt, encrustations and prior repairs but it is not intended to include cleaning to the point that marble surfaces have a bright white or "as new" appearance.
- B. Pre-Wet surface of stone with potable water. Apply Triton X-100 Non-ionic detergent diluted with water to stone surface using a natural bristle brush. Allow detergent and water to remain on surface for length of time determined in cleaning mock-ups. Rinse surface with water from garden hose.
- C. Repeat water and non-ionic detergent wash or proceed to clean with other specified cleaning agents as determined by the results of cleaning mock-up.

3.10 RE-ADHESION OF STONE (NON STRUCTURAL)

- A. Prepare mating surfaces of stone that is to be re-adhered by cleaning surfaces until surfaces are free of dirt, sand, old grout, old mortar, ferrous metal stains or deposits and organic materials. After cleaning with specified cleaning agents clean with specified solvents just prior to apply adhesive materials.
- B. Loose pieces of stone shall be reattached with Acrylic Resin B-72 dissolved in a solvent such as acetone. Approximately 10%-15% solids. Area of stone to receive reattachment and piece

to be reattached shall be thoroughly coated with adhesive. Secure fragment until adhesive is set. Secure with reversible means. Clean surface of stone so that no adhesive residue remains on surface.

3.11 B-72 INJECTIONS FOR AREAS OF SHALLOW EXFOLIATION

- A. Using a hypodermic needle, inject solvent into crack or fissures to clean surfaces. After solvent has evaporated inject Acrylic B-72 10-15% by volume in solvent. Wipe surface clean and remove any excess with solvent. Hold acrylic back ½ inch from face of seam with clay. Remove clay and grout seam face with either Edison Custom 45 Tinted to match or bulked and tinted B-72.

3.12 ADHESIVE REPAIRS (STRUCTURAL)

- A. Prepare mating surfaces by removing prior adhesives where applicable and cleaning to remove soiling with detergents as specified above. Use solvents to remove any oil or grease from the mating surfaces.
- B. Lay fragments to be adhered on clean flat surface if marker has been removed from ground and locate the centerline of holes for pins. The diameter of the pin shall not exceed 20% of the width of the marker. Markers under 2" in thickness, as well as markers that are actively delaminating, shall not be pinned. Minimum pin embedment on either side of the joint shall be three inches. Holes shall be 1/16" larger than the diameter of the pin.
- C. Drill holes to receive pins where applicable. Blow dust out of drill holes. Test fit by placing pins in holes and dry setting. Set pins in edge of one fragment with epoxy and then dryset fragments to ensure that the pins are in the proper locations. Mate surfaces. Do not apply epoxy to mating faces or other end of pin at this point. Adjust fit using clamps and jigs to hold stone in place. It is important that proper mating be achieved at this point. When the epoxy in the pin holes has set, separate pieces and apply epoxy to other end of pins and sparingly along mating surfaces. Reclamp stones and keep under pressure until epoxy has set. Set time will vary depending on temperature of air and stone.
- D. For fragments that will not be pinned, follow steps above for cleaning and dry setting to ensure proper fit. Use clamps and jigs as required to secure pieces.
- E. For fragments to be adhered while marker is still in the ground, follow steps above for cleaning. Use jigs and flat surfaces clamped to the stone in order to achieve best possible mating of surfaces.
- F. Mix and apply adhesives as per manufacturer's recommendations.
- G. Hold glue line away from face of stone in order to grout seam with tinted grout. Immediately remove any adhesive residue that has flowed over the face of stone using acetone or other solvent.
- H. Apply a tinted grout to the seam after the structural epoxy has set. Grout in seam should be flush with edges of stone on either side of the repair

3.13 REMOVAL OF MARKERS FROM THE GROUND

- A. Carefully dig on both sides of the marker without damaging or scraping the marker.
- B. If lifting equipment is required to lift the marker out of the hole, carefully place straps around marker so that the straps will not abrade or scratch the stone. For soft or friable stones such as deteriorated marble, place moving blankets around marker prior to securing straps and lifting marker.
- C. Store markers or component pieces of markers in a safe location. Cover markers when necessary to prevent damage or soiling.

3.14 REMOVAL OF OLD SETTING MORTARS FROM STONES OR SLOT BASES

- A. Carefully remove existing setting mortars with hand held chisels being careful not to damage the

edges or faces of the stones.

- B. Completely remove old setting mortar in order to ensure a good bond for the new setting mortar.

3.15 REMOVAL OF EXISTING FERROUS PINS AND/OR EPOXY ADHESIVES FROM EXISTING PIN CONNECTIONS

- A. Carefully remove existing pins by either drilling into the grout, mortar or epoxy around the pin until the pin is free or by core drilling around existing pins.
- B. After core drilling carefully remove any remaining cement in the setting holes by chipping out the cement with small chisels.

3.16 RESETTING SINGLE PIECE UPRIGHT MARKERS (SLAB MARKERS)

- A. Carefully remove and retain sod with topsoil retained in the root systems. Following sod removal, remove topsoil down to a depth where it becomes sandy and retain for reuse. Remove balance of earth to required depth without damaging marker. If marker is broken below grade search soil for fragments and reattach fragments. If no fragments are located proceed to extend the stone or manufacture a custom slot base so that it can be set with the letting and carving above grade.
- B. Shoring and Bracing: Slope excavations and provide shoring and bracing as needed to prevent collapse of the soil.
- C. Mark site of excavation with caution tape and orange cones and protect area by covering hole with plywood to prevent anyone from stepping into hole.
- D. Dewatering and Drainage: Remove water from hole using appropriate methods and protect excavations from surface runoff.
- E. When resetting single piece upright markers, place backfill in lifts of not more than 6" and compact material around grave marker prior to starting next lift. Brace the grave markers as required while surrounding them with compacted structural fill. Replace top soil and sod to existing depths.
- F. Disposal: Dispose of excess materials off site in a legal manner.
- G. Cold Weather: Do not reset grave markers when temperatures are below freezing or the fill could freeze prior to compaction.
- H. Stockpile soil, sod and inorganic soil removed from grave on site in separate piles for reuse.
- I. Protect all grave markers from damage during excavation and backfill operations.

