

** Recommendations that are yearly maintenance are initial cost these will be less following restoration.

Fort Lee

Short-Term

Project Area at Fort Lee

	Location	Cost
Establish Friends of the Forts Committee and hold public participation meetings.		
** Add selected fill material to eroding areas, seed and compact by hand.		\$6,000
** Monitor erosion and replace soil wash.		\$2,000
** Add approved ground cover to bare areas and maintain. Seed areas that are eroding.		\$8,000
Identify and protect existing stone monuments		\$300
Construction Costs		\$16,300
Contingencies (40%)		\$6,520
TOTAL		\$22,820

Mid-Term

Project Area at Fort Lee

	Location	Cost
Selectively remove vegetation to allow site survey to be completed and contract for complete site survey.		\$7,000
Contract for a complete topographic survey for use in planning and design. (Cost included below)		\$15,000
Modify Restoration Master Plan as required with new information and with new phases if appropriate.		\$10,000
Prepare technical specifications and working drawings for proposed Mid- Term restoration. (Cost included below)		
Construction Costs		\$32,000
Design Costs and Contingencies (40%)		\$12,800
TOTAL		\$44,800.

Long-Term

Project Area at Fort Lee	Location	Cost
Clear vegetation to allow original fort form to be recognizable and to create viewing areas from the ramparts. Large trees in specific areas may remain; however, the final recommendations must be made after a complete topographic survey is compiled.		\$15,000
Where ramparts have been damaged by erosion, or soil instability, corrective action is required. Depending on the level of treatment prescribed, earthwork may involve work ranging from interim stabilization to full restoration of a section to be used as an interpretive guide.		
Install vegetative materials. (2)		\$10,000
Install compacted gravel on formal walks. (2)		\$15,000
Restore sections of the rampart to the original form (3)		\$20,000
Remove part of Memorial Drive that separates Fort Lee from the Salem Willow Park. (1)		\$50,000
Extend new concrete walks and ramps from Salem Willows to Fort Lee. (1)		\$35,000
Modify grades to create wheelchair accessible access to top of rampart. (3)		\$20,000
Construct a new Forts Visitor's Center at the east open area visible from Fort Ave. This center should house some of the appropriate artifacts of the fort area and displays should be developed to convey an understanding of the geology, prehistory and history of the forts and their importance to Salem. (1)		\$350,000
Build parking area off of Fort Avenue. (1)		\$150,000
Provide new interactive interpretive kiosks at main entry to fort. (1)		\$8,000
Provide new plaque type interpretive signs at specific locations in existing stone. (2)		\$10,000
Fund and implement maintenance program (cost can be determined following final restoration)		
Construction Costs		\$668,000
Design Costs and Contingencies (40%)		\$267,200
TOTAL		\$935,200

Fort Pickering

Short-Term

Project Area at Fort Pickering	Location	Cost
Establish Friends of the Forts Committee and hold public participation meetings.		
** Add selected fill material to eroding areas and compact by hand.		\$5,000

** Monitor erosion and replace soil wash.	\$1,500
** Add approved ground cover to bare areas and maintain.	\$3,000
Barricade paths to prevent further erosion at entry stone rampart. Barricade path to prevent further erosion at Waikiki Beach. Barricade path to prevent further erosion at Winter Island beach. Barricade path through rampart. Barricade path at bunker B.	\$1,000
Prepare technical specifications and working drawings for proposed short-term restorations. (Cost included below)	\$0
North Entry Wall	\$6,000
West Face: Chink voids in joints to match existing chinking, and fill large void on left side with a single stone plus chinking. Restore soil cover to parade side flank. Remove graffiti. (1)	
Moat Face: Rebuild with added chinking to match character of west face. Restore soil cover to top. (2)	
North Rifle Gallery Rear Wall	\$8,000
Rebuild corners at rifle gallery passage, and at west end as required to stabilize the flanking walls and retain soil. Rebuild remainder only as required to stabilize erosion and secure random loose stones. Maintain general existing appearance of wall, but use 1942 photo as guide for rebuilding the rifle gallery passage.	
East End Walls @ North Moat	\$3,000
Limited rebuilding and chinking of wall "An" as necessary to support an improved pathway and reset any loose stone. The extent of repair needed at wall "B" cannot be determined until the vegetation is removed. (1)	
West Moat	\$7,000
Remove existing vegetation along all banks and determine full extent and condition of rip rap. Assuming moat is to remain as is (i.e., not dug out and re-filled), repair only as necessary to stabilize the rip rap in its current state.	
West rampart and Rifle Gallery	\$5,500
Remove existing vegetation from walls. (1)	
Rechink to secure any loose stones. (1)	
Partially rebuild the northern portion where it bulges as required to stabilize it. (2)	
South and East Ramparts	\$8,000
Remove existing vegetation using care to not disturb any stones including those that appear to be lying at random. (1)	
Rechink any loose or missing stones in the areas having organized stone parapet walls. (1)	
Tidal Rip Rap	\$2,000

	Inspect rip rap every spring for loose or dislodged stone, and soil erosion at its top perimeter; repair any such defects as they occur.	\$500
	Magazine A	
	Clean modern debris and accumulated silt off the stairs and the corridor floor below. (1)	\$6,000
	Magazine A	
	Regrade the surface area outside the entry and/or rework the door and threshold to direct surface runoff away from the staircase.	
	Replace the missing lintel stone at the top of the entry.	
	Include archeological recovery for any work that will remove existing soil. See text above for more detailed discussion.	
		\$1,500
**	Magazine B	
	Clean modern debris and accumulated silt off the corridors, stairs and the magazine floor. (1)	\$1,000
**	Magazine B	
	Monitor magazine ceiling for any substantial increase in seepage (check yearly in spring after winter thaw, and after periods of prolonged heavy rain). Actively investigate roofing conditions from above and institute repairs only if leakage develops to an extent threaten that the integrity of the magazine	\$2,000
**	Magazine C	
	Clean modern debris and accumulated silt off the corridors, stairs and the magazine floor. (1)	\$3,500
	Magazine C	
	Restore the soil cover over the exposed vault masonry above the entry corridor.	
	Take steps to discourage people from climbing up the mound at this location.	\$2,500
**	Magazine C	
	Monitor spalled brick in magazine wall for any substantial increase in seepage (check yearly in spring after winter thaw, and after periods of prolonged heavy rain). Actively investigate conditions and institute repairs only if leakage develops to an extent threaten that the integrity of the magazine.	\$18,000
	North Bastion Masonry (Igloos)	
	1. Fully excavate the rear side of a vertical panel under the joint direction of an archeologist and an architectural conservator in order to determine: (3)	
	a. The construction detailing of the rear side of the panels and assess the feasibility of replacing severely spalled vertical panels.	
	b. The extent that replacement of individual vertical panels would impact potential remaining archeological features of the bastion.	

2. Clear all woody vegetation from the top of the bastions. At a minimum the area within 4' of the concrete panels should be cleared. Woody roots should be physically removed adjacent to the panels assuming their removal will not affect archeological features, will not further damage the panels, and that the soil surface will be immediately treated to prevent further erosion. (1)

3. Provide fill to bring the soil surface level to the top of the panels. (1)

4. Remove and store for future reinstallation any of the top igloo panels that are in danger of falling, or reset them to make them secure.

5. Remove graffiti (leaving it in place is an open invitation for more extensive graffiti). (1)

6. Clean out drainage swale on the inner side of the concrete roadway. (1)

Construction Costs

Design Costs and Contingencies (40%)

\$85,000

TOTAL

\$34,000

\$119,000

Mid-Term

Project Area at Fort Pickering

	Location	Cost
Selectively remove vegetation to allow site survey to be completed and contract for complete site survey.		\$20,000
With complete survey prepare final Restoration Plan with phased development if required.		\$30,000
Prepare plans and technical specification for proposed mid Term restorations. (Cost included below)		0
East End Walls @ North Moat		\$20,000
Fully rebuild both walls (A and B) to their original height and character with tight chinking. (3)		
West rampart and Rifle Gallery		\$3,000
Provide signage to interpret the archeological features at the southern end of the west rampart (rear rifle gallery wall, wood beam ends, chimney slot, and rifle gallery front foundation). (1)		
South Ramparts		\$10,000
Carry out archeological testing at locations of former embrasures and gun emplacements for evidence of their construction detailing. (3)		
Carry out additional document research at the National Archives and Coast Guard archives for details of original construction and later changes.		
Magazine A		\$8,000

Examine existing newel area of stair and related period examples and literature to determine how best to restore the missing newel post. The study should include an engineering evolution of the newel area and the masonry immediately above it, and sophisticated analysis of the historic mortar to design a suitable mortar formula for rebuilding work.

\$5,500

Magazine B

Replace framing and sagging plywood floor at base of stone stair to provide a sound landing platform. (2)

Replaces missing lintel in doorway to magazine vault sized to match the void of the original lintel. Use rot resistant wood such as white oak or black locust instead of modern pressure treated lumber or common pine. (1)

\$5,000

Magazine B

In magazine vault Restore 2 ventilation slots where the brick is missing using matching water struck brick and a 1:1:6 mortar mix (Type S hydrated lime: white Portland cement: sand) tinted to match adjacent mortar. (1)

At exterior entry cut and repoint capstone joints and open wall joints using 1:1:6 mortar. (1)

At exterior sidewall fill in areas of missing stone with new stone similar in general size, shape, and finish to the existing, and rechalk entire wall without using mortar. (2)

\$8,500

Magazine C

Replace missing brick over current metal entry door. (1)

Replaces missing lintel in doorway to magazine vault sized to match the void of the original lintel. Use rot resistant wood such as white oak or black locust instead of modern pressure treated lumber or common pine. (1)

\$5,000

Magazine C

At exterior entry cut and repoint capstone joints and open wall joints using 1:1:6 mortar. (1)

At exterior sidewall fill in limited areas of missing stone and open mortar joints with new stone similar in general size, shape, and finish to the existing, using 1:1:6 mortar mix. (1)

\$115,000

Construction Costs

\$46,000

Design Costs and Contingencies (40%)

\$161,000

TOTAL

Long-Term

Project Area at Fort Pickering

Location Cost

Remove vegetation as required by the final restoration plans.

\$10,000

Regrade areas to conform to approved final restoration plan.	\$12,000
Excavate to stable soil materials and make repairs to structures, foundations, and waterproofing materials as required.	\$15,000
Install new drainage systems or repair existing systems.	\$10,000
Install vegetative materials for ground cover and stabilization.	\$12,000
Construct formal paths and reconstruct original walls and ramparts at Waikiki Beach and Winter Island Beach	\$20,000
Re-grade earth rampart to restore original earth form.	\$25,000
Remove fill between bunker A and B.	\$10,000
Remove existing wooden telephone pole and abandoned conduits.	\$4,000
Level and construct new paths from parking to viewing area.	\$25,000
Modify grades to create wheelchair accessible access to top of rampart.	\$15,000
Repair all earth ramparts at bunkers.	\$35,000
Create a viewing platform and stair access to top of the Bomb Proof Magazine Bunker.	\$20,000
Re-grade earth rampart to restore original earth form.	\$50,000
Enlarge the grass entry area removing the entry drive and create Fort Pickering accessible and designated parking.	\$100,000
Create a main entry plaza with informational kiosk.	\$35,000
Provide new interactive interpretive kiosks at main entry to fort.	\$15,000
Provide new plaque type interpretive signs at specific locations.	\$20,000
West Moat	\$45,000
Dredge and restore moat with reconstruction of any missing or badly deteriorated rip rap to match the rip rap at the north moat, including the berm at the south end. Restoration of the moat would also likely require opening a clear passage for water flow under the causeway from the north moat. (3)	
West rampart and Rifle Gallery	\$150,000
Reconstruct the entry end of the west rampart to match the contours documented in the 1864 drawing, including a section of the rifle gallery. The total length should be about 60' terminating at the former passage from the parade. This should be coordinated with the restoration of the west moat. (3)	
Consider using the interior of the reconstructed rifle gallery as a visitor center. (1)	
South Ramparts	\$20,000
Consider restoring more sections of organized stone parapet walls along the ramparts if further research and physical evidence indicates they were present. (3)	

South Ramparts	\$24,000
Consider reconstruction of an embrasure and gun emplacement to further the interpretation of the fort, depending on the results of archeological testing and research. (3)	
Magazine A	\$8,000
Restore the missing staircase newel post and related masonry including any broken or partially missing stair treads. (2)	
Magazine A	\$1,500
Consider opening the interior of this magazine to guided public tours for small sized groups, assuming safety and liability issues can be resolved.	
Magazine A	\$1,000
Monitor condition of interior masonry regarding spalled brick and eroded mortar joints on a yearly basis, but do not replace spalled brick or repoint masonry unless significant deep deterioration is detected.	
Magazine B	\$15,000
If the magazine is to be opened for limited public tours, consider restoring the wood floor in the magazine vault to match the existing 2" plank floor, applying whitewash to the masonry, and redoing the electric lighting. (2)	
Recommendations - Magazine C	\$8,000
If the magazine is to be opened for limited public tours, consider restoring the wood floor in the magazine vault to match the existing WWII flooring, applying whitewash to the masonry, and redoing the electric lighting. (2)	
North Bastion Masonry (Igloos)	\$45,000
Replacement of the 16 missing or severely spalled 4' panels over the igloos, along with minor patching and realignment of the remaining 14 sound units (many of this units are severely dislodged). Note that this will require 3 distinct casting patterns, and will also require the fabrication of at least 40 bronze retaining clips in at least two different configurations (1 at the tops and 1 at the lower sides).* (1)	
Plastic patching repair of edge spalls at the igloos (14 individual repairs)* (1)	
Plastic repair to shallow surface spalls at the igloos (12 locations)* (1)	
Replacement of severely spalled vertical panels (9 panels total, 5 being on the south wall)* (3;see Item #1 above)	
Plastic patching repair and/or replacement of vertical panels having moderate spalls, together with realignment of severely dislodged vertical units. (3;see Item #1 above)	
Incipient spalls; postpone repair until spalling becomes more fully developed, at which time carry out plastic patching. (1)	
At the roadway carry out plastic patching repairs to any areas where the surface spalling has deepened to become a hazard to pedestrian usage; treat the patched	

surface to reproduce the original brushed surface texture. (1)

* The number of repairs listed in the above recommendations are estimates of current conditions based on a very brief survey. The execution of plastic repairs And replacement of deteriorated units should be preceded by a resurveying of the units on a detailed level, and the preparation of detailed technical specifications based on the literature cited in the appendix.

Fund and implement maintenance program (cost can be determined following final restoration)

Construction Costs

Design Costs and Contingencies (40%)

\$750,500

TOTAL

\$300,200

Notes

\$1,050,700

1. Further archeological testing and recovery is not required for this activity.
2. Further archeological testing and recovery is required only if the specific construction work will require removal of soil below existing grade, or where rebuilding sections of retaining walls will likely dislodge the soil behind the wall.
3. Substantial additional archeological research and testing is required for this activity prior to construction.

Limits of Cost Estimates

Since we do not have any control over the cost of labor, materials or equipment, or over the contractor's method of determining prices, or over competitive bidding or market conditions, our opinions of the probable construction cost provided for herein are made on the basis of our experience and with reference to standard estimating manuals (Means Building Construction Cost Data) and these opinions represent our best judgment as architects familiar with the construction industry. However, we cannot and do not guarantee that proposals, bids or the actual construction cost will not vary from our opinions of the probable cost prepared by us. If greater assurance of the construction cost is desired a professional cost estimator should be retained.

LIST OF FIGURES

- Figure 1 Defense of Salem 1822
- Figure 2 Post card of Fort Lee from Salem Willows
- Figure 3 Aerial photograph of Winter Island
- Figure 4 Plan of Salem c. 1893
- Figure 5 Partial Plan of Fort Lee c. 1820
- Figure 6 Rochefontaine's Plan of Fort William
- Figure 7 Plan of Fort Pickering, 1864
- Figure 8 Forts Location Plan
- Figure 9 Fort Lee Existing Boundary Plan
- Figure 10 Fort Lee and Salem Willows Existing Site Plan
- Figure 11 Fort Lee Master Plan
- Figure 12 Fort Pickering Existing Site Plan
- Figure 13 Fort Pickering Master Plan
- Figure 14 Gun on display at Fort Lee
- Figure 15 Plan of Fort Lee, 1820
- Figure 16 Plan and Sections of Fort Lee, 1864
- Figure 17 Fort Lee proposed alteration, 1863
- Figure 18 Plan of Fort Lee's most visible remaining features
- Figure 19 Fort Lee proposed alterations, 1863
- Figure 20 Fort Lee, 1865
- Figure 21 Photograph of Fort Lee, 2003
- Figure 22 Plan of Existing Paths at Fort Lee
- Figure 23 Plan of Proposed Paths at Fort Lee
- Figure 24 Plan of Existing Paths at Fort Lee
- Figure 25 Granite Stairs at Fort Lee
- Figure 26 Postcard of view from Fort Lee Ramparts to Beverly
- Figure 27 Viewing Area at Fort Lee
- Figure 28 Photograph of vandalized plaque stone, Fort Lee
- Figure 29 Photograph of remaining plaque at Fort Lee
- Figure 30 Ruins of Fort Pickering, 1942
- Figure 31 Plan of existing features, Fort Pickering
- Figure 32 Aerial photograph showing approximate location of Rochefontaine's 1794 design of Fort William
- Figure 33 Plan of Fort Pickering, 1936
- Figure 34 Approximate outline of the 1864 drafted plan of Fort Pickering
- Figure 35 Approximate outline of Crane and Morrison's plan of basic topographic features
- Figure 36 Photograph of Fort Pickering, 1942
- Figure 37 Photograph of Fort Pickering, 2003
- Figure 38 Photograph of Fort Pickering Parade and Bunkers
- Figure 39 Plan of Proposed Vegetation and Landforms, Fort Pickering
- Figure 40 Photograph of Waikiki Beach, Winter Island 2003
- Figure 41 Photograph of steps near Lighthouse, Winter Island, 2003
- Figure 42 Plan of Existing Paths
- Figure 43 Plan of Proposed Paths, Winter Island
- Figure 44 Rochefontaine's 1794 Blockhouse Elevation
- Figure 45 Aerial photo of Fort Pickering
- Figure 46 Restoration Master Plan of Fort Pickering
- Figure 47 Photo of Fort Pickering Gate
- Figure 48 Current appearance of north rampart, north wet ditch and entry to Fort Pickering
- Figure 49 Photo of north rampart, Fort Pickering c. 1860's
- Figure 50 Dry laid stone wall, Fort Pickering
- Figure 51 Conjectural section of current condition of north rampart, Fort Pickering
- Figure 52 Section of current condition of north rampart, Fort Pickering
- Figure 53 Photo of north rampart, Fort Pickering, C. 1860's

- Figure 54 Photo of west rampart, Fort Pickering C. 1900
- Figure 55 Main entry wall at north rampart, Fort Pickering
- Figure 56 Parade side flank of entry wall, Fort Pickering
- Figure 57 Entry wall at wet ditch side, Fort Pickering
- Figure 58 Rifle gallery wall, current view, Fort Pickering
- Figure 59 Rifle gallery wall, 1998 view, Fort Pickering
- Figure 60 Passage from parade through rampart, Fort Pickering
- Figure 61 Photo looking over remains of north rampart, rifle gallery at Fort Pickering
- Figure 62 East end of moat, current view, Fort Pickering
- Figure 63 East end of moat c. 1900, Fort Pickering
- Figure 64 Erosion on path behind wall "A"
- Figure 65 Overview of remains of west rampart
- Figure 66 Remains of rifle gallery rear wall, Fort Pickering
- Figure 67 Remains of beam end of rifle gallery
- Figure 68 Parapet wall at south rampart, Fort Pickering
- Figure 69 Parapet wall eastward from south rampart, Fort Pickering
- Figure 70 Aerial photograph of Fort Pickering c. 1942
- Figure 71 Portion of 1864 plan
- Figure 72 1830 drawing by West Point Cadet Thomas J. Lee
- Figure 73 Sections of 1864 plan of Fort Pickering
- Figure 74 1864 plan of Fort Pickering
- Figure 75 Entry to magazine A, Fort Pickering
- Figure 76 Southerly vault of magazine A, Fort Pickering
- Figure 77 Outer end of vault in magazine A, Fort Pickering
- Figure 78 Stair treads magazine A, Fort Pickering
- Figure 79 Lower portion of spiral stair magazine A, Fort Pickering
- Figure 80 Top of spiral stair magazine A, Fort Pickering
- Figure 81 Top of spiral stair magazine A, Fort Pickering
- Figure 82 Entry landing of spiral stair magazine A, Fort Pickering
- Figure 83 Minor spalling and joint erosion in staircase of magazine A, Fort Pickering
- Figure 84 Top entry to magazine A, Fort Pickering
- Figure 85 Vault in magazine B, Fort Pickering
- Figure 86 Front end of vault in magazine B, Fort Pickering
- Figure 87 Entry level corridor of magazine B, Fort Pickering
- Figure 88 Undated photograph of entry to magazine B, Fort Pickering
- Figure 89 2003 Photograph of entry to magazine B, Fort Pickering
- Figure 90 Current condition of exterior side wall magazine B, Fort Pickering
- Figure 91 Detail of ventilation slot magazine C, Fort Pickering
- Figure 92 Rear end wall of magazine C, Fort Pickering
- Figure 93 Detail of ventilation slot magazine C, Fort Pickering
- Figure 94 Front end wall of magazine C, Fort Pickering
- Figure 95 Spalled brick magazine C, Fort Pickering
- Figure 96 Area where soil has eroded to expose the top of the entry corridor vault magazine C, Fort Pickering
- Figure 97 Top of inner doorway to magazine C, Fort Pickering
- Figure 98 Aerial photograph of Fort Pickering before 1943
- Figure 99 Overview of munitions storage igloos, Winter Island
- Figure 100 Igloo #1, Winter Island
- Figure 101 Igloo #10, Winter Island
- Figure 102 Spalling on igloo, Winter Island
- Figure 103 Edge spall on igloo, Winter Island
- Figure 104 Severe edge spall on igloo, Winter Island
- Figure 105 Severe edge spall at Igloo top panel, Winter Island
- Figure 106 Surface spall - Igloo, Winter Island
- Figure 107 Surface spall - Igloo, Winter Island

Figure 108 Incipient spall - Igloo, Winter Island

Figure 109 Missing igloo top panel, Winter Island

Figure 110 Dislodged vertical panel - igloo, Winter Island

Figure 111 Dislodged igloo top panel, Winter Island

Figure 112 Bronze clip used to join vertical panels at top of igloos, Winter Island

Figure 113 Invasive vegetation around igloos, Winter Island

Figure 114 Surface spalling at concrete access road, Winter Island

Figure 115 Summary of existing conditions at Fort Pickering with location of modern photographs used in report text.

Figure 116 Sensitivity map for finding ancient Native American archaeological resources at Winter Island Marine Park, Salem, MA.

Figure 117 Sensitivity map for finding historical archaeological resources at Winter Island Marine Park, Salem, MA.

Figure 118 Sensitivity map for finding historical archaeological resources at Fort Lee, Salem, MA.

Figure 119 Sensitivity map for finding ancient Native American archaeological resources at Fort Lee, Salem, MA.

Figure 120 Plan of Fort Lee, 1869.

Figure 121 Plan of Fort Pickering, 1862.

Figure 122 Initial plans for alterations to Fort Pickering, 1863.

Figure 123 Postcard view From Fort Lee to Beverly

Figure 124 Postcard view of Fort Lee.

Figure 125 Plan of Fort Pickering, 1820.

Figure 126 Nathaniel Bowditch's Chart of the Harbors of Salem, Marblehead, Beverly and Manchester.

Figure 127 Plans and cross sections of proposed fort near Fort Pickering, 1822.

Figure 128 deleted

Figure 129 Plan of Winter Island, 1865.

Figure 130 Plan of Winter Island, 1867.

Figure 131 Redrafting of plans and sections of Fort Pickering,

1864.

Figure 132 Map of Salem Harbor from the U.S. Navy Survey of the Coast of the United States, 1859

Figure 133 Plan for casmated masonry fortification at Fort Pickering, 1822.

Figure 134 Plans of Forts Sewall, Lee and Pickering, 1869

Figure 135 Aerial photograph of U.S. Coast Guard Air Station, Winter Island, Salem, MA.

Figure 136 Aerial photograph of Winter Island and part of Salem Neck.

Figure 137 Aerial view of Fort Pickering

Figure 138 Portion of an aerial photograph of Fort Pickering

Figure 139 Aerial photograph of the construction of the U.S. Coast Guard Air Station.

Figure 140 Postcard of view from Fort Lee to Beverly

Figure 141 Detail of aerial photograph of U.S. Coast Guard Air Station Fig. 135

Figure 142 South side of Fort Pickering and the Lighthouse

Figure 143 Postcard of view from Fort Lee

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Pacific Northwest Preservation Partnership (David M. Hansen, Kimberly Keagle, and Deborah Rehn, AIA) *Historic Fortification Preservation Handbook*, Washington State Parks and Recreation Commission (7150 Cleanwater Lane, PO Box 42650, Olympia, WA 98504-2650), 2003. This is a very complete and detailed reference for the maintenance and preservation of sites like Fort Pickering, and includes much useful information on both earthworks and concrete; it is highly recommended.

II. Web Sites

CIVIL WAR FIELD FORTIFICATIONS WEBSITE; site includes a detailed glossary of military fortification terms, and a library of period texts that can be viewed on the web. (<http://civilwarfortifications.com/>)

Dry Stone Conservancy; Site promoting the construction and preservation of dry stone walls, and includes a bookstore featuring publications relating to dry stone walls including their own guidebook for the building and maintaining dry stone walls. (<http://www.drystoneusa.org/>)

Golden Gate National Recreation Area Seacoast Fortifications Preservation Manual (<http://www.nps.gov/goga/history/seafort/>)

National Park Service, Technical Preservation Services for Historic Buildings; Preservation Briefs; All 42 Preservation Briefs can be viewed on line and printed from this site (<http://www2.cr.nps.gov/tps/briefs/presbhom.htm>)

U. S. CORPS OF TOPOGRAPHICAL ENGINEERS, References On-line; Links; extensive bibliography with links to websites that texts that can be viewed on-line, including the three books by D. H. Mahan listed above. (<http://www.topogs.org/Links2.htm>)

III. Manuscripts

Lee, Thomas J., Folio of Drawings Related to Fortifications made as an Cadet at West Point, c. 1830. (Manuscript; bound folio of original drawings in collection of Finch&Rose).

SENSITIVITY MAPS

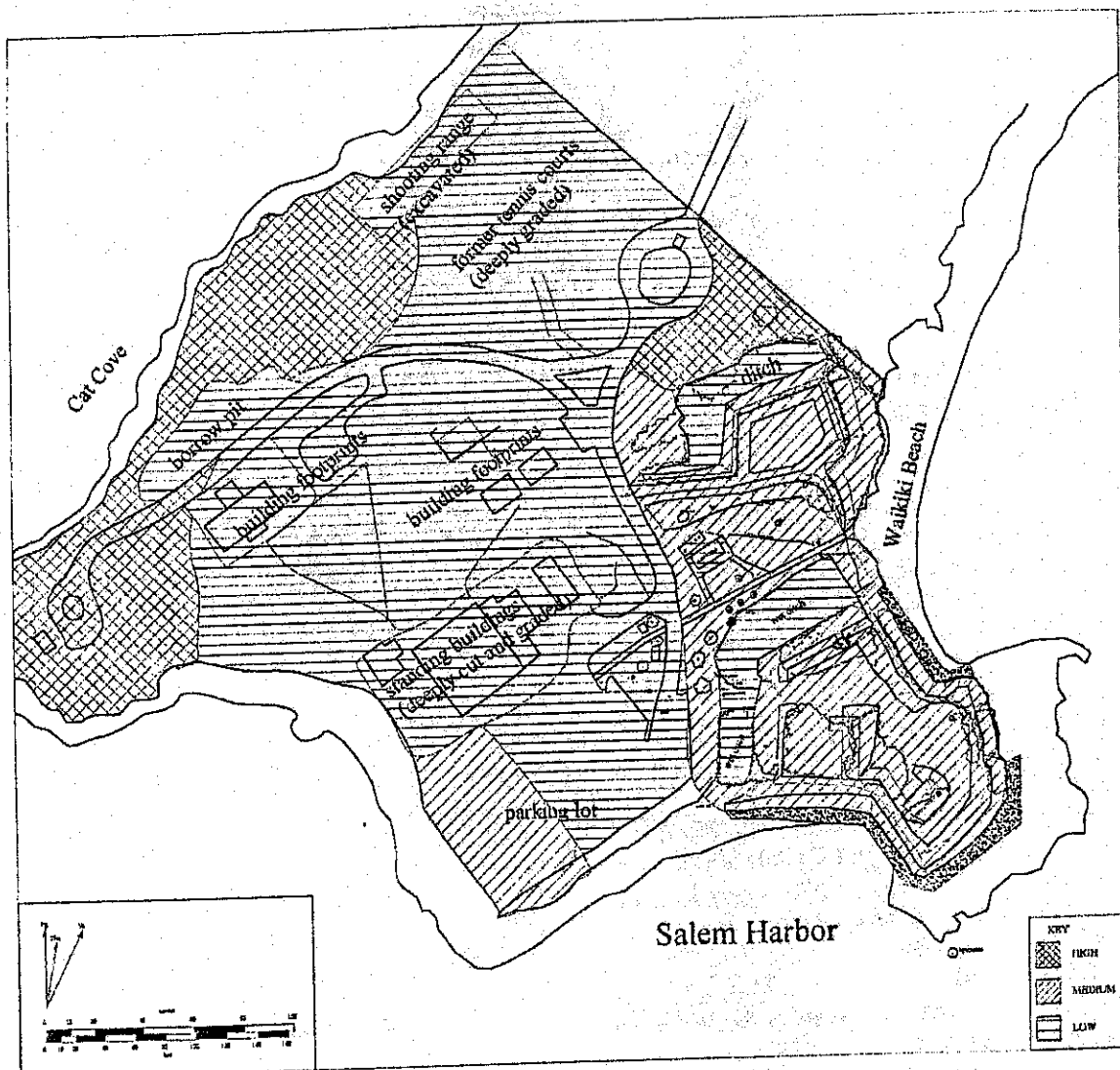


Figure 5.9. Sensitivity map ranking the potential for finding ancient Native American archaeological resources at Winter Island Marine Park, Salem, Massachusetts. The potential for sites was based on environmental characteristics, as compared to places where sites have been found in the region, proximity to known sites in the immediate area, and the results of archaeological testing. These factors were modified by the presence of documented severe disturbances, as seen in a borrow pit, and historical period defensive ditches.

Sensitivity Map Native American Archaeological Resources at Winter Island

Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

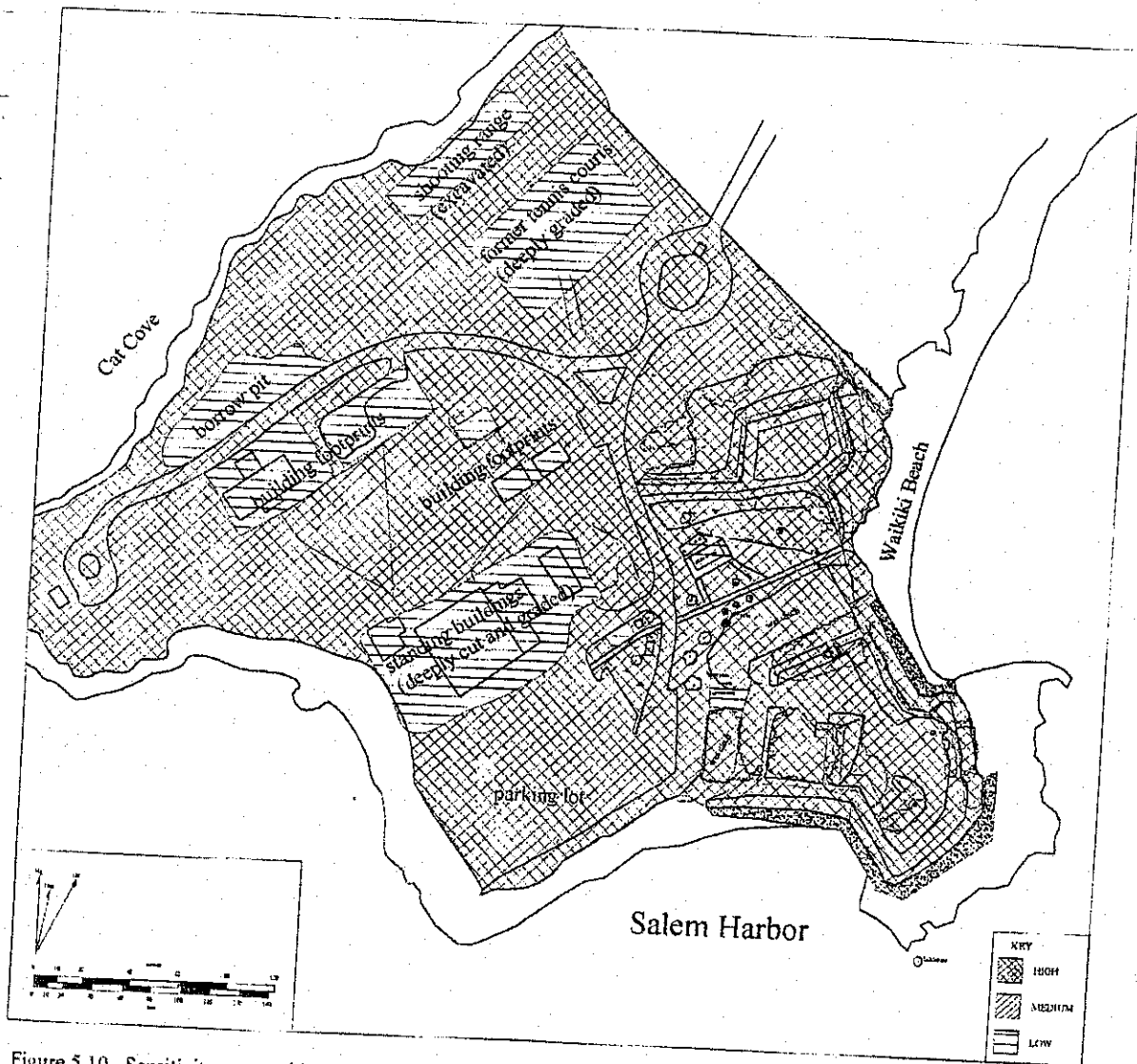


Figure 5.10. Sensitivity map ranking the potential for finding historical archaeological resources at Winter Island Marine Park, Salem, Massachusetts. In essence, the history of the island makes it likely that historical period archaeological resources may exist anywhere that intensive disturbances cannot be documented. This presumption has been partially confirmed in archaeological testing. Given the limited amount of testing to date, low potential can only be predicted within areas of severe documented disturbances: the footprint of 20th century buildings, a borrow pit, former tennis courts, rifle range, in the moat causeway, built circa 1943, in the site of buried tanks, and in the location of buried utilities (not shown on this map).