3.17 RESETTING MARKERS IN EXISTING OR NEW SLOT BASES

- A. Reset slot base on six inches of compacted gravel and sand. Do not widen holes so that fill is visible around the edges of the base. Set slot base to its original depth so that top of base is at or just above grade for historic markers with existing slot bases. Set new slot bases created for broken markers below grade so that concrete base is not visible.
- B. After slot base has been cleaned of old mortar and re-set, set upright portion of marker in slot using specified grout/mortar. Compress setting grout/mortar and add another lift of mortar to create a bevel that will shed water away from the slot. Brace markers in place until setting mortar has cured and slab will not shift.
- C. Do not cut the bottom edge of broken markers to make a level edge if the break occurs in an area of carved lettering or decorative carving.

3.18 CASTING OF NEW SLOT BASES

- A. Cast new concrete bases using wood forms and a removable insert to create the slot. Slot in base should be wide enough on all sides to allow for a soft mortar to be installed between the stone and the concrete. Slot should contain drainage holes to keep water from accumulating in

the slots.

3.19 EXTENTIONS TO SLAB MARKERS THAT ARE TOO SHORT TO BE RESET

- A. Stone extensions: Markers that are too short to be reset in the ground without covering the existing lettering and carvings can be extended with natural stone in the same manner that fragments of broken markers are reattached. See paragraph 3.12 Adhesive Repairs (Structural). The new piece of stone must be of the same with and thickness as the original and from the same geological class of stone. i.e. marble with marble and slate with slate. The new piece of stone must be coped out to mate with existing piece of stone without removing any of the historic material that contains carving or lettering.
- B. Cast Stone Extensions: Markers that are too short to be reset in the ground without covering the existing lettering and carvings can be extended with cast concrete. Stainless steel pins must be secured to the stone with an approved epoxy prior to casting the extension. The stainless steel pins shall be bent in an "L" or "J" configuration to create a mechanical bond between the stone and the cast concrete extension.

3.20 TREATMENTS TO MARKERS ENCASED IN CONCRETE COVERS

- A. Remove concrete covers around markers without damaging grave markers. Cut and chip concrete using diamond cutting blades and carbide tipped hand chisels.
- B. Carefully cut concrete without touching markers. Chip concrete with carbide chisels when it is not possible to remove additional concrete without coming too close to the stone.
- C. Salvage all fragments of markers used as shims between the primary marker and the concrete. Evaluate fragments with City of Boston's representative for additional treatment.
- D. If additional fragments of the primary marker that was encased in concrete can be located, repair marker and reset in ground. If no original fragments are located, extend markers using techniques described in paragraph 3.18 and then reset in ground.

3.21 RESETTING BASE AND DIE GRAVESTONES

- A. Base and die gravestones
 - 1. Remove die that is on the ground or that is out of plumb.
 - 2. Remove base.
 - 3. Excavate hole gravel subbase and base.
 - 4. Reset base stone to be plumb and level.
 - 5. Set die on top of base on prepared lime based mortar setting bed.
 - 6. If the base and die have connecting pins, anchor stainless steel all-thread rods in holes with epoxy.
 - 7. Tool mortar base with a concave shape.
 - 8. Place topsoil and seed.
- B. Document conditions following resetting

3.22 MARBLE GRAVESTONE CONSOLIDATION

- A. Document conditions prior to conservation.
- B. Clean all gravestones per the specifications above.
- C. Before applying, read "Preparation" and "Safety Information" sections in the Manufacturer's Product Data Sheet for OH100 Consolidation Treatment. Use in concentrate; do not dilute or alter. Stir or mix well before use.
- D. Apply by low-pressure spray, brush or dipping. Larger surfaces should be treated using low-pressure spray equipment, small areas with spray tanks. Mobile objects such as sculptures are best treated indoors by dipping or with the use of compresses.

- E. Apply H100 Consolidation Treatment in repeated applications referred to as "cycles." A cycle consists of three successive saturating applications at 5-15 minute intervals. Typical treatments involve two or three cycles (6-9 separate applications).
- F. Allow 20 to 60 minutes between cycles.
- G. Apply H100 until excess material remains visible on the surface for 60 minutes following the last application.
- H. Immediately flush excess surface materials using industrial grade MEK (methyl ethyl ketone) or mineral spirits. If a second treatment is necessary, allow two to three weeks curing time following first treatment.
- I. Cleanup: clean tools and equipment immediately with mineral spirits, denatured alcohol or an equivalent cleaning solvent. Remove over spray and spills as soon as possible.
- J. Document conditions following conservation.

3.23 SITE RESTORATION

- A. Follow gravestone restoration, place topsoil, compact and seed. Place pelletized seeding mulch over the seeded area.

3.24 PROTECTION

- A. Protect all surfaces adjacent to the masonry to be cleaned to avoid splatter, overspray, dripping, or unintentional cleaning.

**-END OF SECTION 04 01 40-
GRAVESTONE RESTORATION**