Sensitivity Map Archaeological Resources at Winter Island

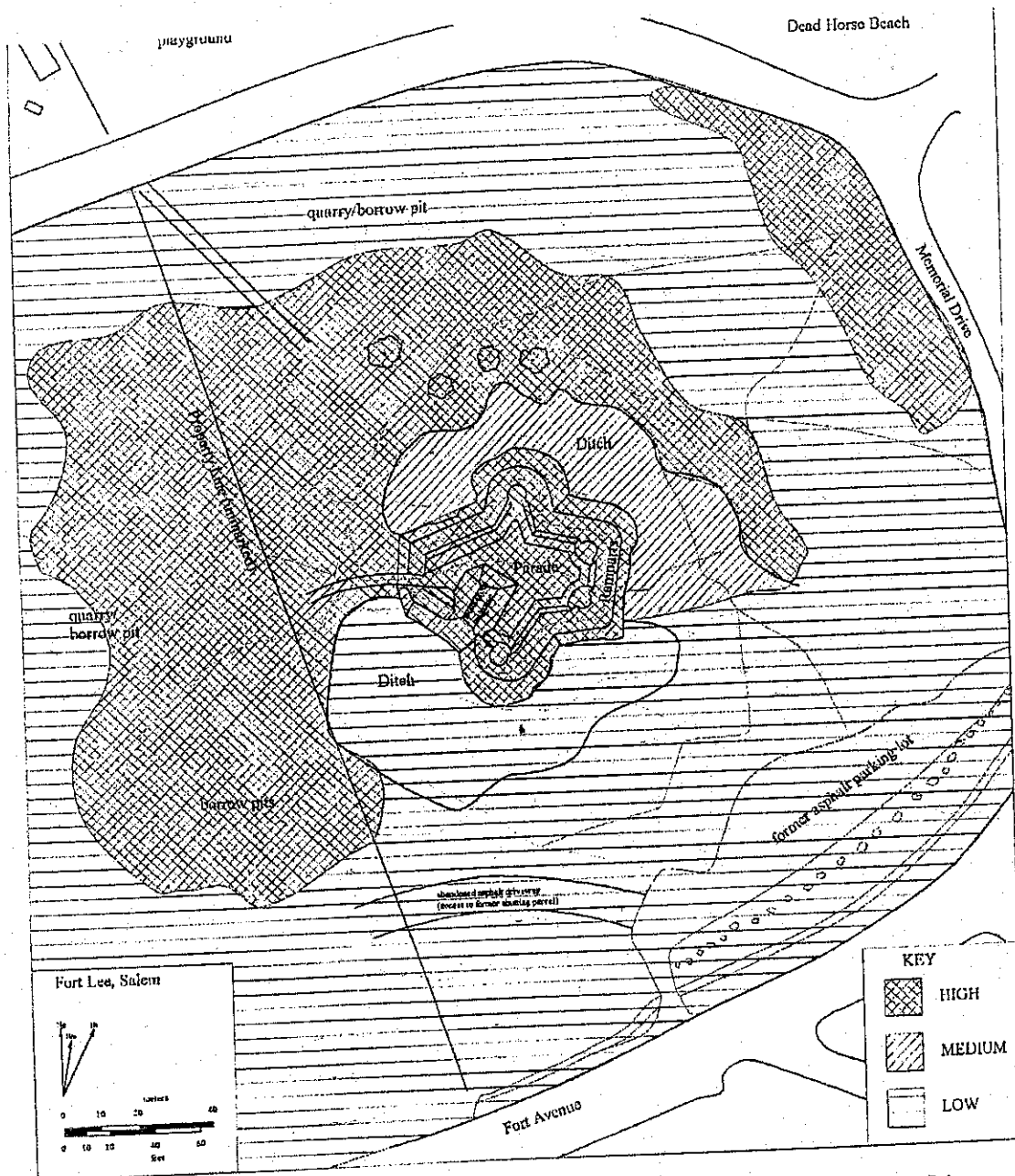


Figure 5.12. Sensitivity map ranking the potential for finding historical archaeological resources at Fort Lee, Salem, Massachusetts. Historical resources are believed on the relatively level areas at and near the hill's top and bottom. Sites are less likely on the relatively steep hill side. Absence of buried resources can also be anticipated in areas of severe documented disturbances, as in borrow pits and quarries, and in some areas of the ditch. Archaeological testing has partially borne out this model.

Sensitivity Map Archaeological Resources at Fort Lee

Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

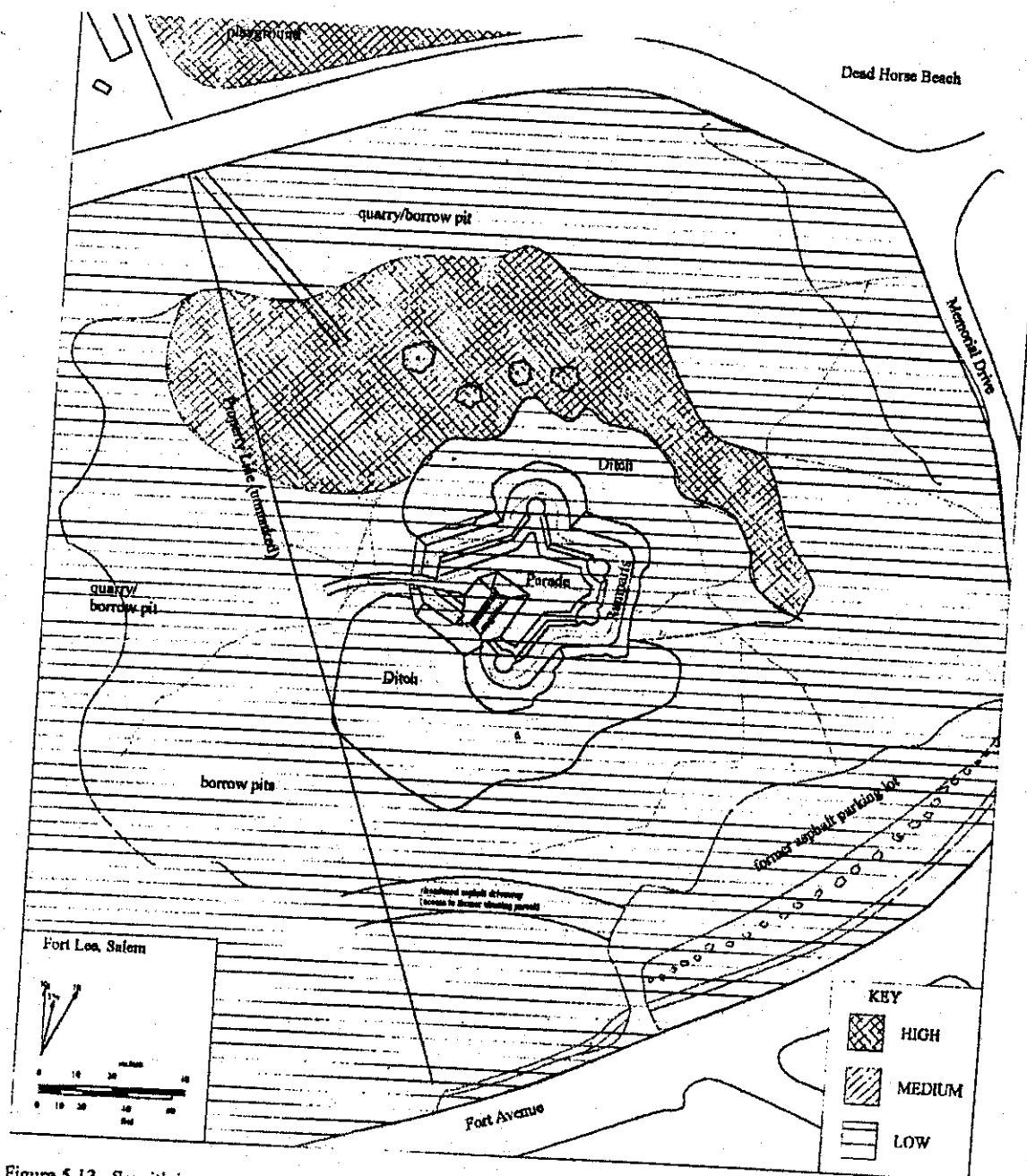
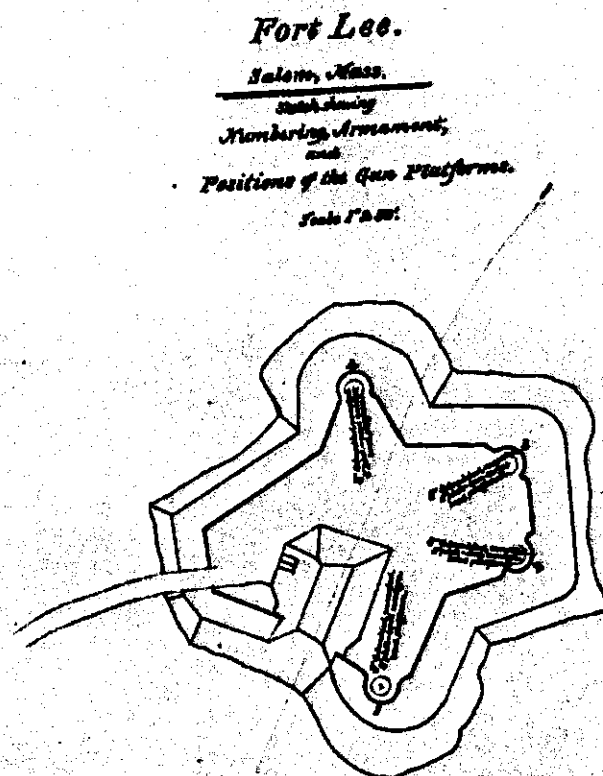


Figure 5.13. Sensitivity map ranking the potential for finding ancient Native American archaeological resources at Fort Lee, Salem, Massachusetts. The potential for sites was based on environmental characteristics, as compared to places where sites have been found in the region, proximity to known sites in the immediate area, and the results of archaeological testing. These factors were modified by the presence of documented severe disturbances, as seen in borrow pits, and historical period defensive ditches.

Sensitivity Map Native American Archaeological Resources at Fort Lee

Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

PHOTOGRAPHS AND MAPS



July 24th, 1869.
 Drawn under direction of Gen. William B. Wood, Major of Artillery,
 by H. W. Graham.

U.S. Engineer Office, Boston, Aug 5, 1869.
 Sent to Office of Chief of Engineers, Washington D.C.
 with letter of this date.
 H. W. Graham
 H. W. May Seal

Fig. 120: Fort Lee showing numbering, armaments and positions of the gun platforms, 1869. RG 77 Dr 259 Sh 10. National Archives and Records Administration.

Drummer 18
Sheet 13



Fig.121: Plan of Fort Pickering recorded during the Engineering Department's survey of Salem Neck and Winter Island. The quarters at the upper right predates Rochefontain's work of 1794. RG 77 Dr 18 Sh 13. National Archives and Records Administration Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

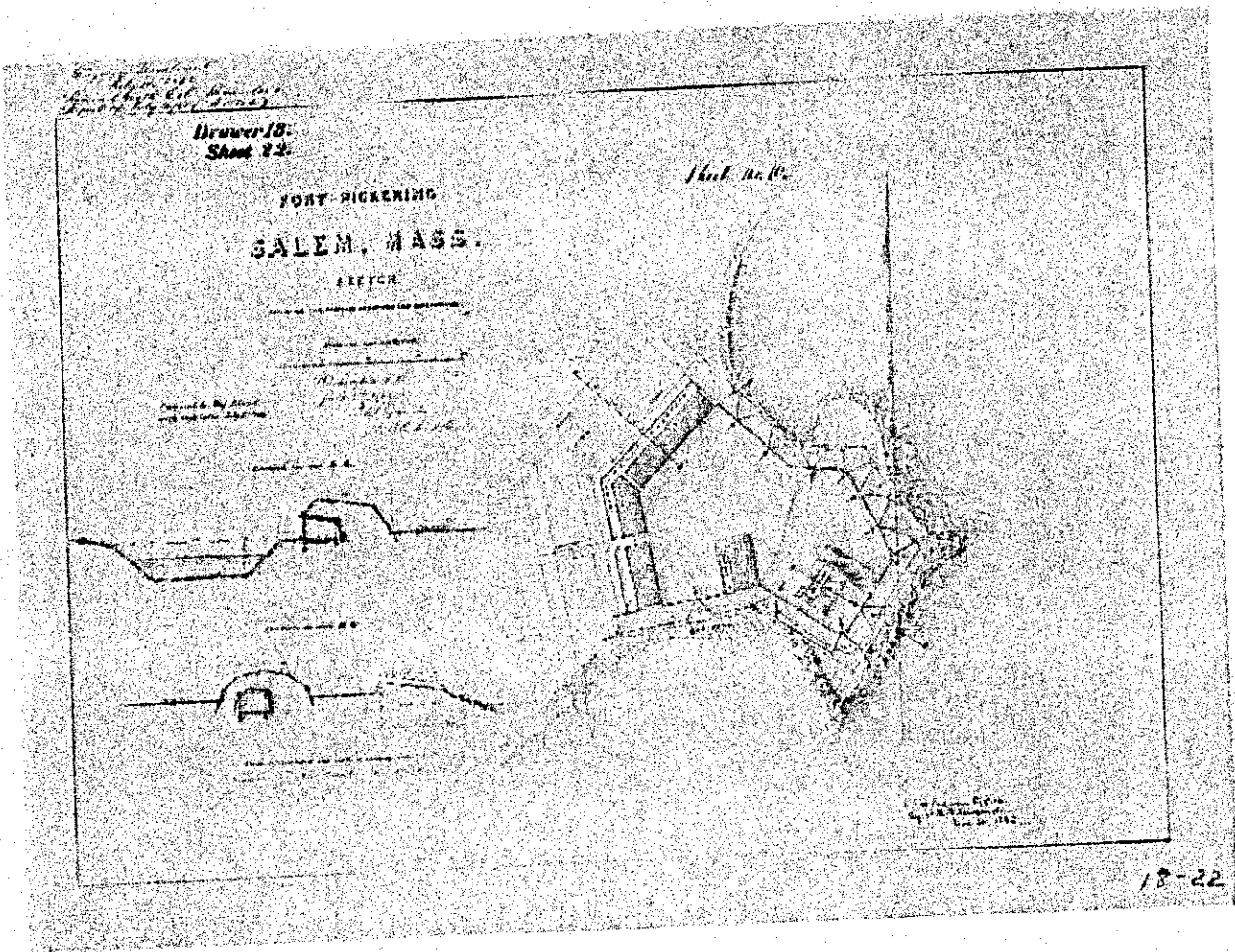


Fig. 122: Initial plan for alterations to Fort Pickering, 1863. Lines in red show conditions prior to construction, i.e. the footprint of Fort William as modified in 1794. RG 77 Dr 18 Sh 22. National Archives and Records Administration.

Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

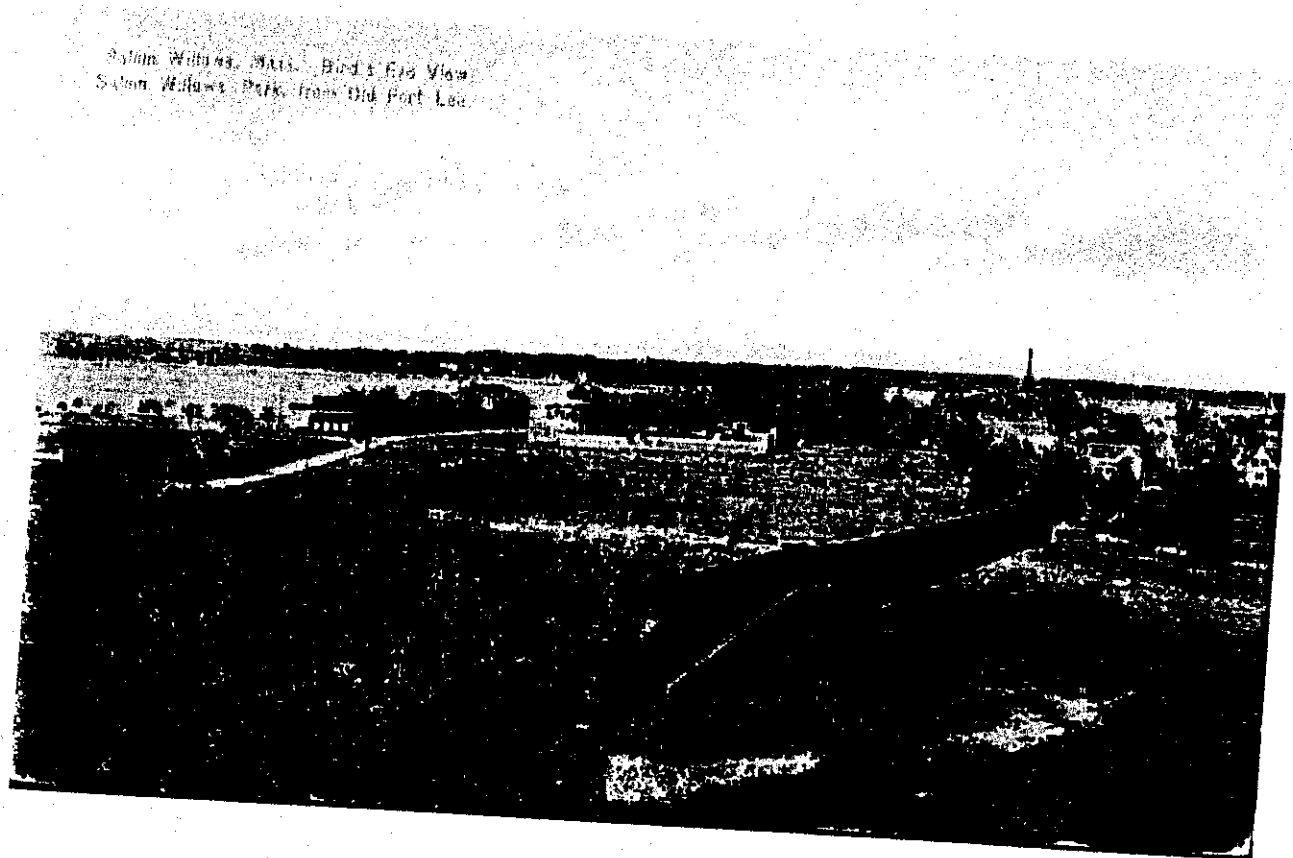


Fig. 123: Postcard view from the ramparts of Fort Lee to Beverly, date unknown, The Hugh C. Leighton Co., Portland, ME.

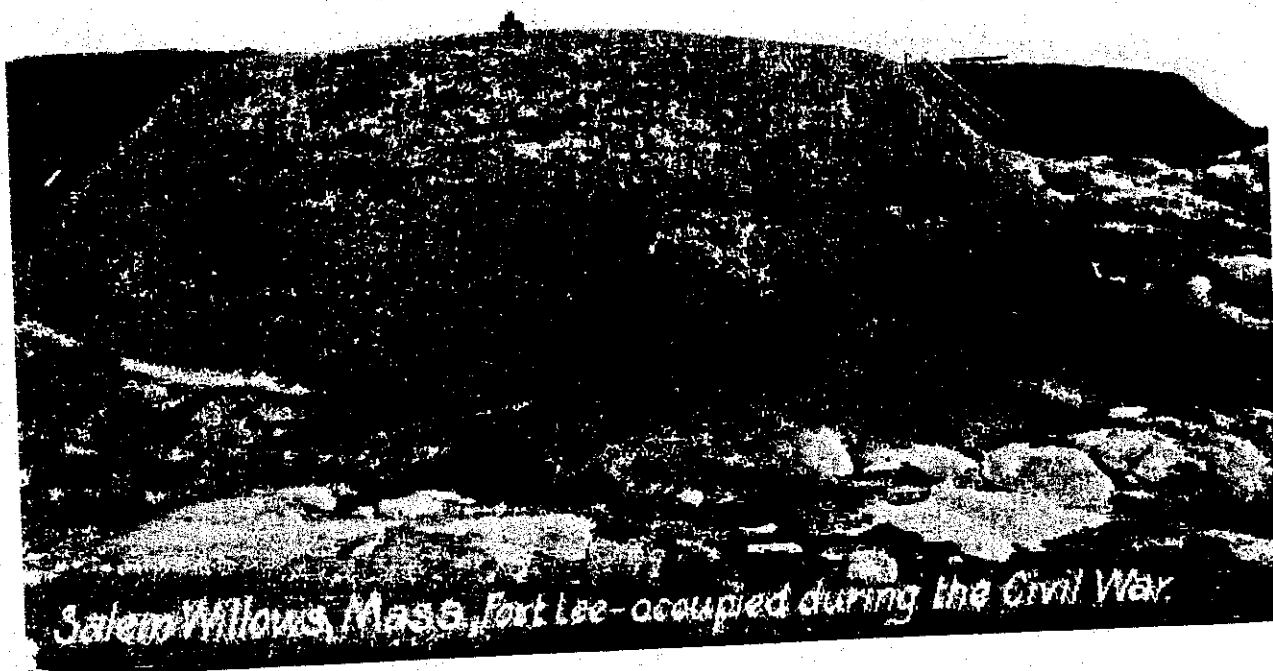


Fig. 124: The south lobe of Fort Lee as depicted in a color postcard, date unknown. The Hugh C. Leighton Co., Portland, ME.

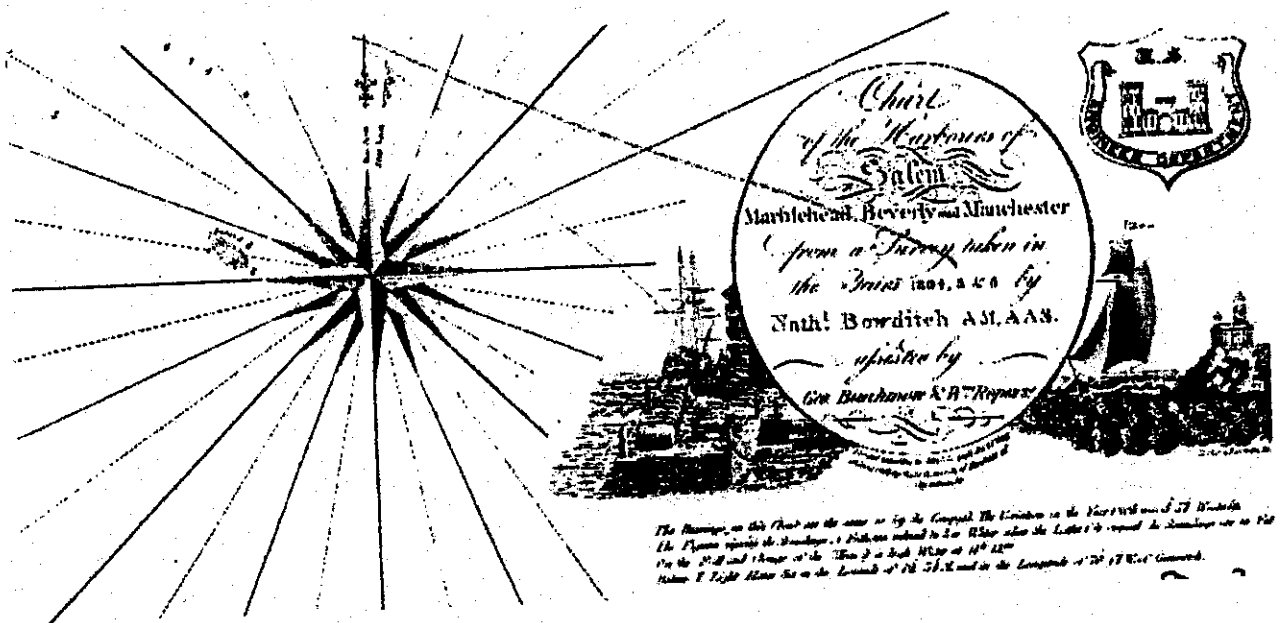
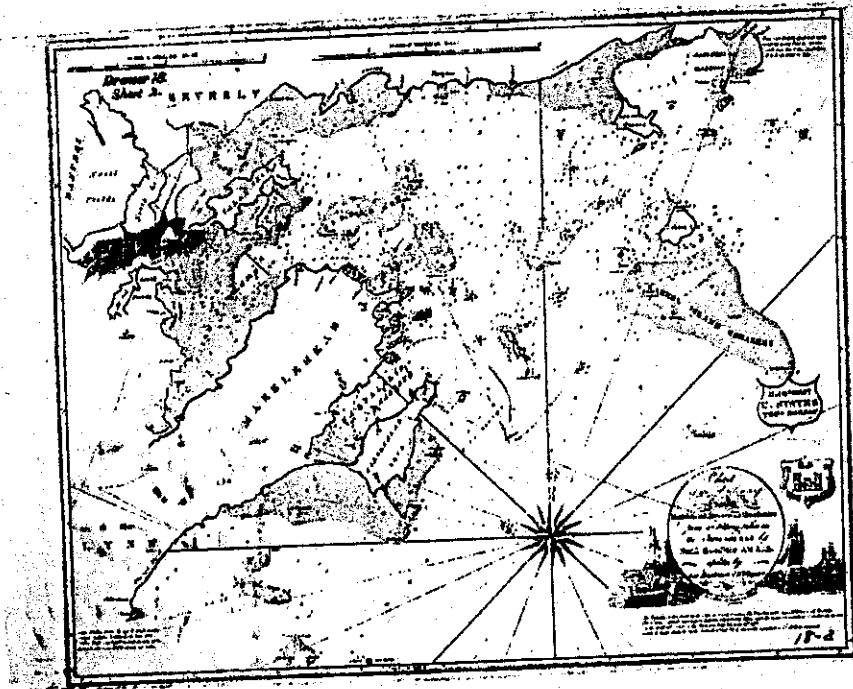


Fig. 126: Chart of the Harbors of Salem, Marblehead, Beverly and Manchester by Nathaniel Bowditch. Rg 77 dr018 sh 02. National Archives and Records Administration.

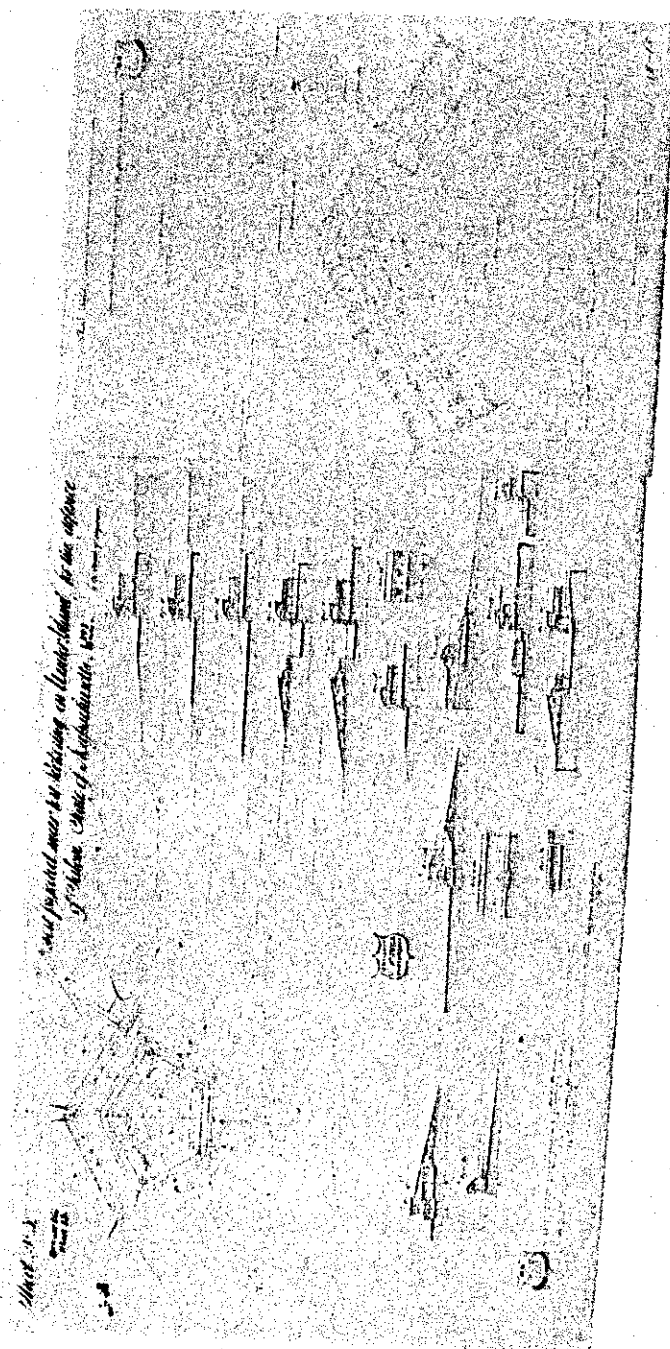


Fig. 127: Plans and cross section drawings of the Fort projected near Fort Pickering, 1822. This fort, never built, was to have a regular pentagonal trace. The water front had provisions for perhaps 40 main cannons mounted in bombproof casements and on the terreplein. The land front would have been protected by an elaborate system including a glacis, covered way, dry ditch, scarp and counter scarp galleries, and flanking howitzers. National Archives and Records Administration.

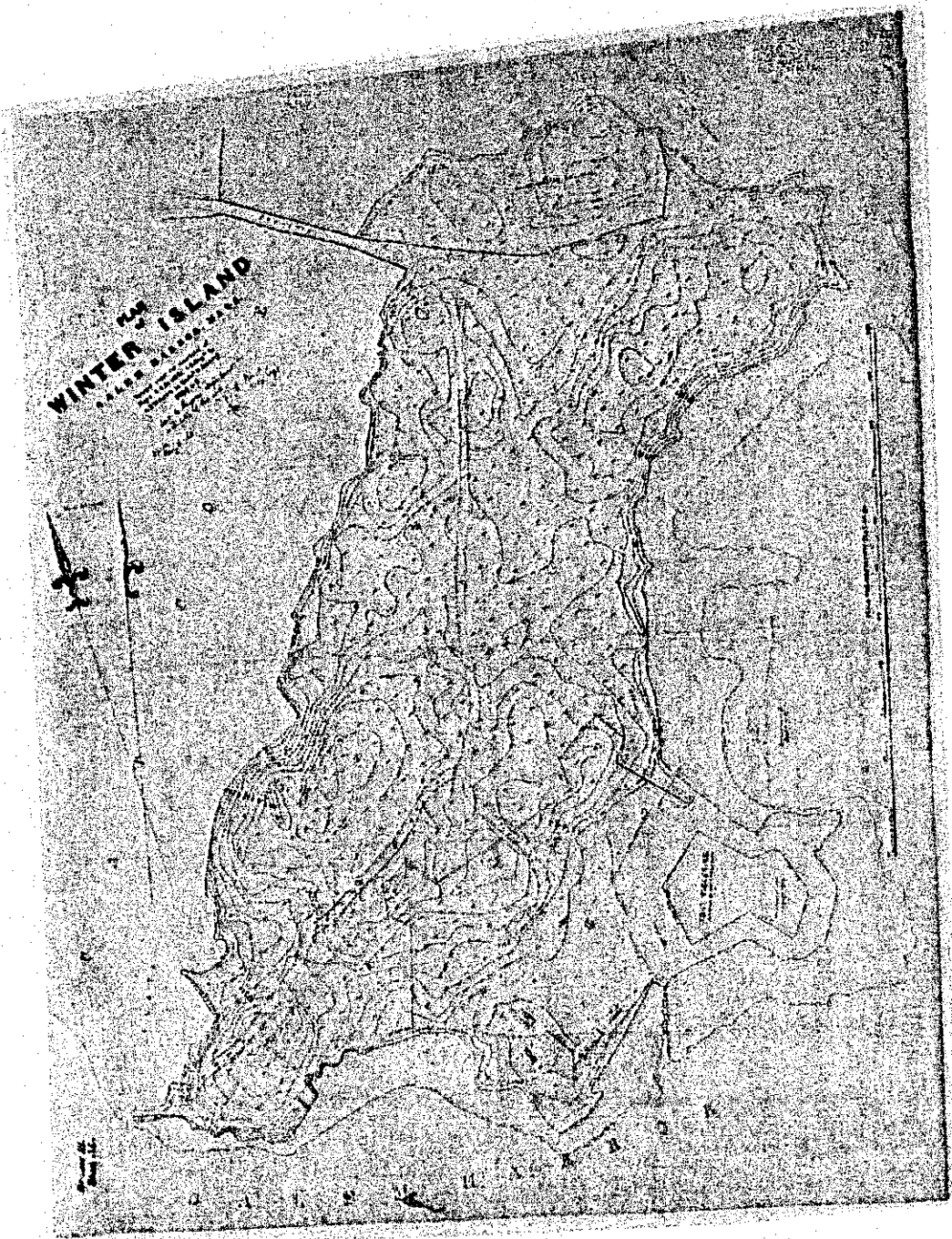


Fig.129: Plan of Winter Island, without elevations, 1865. National Archives and Records Administration.

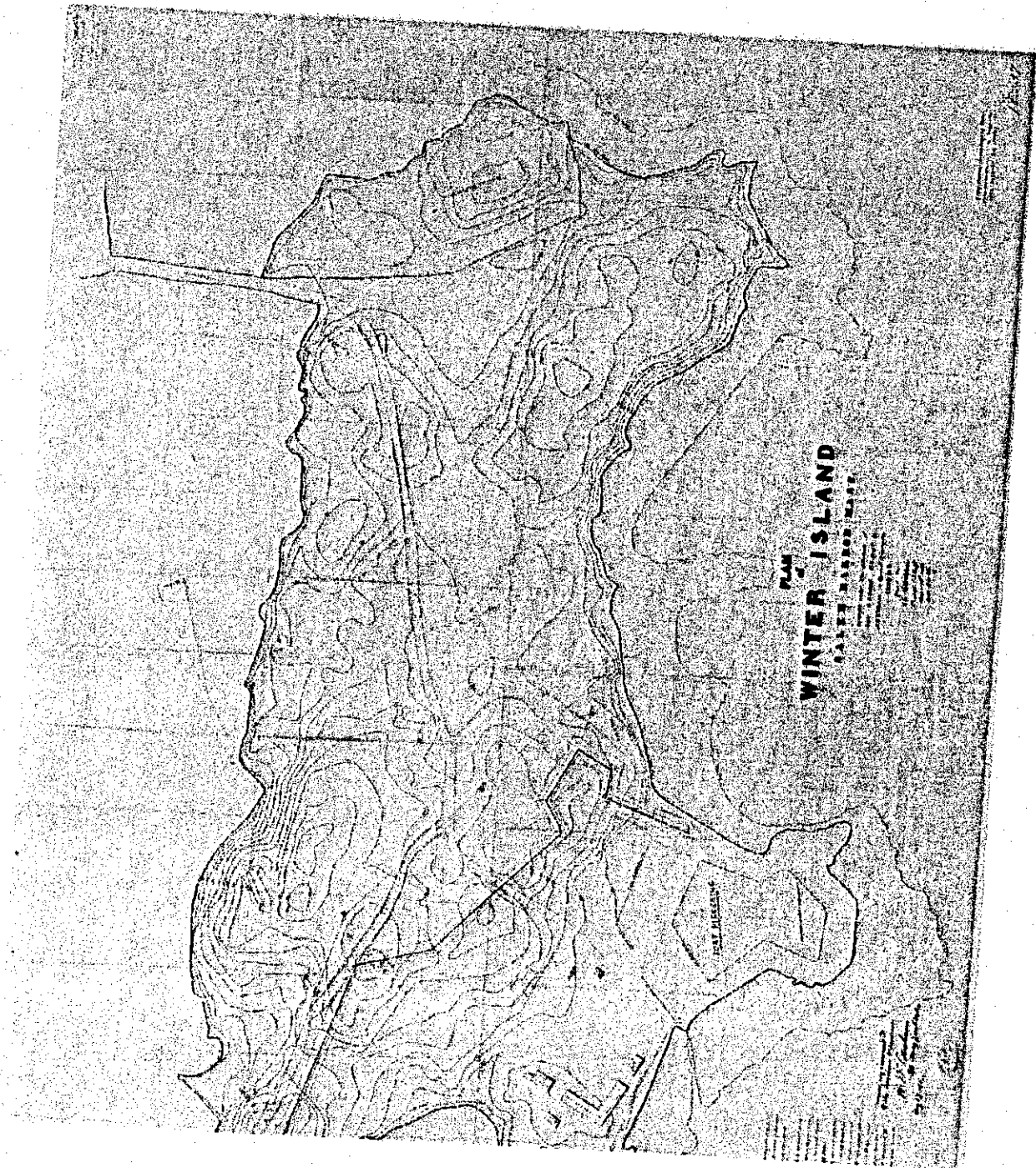


Fig.130: Plan of Winter Island, without elevations, 1867. National Archives and Records Administration.

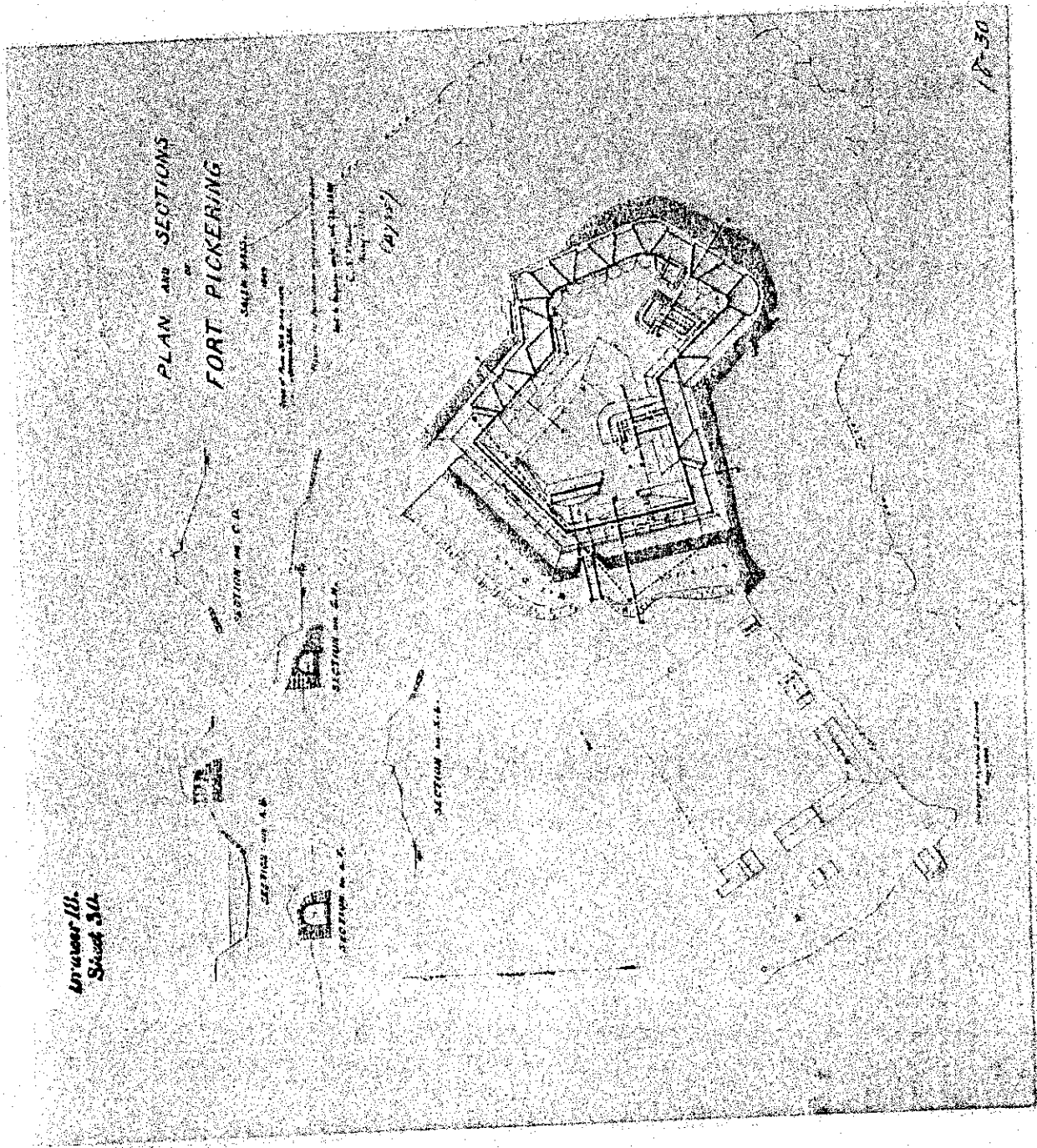


Fig. 131: Redrafting of plan and sections of Fort Pickering, 1864. RG 77 Dr 18 Sh 30. National Archives and Records Administration.

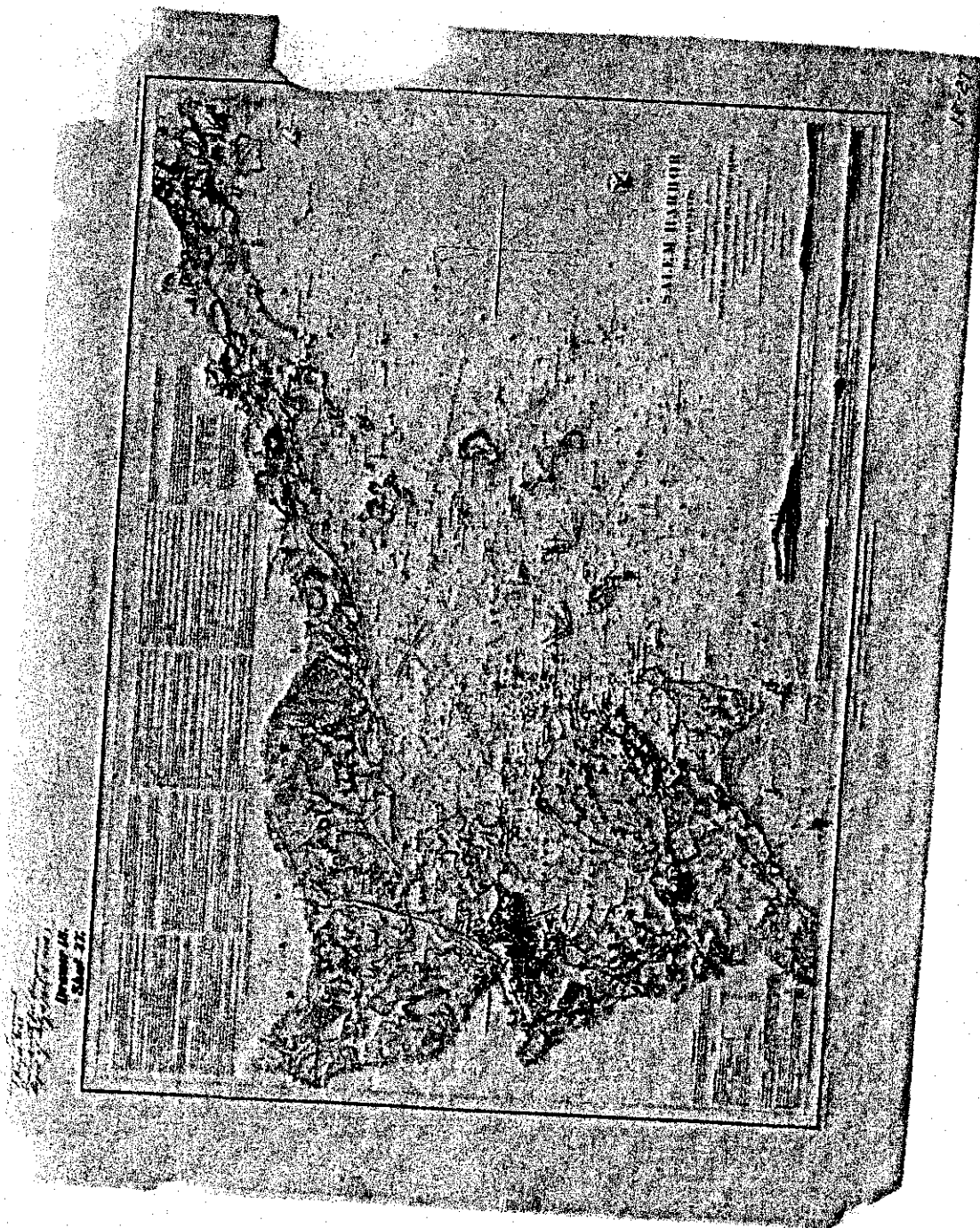


Fig. 132: Map of Salem Harbor from the U.S. Navy survey of the Coast of the United States, 1859. RG 77 Dr 018 Sh 27. National Archives and Records Administration.

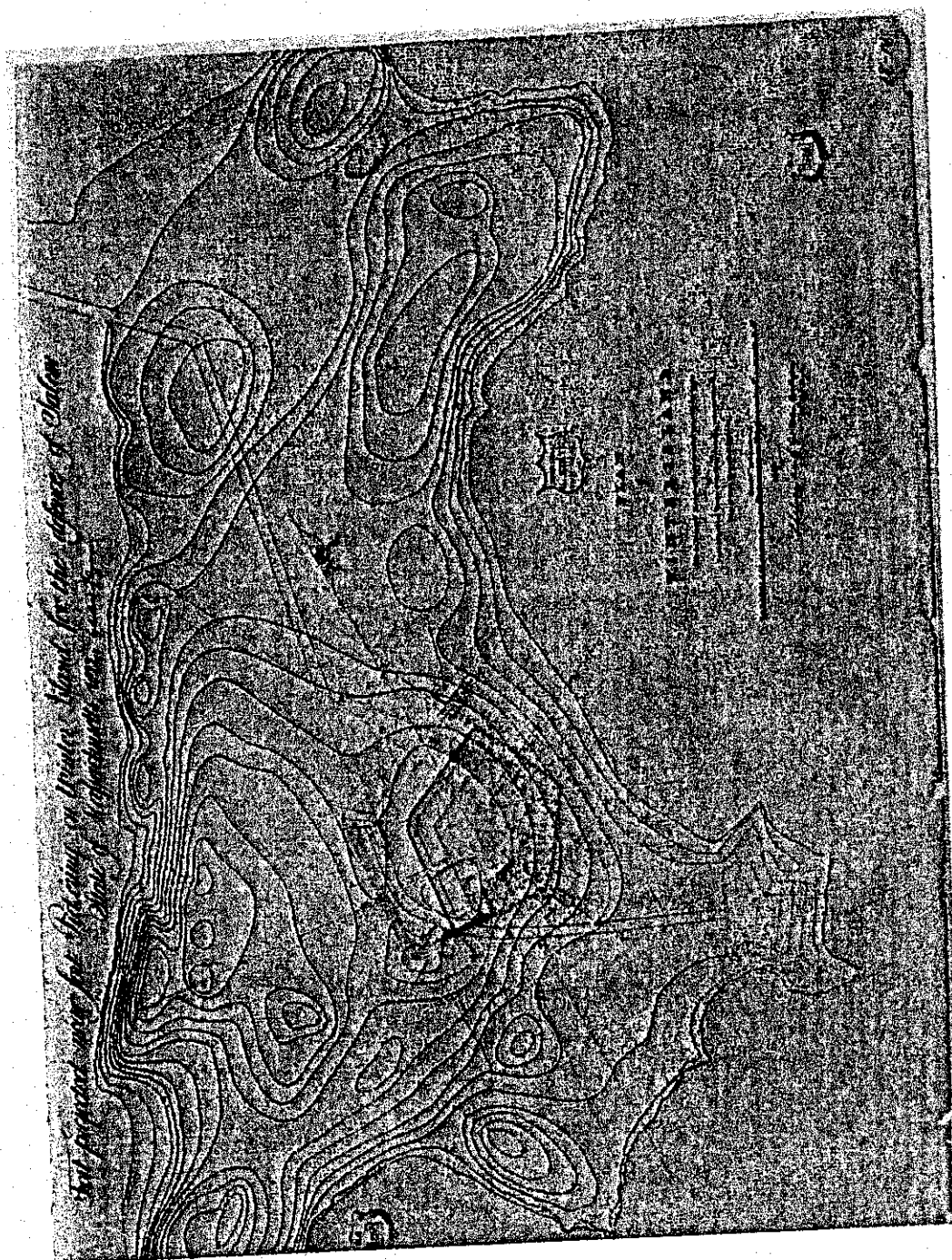


Fig.133:1822 plan for the construction of a casmated masonry fortification to replace the earthwork fort of 1794 and earlier. The new fort was never built. National Archives and Records Administration.

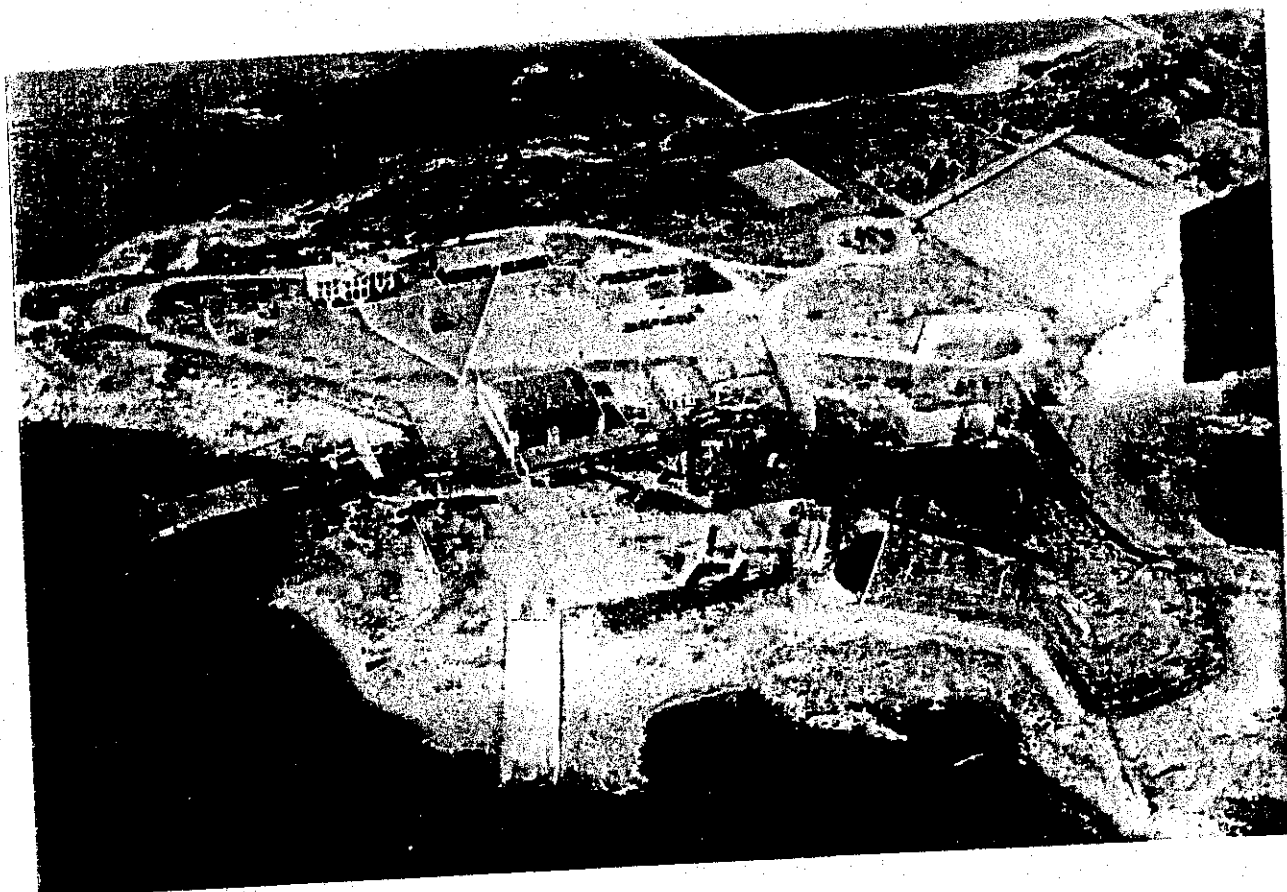


Fig.135: Aerial photograph of U.S. Coast Guard Air Station, late 1940's?. Courtesy Winter Island Marine Park, City of Salem.

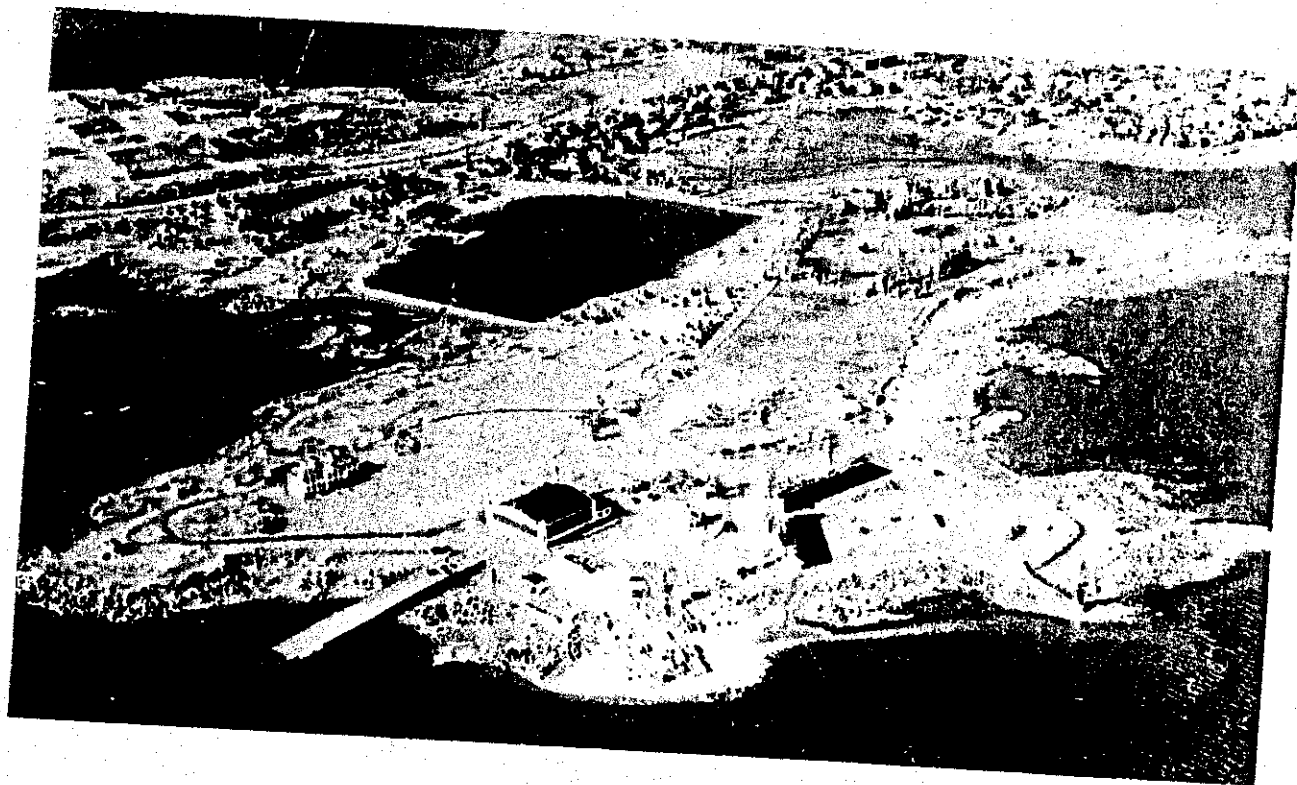


Fig.136: Aerial photograph of Winter Island and part of Salem Neck seen from the south, before 1943. Courtesy Winter Island Marine Park, City of Salem.



Fig. 137: Aerial view of Fort Pickering. Richard C. Kelsey photograph, on file Office of Planning and Community Development, City of Salem.



Fig. 138: Portion of an aerial photograph taken April 1, 1942. Richard C. Kelsey photograph on file Office of Planning and Community Development, City of Salem.



Fig. 139: Aerial view of the U.S. Coast Guard Air Station under construction. View is to the northeast. April 1, 1942. Richard C. Kelsey photograph on file Office of Planning and Community Development, City of Salem.

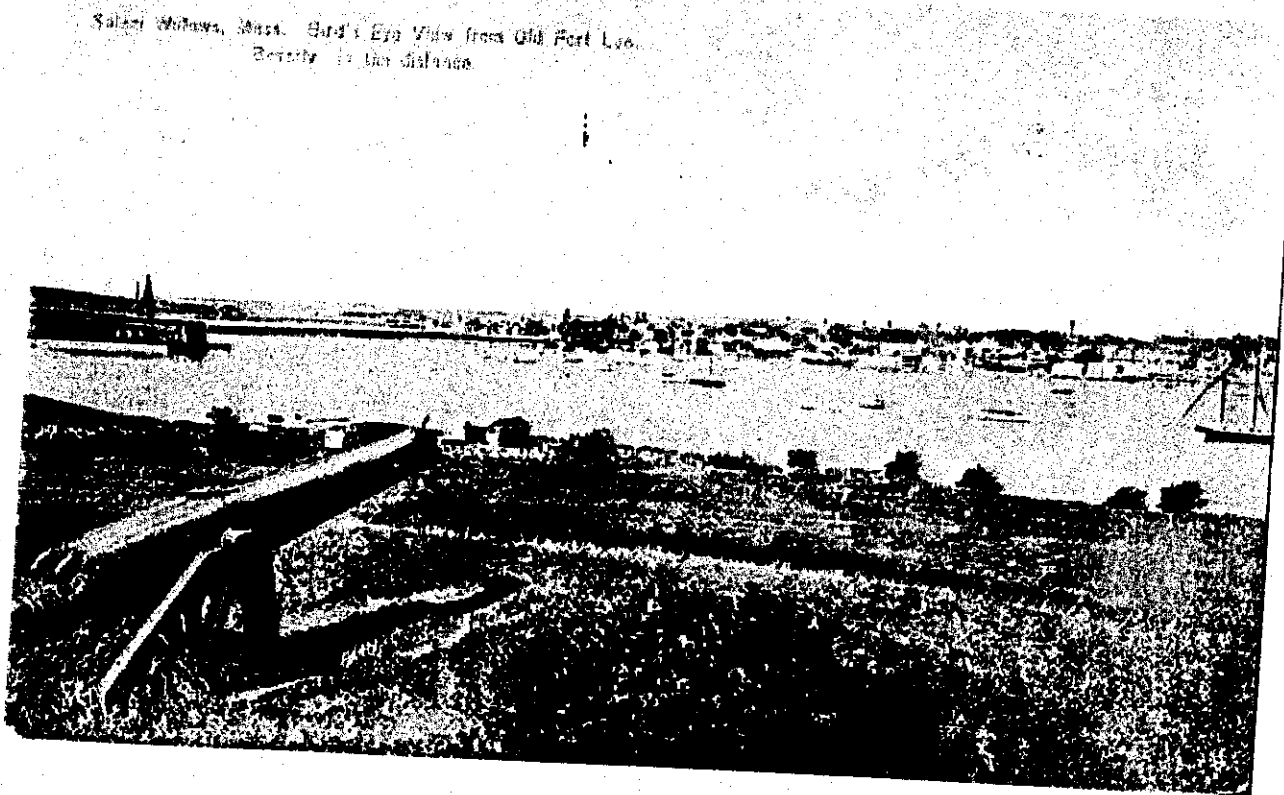


Fig.140: Postcard of view from the ramparts of Fort Lee to Beverly, date unknown, the Hugh C. Leighton Co., Portland, ME.



Fig. 141: Detail of Fig. 135, U.S. Coast Guard Air Station showing trucks parked on terreplein, the former moat bridge and causeway.



Fig. 142: South side of Fort Pickering and the lighthouse, date unknown. Courtesy, Peabody Essex Museum, Salem, MA.

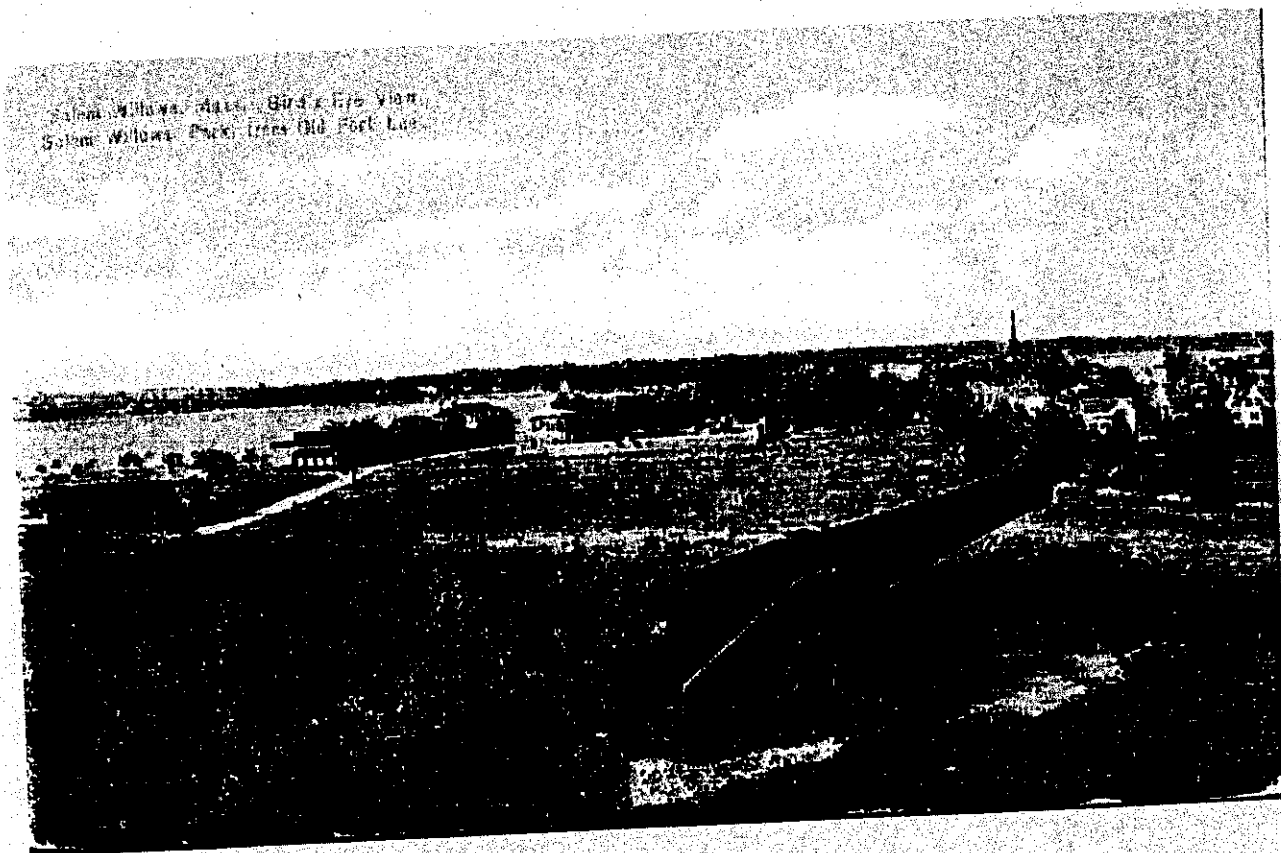


Fig. 143: Postcard of view from the ramparts of Fort Lee, date unknown. The High C. Leighton Co., Portland, ME.

ACKNOWLEDGEMENTS

The *Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan* has been funded, in part, by the City of Salem. It is prepared as part of the, preservation, restoration and management of the National Register sites of Fort Lee and Fort Pickering.

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The study team wishes to thank the following people for their initiatives, assistance and counsel in the preparation and review of this study.

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Historic Salem Incorporated
Staff of the National Park Service
Salem Public Library
Peabody Essex Museum
Winter Island staff

STUDY SCOPE AND LIMITS

This study was prepared by Gray Architects Inc., Crane Morrison Archaeology, Leslie C. Shaw the Native American Specialist and Finch and Rose Architectural Preservationists. The statements and recommendations are those of these consultants and have been prepared to pro-

vide guidance for the preservation, restoration, management and maintenance of Fort Lee and Fort Pickering.

The majority of the study efforts are focused on the historic research, documentation and archaeological studies. The restoration, management and maintenance recommendation part of the study reference this research in preparing a restoration plan with specific maintenance and management recommendations. This part of the study, although limited, does lay the foundation for the forts preservation. To begin any actual work on the sites the archaeological documentation and the preservation recommendations must first be reviewed by all involved. Additionally, a complete topographic survey must be prepared showing, in scale, the specific locations of historically sensitive features, actual topography, utilities, structures and vegetation. Any work on the forts must first be preceded by field locating historically sensitive features, where required, and confirming locations and sensitivity with the archaeologist.

Appendix A

LISTING OF THE NATIONAL REGISTER OF HISTORIC PLACES, ESSEX COUNTY, MASSACHUSETTS

Fort Lee

(added 1994 - Site - #94000285)
Address Restricted, Salem

Historic Significance:	Event, Architecture/Engineering, Information Potential
Area of Significance:	Agriculture, Military
Cultural Affiliation:	American Military culture
Period of Significance:	1750-1799, 1800-1824, 1825-1849, 1850-1874
Owner:	Local Gov't
Historic Function:	Defense
Historic Sub-function:	Fortification
Current Function:	Landscape
Current Sub-function:	Park

Fort Pickering

(added 1973 - Site - #73000320)
Also known as Fort William; Fort Anne,
Address Winter Island, Salem

Historic Significance:	Event, Architecture/Engineering
Area of Significance:	Engineering, Military
Architect, builder, or engineer:	American Military culture
Architectural Style:	No Style Listed
Period of Significance:	1600-1649, 1750-1799, 1850-1874, 1875-1899
Owner:	Federal
Historic Function:	Defense
Historic Sub-function:	Fortification
Current Function:	Landscape
Current Sub-function:	Natural Feature

Winter Island Historic District and Archeological District

(added 1994 - District - #94000335)
Winter Island, Salem

Historic Significance:	Information Potential, Architecture/Engineering, Event
Area of Significance:	Prehistoric, Historic - Aboriginal, Commerce, Military, Community Planning And Development, Education, Social History Cultural Affiliation:
Architect, builder, or engineer:	Native American; European
Architectural Style:	American Military culture
Period of Significance:	Other
Owner:	7000-8999 BC, 5000-6999 BC, 3000-4999 BC, 1000-2999 BC, 1000 AD-999 BC, 1499-1000 AD, 1749-1500 AD, 1900-1750 AD, 1900-1924, 1925-1949
Historic Function:	Local Gov't, Private
Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan	Defense, Domestic, Industry/Processing/Extraction,

Historic Sub-function:	Transportation Camp, Coast Guard Facility, Fortification, Institutional Housing, Single Dwelling, Water-Related
Current Function:	Domestic, Landscape, Transportation
Current Sub-function:	Institutional Housing, Park, Single Dwelling, Water-Related

Salem Willows Historic District
 (added 1994 - District - #94000265)
 Roughly, Columbus, Bay View, Beach and Fort Aves., Salem

Historic Significance:	Event, Architect, builder, or engineer:	Architecture/Engineering
Area of Significance:	Community Planning And Development, Architecture, Entertainment/Recreation, Social History	
Architect, builder, or engineer:	American Military culture	
Multiple Architectural Style:	Other	
Period of Significance:	1850-1874, 1875-1899, 1900-1924, 1925-1949	
Owner:	Local Gov't , State , Private	
Historic Function:	Domestic, Landscape, Recreation And Culture	
Historic Sub-function:	Fair, Outdoor Recreation, Park, Secondary Structure, Single Dwelling	
Current Function:	Domestic, Landscape, Recreation And Culture	
Current Sub-function:	Fair, Outdoor Recreation, Park, Secondary Structure, Single Dwelling	

Appendix B

EROSION CONTROL PRODUCTS

Temporary Erosion Control Products, (until the vegetation fills in).

S1: 100% straw fibers stitch-bonded to a photodegradable net on the top side. Suitable for low flow to moderate flow run-off conditions.

S2: 100% straw fibers stitch-bonded to a photodegradable net on top and bottom sides. Suitable for moderate flow run-off conditions.

CS2®: 70% straw 30% coconut fiber, netting on two sides. For use on 2:1 - 1:1 slopes with heavy run off conditions. Handles steep slide rehabilitation, drought area revegetation, long slope cut and fill, mine land and landfill reclamation. Bridge abutments, ski runs, and channel shoulders. *Also available with 100% biodegradable netting.

C2®: 100% coconut fiber, netting on two sides. For use as a channel liner with high velocity intermittent flows, center runs on grassed waterways, drainage ditch lining and stream bank rehabilitation. Also used as an erosion control blanket on extreme slopes and very harsh sites. * Also available with 100% biodegradable netting.

*ECONET: CS2 and C2 blankets are also available with high strength, 100% organic netting and stitching for use on environmentally sensitive areas. We strongly recommend the use of this 100% biodegradable netting adjacent to all wetland sites.

Coir Mats: These long-lived, high strength, woven 100% coconut grids have numerous bioengineering and erosion control applications. They are particularly effective on sites where they can hold extreme slopes that are susceptible to slumping or frost shear. They are available in three weights: 400 gms/sq m, 700 gms/sq m, and 900 gms/sq m.

Coir Fiber Logs: These 20' long 100% coconut "logs" with biodegradable netting have proven to be one of the most efficient and cost-effective methods to immediately stabilize the banks of ponds, streams, rivers, and coastal banks. They can be easily installed with either earth anchors or with wooden stakes. They are generally planted with wetland plants (2" plugs) which root through the coir logs into the bank and substrate. They are available in 12" or 16" diameters. The effective life is 4-8 years, after which the planted vegetation stabilizes the banks and slope.

Permanent Erosion Control Products

PYRAMAT®: An ecologically sensitive, cost-saving alternative to rock rip-rap lining for channels, this three-dimensional, vegetated erosion reinforcement matrix offers equal structural stability to 12-18" rock at approximately half the cost. PYRAMAT® is a woven heavy weight UV stabilized monofilament yarn product with an effective lifespan of 50 years. PYRAMAT® can be used to line drainage swales to treat stormwater runoff, and has been named as a Best Management Practice by the EPA. Added benefits over rip-rap include: permeability; decreased thermal pollution; increased species diversity, pollution attenuation and improved wildlife habitat.

LANDLOK TRM®: 435/450/1060/1061B: These permanent, synthetic turf reinforcement mats are designed to resist high flow velocities down steep slopes and channels. 1061B is backed with a lightweight non-woven geotextile.

Dormant Live Material for Bioengineering

Dormant woody Willow and Dogwood species for use as brush layers, brush fascines, and stakes. Fascines are usually 6-12 feet long and 4-8" in diameter, brush cuttings are 3-5' long and stakes are 2-3' long. Brush is available only in the dormant season (November 15 - March 15).

Tubelings for Bank Stabilization and Soil Bioengineering

Rooted cutting in 5" long soil filled tubes to be used as an inexpensive method for revegetating and stabilizing slopes, banks and soil bioengineering projects. Because tubelings have established root systems, successful planting is not limited to the period in which a plant is dormant, but extends into the growing season. This allows for the installation of soil bioengineering projects from early spring through the summer and fall, freeing projects from the time constraints of dormant plant materials. Tubelings may be used in place of dormant stakes, and have the advantage of being easier to install (using a dibble stick) and produce soil stabilizing roots upon planting during the growing season. Stems typically measure between 6" and 24" in height.

Species Available in Tubelings

- Pussy Willow (*Salix discolor* and *Salix* spp.)
- Black Willow (*Salix nigra*)
- Sand Bar Willow (*Salix exigua*)
- Purple-osier (Streamco Willow) (*Salix purpurea*)
- Dwarf Bankers Willow (*Salix x cotteti*)

Appendix C

RECOMMENDATIONS FOR PRESERVING THE ARCHEOLOGICAL RESOURCES

Identify, retain, and preserve	
Recommended	Not Recommended
Identifying, retaining, and preserving pre-historic, pre-history, and historic archeological resources such as graves, campsites, mounds, foundations, and artifacts that have yielded or are likely to yield information about the past.	Removing or radically altering archeological resources prior to thorough survey and documentation.
Surveying and documenting areas that are likely to contain archeological resources.	Failing to conduct appropriate survey and documentation of archeological resources.
Minimizing disturbance of terrain, thus reducing potential impact on archeological resources.	Disturbing terrain likely to contain archeological resources prior to thorough survey and documentation
Protect and maintain	
Recommended	Not Recommended
Preserving <i>in situ</i> important archeological resources.	Leaving archeological resources unprotected so that they are damaged during rehabilitation work or are susceptible to vandalism.
Planning and executing necessary investigations by qualified professional archeologists when preserving the resources <i>in situ</i> is not feasible.	Failing to perform necessary investigations or permitting unqualified personnel to perform data recovery.
Discovering Resources during Rehabilitation	
Recommended	Not Recommended
If archeological resources are discovered during rehabilitation or new construction, contacting the State Historic Preservation Officer and the Consulting Archeologist, Assistance Division, National Park Service, to determine the significance of the resource.	Failing to contact appropriate authorities if archeological resources are discovered during rehabilitation or new construction.
Halting further work in the area of the resource until a determination of its significance can be made.	Failing to protect archeological resources prior to determination of significance and mitigation.

RECOMMENDATION FOR PRESERVING THE SITE CHARACTER DEFINING ELEMENTS

Identify, retain, and preserve	
Recommended	Not Recommended
<p>Identifying, retaining, and preserving character-defining elements and features of sites. These may include circulation systems such as streets, sidewalks, parking areas, vegetation such as trees, shrubs, herbaceous plantings, and grounds; landforms such as hills, terraces or berms; street furniture such as lamp posts, street and building signs, and flagpoles; monuments; and water features.</p> <p>Retaining the historic relationships among buildings, circulation systems, vegetation, landforms, street furniture, monuments, and other historic elements of the plan.</p> <p>Providing proper drainage to assure that water does not erode foundation walls, drain toward buildings, or damage or destroy the landscape.</p>	<p>Removing or radically changing the historic plan or its character-defining elements so that, as a result, the character is diminished.</p> <p>Removing or relocating buildings, structures or important features of the plan, thus destroying the historic relationship among buildings, structures, circulation systems, vegetation, landforms, and other important elements.</p> <p>Failing to provide adequate foundation drainage so that historic materials are damaged.</p> <p>Radically altering the grade level so that water drains toward structures or destroys the landscape.</p>
Protect and maintain	
Recommended	Not Recommended
<p>Preserving and maintaining historic circulation systems, street furniture, monuments, and other man-made elements of the plan.</p> <p>Preserving historic landscape features including on-going maintenance of historic plant material.</p> <p>Evaluating the overall condition of man-made and landscape elements and features to determine if repair or replacement is necessary.</p>	<p>Failing to provide adequate maintenance for historic circulation systems, street furniture, monuments, and other man-made elements.</p> <p>Allowing important landscape features and plant material to be lost or damaged due to lack of maintenance.</p> <p>Failing to evaluate the overall condition of man-made and landscape elements of the site prior to undertaking repair or replacement.</p>

DISCOVERING RESOURCES DURING REHABILITATION

Repair	
Recommended	Not Recommended
Repairing man-made features in kind based on existing prototypes and materials.	Replacing entire site features and elements in their entirety when repair or limited replacement is appropriate.
Repairing man-made features using compatible substitute materials that have the same visual appearance as the existing and that are physically and chemically compatible with surrounding materials	Using a substitute material that does not convey the visual appearance of the surviving parts of the man-made element, or that is physically or chemically incompatible with surrounding materials
Replace	
Recommended	Not Recommended
Replacing in kind an entire element or feature that is too deteriorated to repair based on surviving materials.	Removing a man-made feature of the site or an important landscape element and not replacing it; or replacing it with a new feature or element that does not convey the same visual appearance as the historic feature.
Replacing an entire element or feature that is too deteriorated to repair using a substitute material when using the same material is not technically or economically feasible.	Replacing elements or features with ones that convey a false sense of history or are historically inappropriate
Replacing deteriorated or damaged landscape features in kind.	
Design for Missing Features and Elements	
Recommended	Not Recommended
Designing and constructing or installing a new man-made feature or landscape element that is completely missing, based on physical, documentary or pictorial evidence.	Designing a missing element or feature based on insufficient physical, documentary or pictorial evidence or on conjecture.
Installing a new feature or element that is designed to be compatible with the base plan, its elements, and landscape features.	Introducing a new man-made element or landscape feature that significantly alters the historic base plan, detracts from historic man-made elements, is out of scale, uses incompatible materials, or is otherwise of an inappropriate design.
Alterations/Additions to the Base Plan and the Historic Landscapes	
Recommended	Not Recommended
Locating and designing new buildings, structures,	Locating new buildings and man-made elements

Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

circulation systems, street furniture, monuments, other man-made elements, and landscape features so that they are compatible with the historic plan, are as unobtrusive as possible, and assure the preservation of the historic relationship among base buildings and elements and features of the site and landscape.

Removing noncontributing buildings, structures, and man-made and landscape elements and features that are no longer functional.

where important landscape features will be damaged or destroyed.

Introducing new construction in historic districts which is visually incompatible in size, scale, design, materials, color or texture to the character-defining elements of the district; which destroys historic relationships among district elements; or which damages or destroys important landscape features.

Installing new landscape materials or features that are visually incompatible with the district, or significantly alter or destroy historic vistas and base plans.

Removing a historic building, structure or contributing man-made element or landscape feature which is important in defining the character of the site.

Appendix D

GLOSSARY OF TERMS USED IN MILITARY ARCHITECTURE

ABATTIS, ABATIS, a continuous thick line of felled trees and shrubs driven into the ground with bows pointing outwards to form an impenetrable obstacle. It was also constructed in shallow water to impede the movements of boats towards the shore.

ABUTMENT, an end wall supporting a row of casemates.

ACROPOLIS, an elevated stronghold of a Greek city, usually containing the temple of the patron divinity within its walls.

ADVANCED WORKS, *ouvrages avancée* - f., defensive works placed beyond the glacis but still near enough to be covered from the main defences.

AIR-HOLE, a ventilating hole, usually above a musketry loophole or embrasure, to extract smoke, especially from inside casemates or musketry galleries.

ALBARRA, detached wall tower designed to allow for better flanking fire and also to be easily isoalted from the main defences if taken by the enemy; a peculiarity of Iberian castles.

ALCAZAR, a Moorish or Spanish castle or fortress.

ALURE, a gallery or passage along the parapet of a castle.

ANTEMURAL, a wall or outerwork surrounding and protecting a castle; in some late medieval documents the word *barbican* was used to denote an *antemurale*.

ARCH, a curved construction spanning an opening.

ARRIS, the sharp edge produced when two surfaces meet together as at the salients of bastions or spurs.

ASHLAR, squared building masonry used in the construction of walls and other structures.

AVANCEÉ, a place-of-arms placed where the road leaves the covertway after passing through the gate.

AVANS MUR, see *antemural*.

BAILEY, the open area or courtyard within a medieval castle. (see *motte-and-bailey*).

BALISTRARIA, a loophole or aperture in medieval battlements through which crossbowmen fired their weapon.

BANQUETTE, a raised walkway, sometimes stepped, behind a high parapet to enable troops to fire their weapons over the parapet.

BARREL VAULT, a continuous arched roof of stone, of semicircular section, supported by parallel walls.

BARBETTE, a barba - í, en barbette - f, a platform on which guns are mounted to fire over a parapet.

BARBICAN, BARBACAN, an outer work defending the gate of a castle or citadel, frequently a fortified gate house.

BARRACK BLOCK, building, sometimes bombproof and fortified, designed to house the garrison of a fort.

BARTIZAN, a battlemented turret projecting outwards from the corner of a tower or wall.

BASCULE, a counterbalanced drawbridge of which there are two main types, the drawbridge levered by pole-arms or a counter-balanced gangway.

BASTION, Bastione, beluardo - i, a work projecting outwards from the main walls of a defensive enceinte, designed to enable the garrison to see and defend the adjacent perimeter together with the area in front of the ramparts. In its embryonic form, the bastion can be found in both cylindrical and polygonal form. The polygonal form was perfected by the Italian engineers of the late 15C and early 16C into a pentagonal work composed of two faces, two flanks and a gorge.

BASTIONETTE, a small bastion added to the salient of a bastion to provide enfilading fire along the two faces of the latter.

BATARDEAU, a dam or wall across a moat or ditch, built with a sharp ridge to prevent enemy troops from crossing the place; sometimes fitted with a turret as an additional barrier.

BAULKS, the beams on which the planks of a bridge spanning a ditch rest. **BATTER**, the inward inclination of the face of a wall from the vertical; a battered wall recedes as it rises.

BATTERY, a platform, usually protected by a parapet, for cannon and mortars; orillon battery, a battery placed in the flank of a bastion and sheltered by the orillon; coastal battery, a work, sometimes fortified against direct assault, designed to engage enemy ships close to the shore.

BATTLEMENT, a fortified parapet with merlons and crenels, or embrasures.

BAYOU, a trench in the rear of a battery designed to allow communication with a magazine; a branch of a trench.

BERM, a ridge below a parapet.

BLOCKHOUSE, a small fortified work consisting of one or more rooms fitted with loopholes in its sides to permit defensive fire in various directions.

BONNET, a small counterscarp in front of the salient angle of a ravelin.

BONNETTE, an increase in height given to a parapet due to the upward prolongation of its exterior and interior slope.

BONNET DE PRETRE, a defensive work resembling a tenaille.

BOULEVARD, Boulevard - f., a substantial defensive work, usually polygonal in plan, projecting outwards from the main enceinte; an early bastion-like structure.

BRATTICE, a temporary breastwork, parapet or gallery of wood used during a siege.

BRAYE, Braga - i., a continuous outerwork protecting the main enceinte, placed inside the ditch and separated from both the scarp and counterscarp walls.

BREACH, Breccia - i., a gap blown open in the walls of a fortress by a mine or artillery fire.

BREASTWORK, a fieldwork thrown up breast-high for defence; a parapet.

BRISURE, a break in the line of a curtain wall in order to increase the area for guns in the flank of a bastion and to allow for a wider view and field of fire from the same.

BULWARK, Bollwerk - g., Bolwerk - s, meaning a log-work, a substantial defensive work of earth; referring also to early bastion-like works of polygonal or semicircular plan (Boulevard, Beluardo), usually detached from the main enceinte.

BUTTRESS, a mass of masonry built against a wall to give additional lateral strength; usually to counteract the lateral thrust of a roof, vault or arch.

CAPANATTO, a masonry loopholed room for defenders, usually with a triangular front and opened towards the interior of the fort.

CAPITAL OF THE BASTION an imaginary line bisecting the salient angle

CAPONIER, a sheltered defensible passage across the ditch of a fort or cut through the glacis, linking the outerworks to the main enceinte; sometimes used to provide additional flanking fire along the ditch.

CASEMATE, cassamatta - i., a vaulted chamber built in the thickness of the ramparts and used as a barrack or gun position (firing through embrasures).

CASEMATED RETRENCHMENT, a retrenchment fitted with guns firing through embrasures from within vaulted casemates and placed behind the main line of fortification.

CASTLE, a stronghold or fortified post, more specifically the fortified residence of a prince or feudal lord.

CASTRUM, a term originally used to refer to a Roman military camp but later also used to refer to early medieval castles,

CAVALIER, a raised earth platform, built on a bastion or curtain wall, designed to mount artillery and to command the surrounding ground.

CHEMIN DE RONDE, a continuous passage or walkway on a rampart, protected by a parapet, designed to allow the defenders access to the various works along the defensive trace.

CITADEL, Cittadella - i., a fortress or castle built to dominate or protect a town. **COPING**, a sloped or bevelled stone cap placed on top of a parapet or wall so as to protect the masonry and infil below from the penetration of water from above.

CORBEL, a small projecting stone designed to support a beam or other horizontal member such as a machicolation.

CORDON, a rounded stone moulding or string-course, below the parapet of the revetment of a rampart, usually going all round the fort.

CORNICE MOULDING, a ~ moulded projection forming the exterior trim of a wall.

COUNTERFORT, a buttress built behind a scarp wall for the purpose of strengthening the latter.

COUNTERGUARD, large outwerworks, open at the gorge, designed to protect the faces of bastions and ravelins.

COUNTERMINE, a tunnel excavated beneath the glacis through the counterscarp wall, terminating in a small shallow pit designed to house an explosive charge which was fired by the defenders when the enemy occupied by the ground directly above the mine.

COUNTERMURE, a wall raised behind another to take its place when a breach is made; a form of retrenchment. **COUNTERSCARP**, *contrascarpa* - i., the outer wall of the ditch facing the ramparts.

COUNTERSCARP GALLERY, a casemate within the counterscarp fitted with musketry loopholes to defend the ditch and scarp wall.

COUPURE, a cut in the parapet and walkway of a rampart designed to prevent an enemy from turning the salient of the work.

COUVRE PORTE, a work designed to cover approaches to the main fortress.

COVERED WAY, COVERTWAY, *chemin couvert* - f., *strada coperta* - i., a path on top of the counterscarp, protected by a parapet formed from the crest of the glacis.

CRENELLATION, the gap in a parapet; an embrasure.

CROCHET, a narrow passage between the head of a traverse and the parapet of the covertway to allow for movement of troops along the latter.

CROWNWORK, *opera coronata* - i., a powerful outerwork, projecting ahead of the main enceinte to cover a vulnerable area, consisting of a central bastion supported by two demi-bastions.

CROWNED-HORNWORK, *opera coronata* - i., a horn work protected further by a crownwork.

CURTAIN, *cortina* - i., the main wall of a defensive work, usually the length of a rampart between two bastions.

CUTTING, a narrow opening in the parapet of the covered way, cut through the crest of the glacis, to allow for the passage of troops onto the glacis designed to facilitate counterattacks and are therefore usually found on the parapets of places-of-arms.

DEAD GROUND, an area of ground in the vicinity of a fortified work not covered by the defenders' guns and thus creating a vulnerable spot in the defences.

DEMI-BASTION, a half-bastion with one face and one or two flanks.

DEMI-CAPONIER, a caponier having only one protected flank.

DEMI-LUNE, mezzaluna - i., a small detached outerwork, similar to a ravelin but smaller, placed before a curtain.

DETACHED LUNETTE, an advanced work in the form of a lunette connected to the covered way by a caponier.

DISCHARGING ARCH, an arch built to relieve the weight of the wall above a weak area.

DITCH, *fossa* - i., *fossé* - f., a dry trench outside a fortified work, usually rock-hewn, to obstruct direct assault on the main walls.

DONJON, the keep or strongest part of a castle.

DRAWBRIDGE, a bridge spanning a moat or a ditch, hinged and provided with a raising and lowering mechanism so as to hinder or enable passage into a castle or a fortress.

DRUM, one of the cylinders of stone which form a column, sometimes used in the walls of a fortress, especially if the latter was built in the vicinity of the ruins of a classical site, from where such material was eagerly quarried as building material.

EGLISE-DONJON, a church-keep or fortified chapel.

EMBRASURE, an opening cut in the parapet through which a gun could be fired without exposing the guncrew, normally wider at the front than at the rear; in casemates an enlargement of a window opening by means of splayed sides.

ENFILADING FIRE, fire from the flank of a bastion along the faces of the adjacent works.

ENCEINTE, the fortified perimeter of a dense work, and the area enclosed by it.

ENTRENCHMENT, *trinceramento* - i., an inner, second line of defence sometimes accompanied by a trench; coastal entrenchment, a entrenchment built along the shoreline to impede an enemy disembarkation.

ENTRENCHED BASTION, a large bastion with an entrenchment built into its gorge.

ESCARPE, scarp, the wall of a fortified work which forms the side of the ditch facing outwards towards the counterscarp.

ESCARPMENT, a steep slope in front of a fortification to impede an enemy's approach.

ESCUTCHEON, a shield, usually of stone or marble, fixed to a fortress wall or above a gateway on which are depicted coats-of-arms and other heraldic insignias.

ESPLANADE, an open, levelled space between a citadel and the buildings of a town, to ensure a clear view of the immediate approaches to the fortress.

Fort Lee and Fort Pickering Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan

FACE WALL, the front, exposed retaining wall of a bastion or other defensive work; the wall of a bastion between the salient angle and the shoulder of a flank.

FAUSSE-BRAYE, *falsa braga* - i., an outer rampart, or vans mur, added to the walls of a fortress, but lower in height than the main walls and preceded by a ditch. The *proteichisma* of Greek and Byzantine fortifications.

FLAT-ARCH, an arch with a horizontal intrados, having little or no convexity.

FLANK, that section of a fortified work designed to defend an adjoining work and to provide enfilading fire.

FLEUR-DE-LYS, French royal lily, conventionalized as an ornament and frequently found decorating the roof of *echaugettes*.

FRONT OF FORTIFICATION, the distance between the salient points of two adjacent bastions.

FOOT OF GLACIS, the line where the sloping glacis meets the level ground of open country.

FOUGASSE, a rock-hewn mortar.

FURROW OF GLACIS, the line where two stretches of glacis meet together at the re-entrant angle of the place-of-arms and covertway.

FORT, a fortified military establishment, a fortress without a city.

FORTRESS, a fortified city or other major defensive work.

FLECHE, a arrow shaped work, similar to a redan; a lunette attached to the main works by a long caponier.

GABION, a cylindrical earth-filled wicker basket used as a temporary parapet to shield both guns and men in filed positions or in makeshift countermures.

GATE, MAIN, *Porta Reale* - i., the principal entrance into a fortress, protected by a drawbridge and a ditch, internally containing one or more guardrooms which may be fitted with loopholes to cover the approaches to the doorway; the exterior facade usually of neoclassical design, embellished, especially in the 17C and 18C, with Baroque and Rococo decorations.

GATE COURT, the courtyard between two successive gates of a castle.

GATEHOUSE, a building accompanying a gateway of a castle or a fortress.

GATE-TOWER, a tower, sometimes two tower joined together, containing the gate of a fortress or castle and usually housing the mechanism for the drawbridge.

GLACIS, *spalto* - i., the sloping ground in front of a fortress spanning from the top of the parapet of the covertway down until it reaches the open country, cleared of all obstacles to bring an advancing enemy into the direct line of fire.

GIBBS SURROUND, the surround of a doorway consisting of alternating large and small blocks of stone.

GORGE, the interior side, or neck, of a bastion, outerwork or other defensive work not protected by a parapet.

GUN-LOOP, GUN-PORT, a circular loophole with accompanying vision-slit through which early medieval guns and cannon could be fired from behind a parapet or from within a casemate.

GUN-TOWER, a hollow or casemated tower fitted with embrasures for cannon.

HOARD, HOARDING, a covered wooden gallery projecting from the top or a wall or parapet of a castle to enable the defenders to shower missiles on attackers at the foot of the wall.

HORNWORK, *opera a corna* - i., an outerwork consisting of a front of two demi-bastions joined by a short curtain wall.

KASR, an Islamic castle in North Africa.

KEEP, the last defensible stronghold of a fortress or castle.

LINE OF DEFENCE, the line of fire from the flank of a bastion along the face of the adjacent bastion.

LINTEL, a horizontal stone placed over an opening to carry the weight of the wall above it.

LODGEMENT, a temporary defensive work erected by the enemy on a captured section of a besieged fortress.

LOOPHOLE, a long and narrow opening in a wall to provide for vision and small arms fire; loop window or arrow slit, a loophole for crossbows; gun loop, a loophole for small early cannon;

LUNETTE, a large outerwork in the shape of a detached bastion; similar to a ravelin.

MAGAZINE, gunpowder magazine, *polverista*, a storage place for gunpowder and other munitions.

MAGISTRAL LINE, the highest point of the scarp of a rampart or any other fortification which, when shown on a plan, is drawn thicker than the other lines.

MAIDEN TOWER, the keep, donjon or principal tower of a castle.

MARBLE THROUGH-COLUMN, antique marble columns used in the building of ramparts to strengthen the walls.

MASONRY, the stonework or brickwork of a building or wall.

MASTIO, a keep or donjon; a stronghold.

MERLON, the solid part of a parapet between two embrasures or crenels.

MEURTRIERES, holes in the ceiling or vault through which offensive materials could be dropped on attackers inside the passage of a gateway; also known as murder holes.

MEZZALUNA, a demi-lune.

MOAT, a wide and deep trench surrounding the walls of a fortress or castle, usually filled with water.

MOTTE, the mound of earth on which the keep or donjon of an 11th or 12th century castle was built.

MOTTE-AND-BAILEY, an early form of castle which appeared in France and Normandy in the 11C and 12C, consisting of a motte, a mound of earth on which stood a tall wooden tower overlooking the bailey, a larger palisaded courtyard.

MUD BRICK FORTS, fortified works built of any type of sun-dried clay brick.

MURUS, a defensive wall of stone or brick built around a Roman town.

MUSHRABIYA, in Moslem fortifications, a machicolated balcony, sometimes with embattled parapet, projecting over a gate or entrance.

NECK OF BASTION, the gorge of the bastion.

OPENWORK, any work not protected by a parapet at the gorge.

OUTWORK, OUTERWORK, a defensive structure placed outside the main enceinte of a fortified work.

PALISADE, a series of wooden poles with pointed times, sometimes fortified with iron tips (*punte di ferro*), driven into the earth and used as a fence or fortification; wooden palisaded gates were placed in front of the drawbridges leading into the main gateways.

PARAPET, *parapetto* - i., a breastwork on top of a rampart intended to provide shelter for troops behind it.

PAS-DE-SOURIS, a staircase giving access from the ditch to the covertway and places-of-arms.

OPERE DA SOLDATO, also *Architettura Soldatesca* - i., earthworks and other field fortifications erected by the troops themselves, such as redoubts, palisades, breastworks and trenches.

ORILLION, *oreccbino, guardanaso* - i., a projecting shoulder of a bastion designed to cover the flank.

PIAZZA, a large open space or courtyard inside a fortress, a parade ground.

PIAZZA BASSA, a low platform in the flank of a bastion; a casemated battery in the flank of a bastion.

PLINTH, a square or rectangular base so designed to give the appearance of a platform.

POLVERISTA, a specially built magazine used for the storage of gunpowder.

POMERIO, the open areas between the walls of a fortress and the urban fabric, to allow space for troops to assemble.

PORTCULLIS, a large iron or wooden grating, used to block a passage when released vertically in retaining grooves cut in the jabs of a fortified gateway.

POSTERN, a sally port; a vaulted stone tunnel under the ramparts leading to an inconspicuous rear gate used for sorties in war; a small door near a larger one.

QUOIN, a hard stone used to reinforce an external corner or edge of wall.

RAMPART, a thick wall of earth or masonry forming the main defence of a fortress, usually reinforced from the rear with terreplein.

RAVELIN, a triangular outerwork placed in front of a curtain to defend it.

REDAN TRACE, a fortification consisting redans forming a serrated system of of a series of

REDOUBT, *ridotto* - i., a small fortified work designed as an infantry stronghold; sometimes built inside a bastion or ravelin as a retrenchment, or in the field as a defence against cavalry attack; coastal redoubt, an infantry stronghold placed on the shoreline against a sea-borne invasion.

REVETMENT, a retaining wall of a fortress.

RUBBLE WALL, a wall of uncoursed stones of irregular shapes and sizes.

SALLY PORT, *porta falsa* - i., a concealed gate or underground passage leading from inside the fortress into the ditch; a postern.

SALIENT OF BASTION, corner of a bastion.

SALIENT OF BASTION, the projecting front angle of a bastion.

SHELL-KEEP, a stone keep with an internal courtyard and dwellings placed against its inner side. Late to develop into the inner ward of a castle.

SHOULDER OF BASTION, the angle between the face and the flank of a bastion.

SPUR, an arrow-shaped work; spur of a bastion, sharp-edged buttress placed at foot of a rounded salient of bastion. **TALUS**, an outward sloping wall, commonly used in medieval defences.

TENAILLON, an outerwork designed to protect a ravelin.

TERRA, term used in medieval times to denote a walled town or city.

TERRAPLEIN, the packing of earth forming the body of a rampart; the gently sloping ground behind a parapet, formed from packed earth.

TRACE, the perimeter or ground plan of a fortified work.

TRAVERSE, a defensive barrier, consisting of a parapet or simple wall placed at right-angles to the main line of defence and in order to protect the defenders from flanking fire; commonly found on covertways (18C) but also on the main ramparts themselves.

TENAILLE, *tenaglia* - i., a small outerwork placed inside the ditch, between two adjoining bastions, and designed to protect the curtain wall; usually detached but sometimes linked to the flanks or shoulders of adjoining bastions.

TROPHIES, in baroque fortifications, carved or sculptured features representing the trophies of war - cannon, shields, flags etc., used for decorative purposes.

TURRET, a small and slender tower, sometimes projecting from the main rampart.

VOUSSOIR, wedge-shaped stones used in an arch or vault.

VENTILATION SHAFT, openings in the ceilings of casemates used as cannon or musketry galleries which are designed to channel the escape of toxic fumes generated by burnt gunpowder.

WALL-TOWER, a tower built as part of a rampart of a castle, usually projecting outwards from the main curtain wall.

WARD, an outerwork of a castle.

WATCH-TOWER, a small tower, lightly fortified and used as a lookout post.

WICKET, a small door forming part of a larger one.

WING, a long and narrow rampart protecting the exposed sides of a horned or crowned work.

Appendix E

MASSACHUSETTS WETLANDS PROTECTION ACT

Authorities: M.G.L. c. 131, § 40: Massachusetts Wetlands Protection Act; 310 CMR 10.00: Wetlands Regulations.

Jurisdiction: Any wetland, including:

- Any bank, freshwater wetland, coastal wetland, beach, dune, tidal flat, marsh or swamp bordering on the ocean, any estuary, creek, river, stream, pond, lake, or certified vernal pool;
- Land under any of the water bodies listed;
- Land subject to tidal action, coastal storm flowage, or flooding; and
- Riverfront areas in the Commonwealth of Massachusetts.

In addition, a 100-foot buffer zone around any fresh water or coastal resource listed above is subject to jurisdiction.

Applicability: Any construction in or near a wetland resource, including intertidal and subtidal habitat, is subject to the provisions of the Wetlands Protection Act (WPA).

Regulatory Summary: Local Conservation Commissions and the Department of Environmental Protection (DEP), Wetlands Program administer the WPA (310 CMR 10.00: Wetlands Regulations). The purpose of the WPA is to protect Massachusetts wetlands resources and to ensure that the beneficial functions of these resources are maintained. The resources identified are protected because they fulfill the public interest to protect public and private water supply, protect fisheries, protect groundwater supply, provide flood control, protect land containing shellfish, prevent storm damage, protect wildlife habitat, and prevent pollution. These interests are protected by a "no net loss of wetlands" policy. Projects that affect wetlands are required to avoid impacts where possible, minimize unavoidable impacts, and mitigate for unavoidable impacts. Performance standards define the levels of environmental impacts that cannot be exceeded.

Projects proposed in wetlands resource areas or in the buffer zone around them must obtain a local Order of Conditions. Wetland resources include land under the ocean, coastal banks, coastal beaches and tidal flats, coastal dunes, barrier beaches, rocky intertidal, salt marshes, land under salt ponds, Designated Port Areas, land containing shellfish, and land on the banks of fish runs.

Review Process: Proponents of projects in wetlands or in the buffer zone around them must apply for an Order of Conditions from the municipal Conservation Commission. In addition to the requirements of the WPA, project proponents should check with Conservation Commission officials to determine if there are any local wetlands by-laws applicable to the project. Applicants must also obtain a list of abutters from the Assessors Office so that the abutters can be notified of the proposed project.

The application, called the Notice of Intent (NOI), which describes the type and boundaries of resource areas and the type of work proposed, is submitted by the applicant to the Conservation Commission along with supporting plans. A professional engineer generally must stamp plans. A copy of the NOI is also submitted to the regional office of DEP, which issues a project number for the proposed activity. A legal notice is published in a local newspaper. Upon completion of these steps, the Conservation Commission opens the public hearing of the proposal.

If the project is approved or approved with conditions, the Commission has up to 21 days to issue an Order of Conditions (OOC). Abutters, a group of 10 citizens, or the applicant have 10 days to appeal an approval to DEP. If the proposal is denied, the applicant can appeal the decision to DEP. If the project is appealed, DEP will issue a Superceding Order of Conditions (SOOC), either confirming or altering the original Order.

Forms: WPA Form 3 Notice of Intent at www.state.ma.us/dep/appkits/forms.htm.

Fees: Based on the category of the proposed activity and resources affected (310 CMR 10.03).

Website: www.state.ma.us/dep/brp/ww/aboutww.htm.

Contact: DEP Wetlands Program (617) 292-5695.

Appendix F

FORT LEE SUMMARY OF MAINTENANCE AND RESTORATION RECOMMENDATIONS

Short-term

Goals:

- *Encourage civic participation in the management and protection of Fort Pickering.*
- *Develop a program for the stabilization and maintenance of the fort.*
- *Develop an implementation program that can be accomplished with current city personnel.*
- *Develop recommendations to assist the city personnel in the necessary and appropriate maintenance of these sites.*

1. Establish Friends of the Forts Committee and hold public participation meetings.
2. Add selected fill material to eroding areas and compact by hand.
3. Monitor erosion and replace soil wash.
4. Seed areas that are eroding.
5. Removal of selected surface vegetation for planning and site survey.
6. Contract for a complete topographic survey for use in planning and design.
7. Modify Restoration Master Plan as required with new information with new phases if appropriate.
8. Prepare technical specifications and working drawings for proposed restoration.

Mid-Term

Goals:

- *Develop ways to make the fort features more visible.*
- *Develop ways to encourage visitors to experience Fort Lee*
- *Enhance the passive recreational features of the fort.*
- *Better integrate Fort Lee with Salem Willows Park.*

1. Remove most of the vegetation that is over growing the fort and plant new stabilizing vegetation.
2. Remove part of Memorial Drive that separates Fort Lee from the Salem Willows Park.
3. Extend new concrete walks from Salem Willows to Fort Lee with period lighting.

Goals:

- *Create wheelchair accessibility.*
- *Enhance the passive recreational uses of the fort area.*

1. Modify grades to create wheelchair access to top of rampart.

Long-Term

Goals:

- *Develop ways to make the fort features more visible.*

1. Construct a new Forts Visitor's Center at the east open area visible from Fort Ave. This center should house some of the appropriate artifacts of the fort area and displays should be developed

to convey an understanding of the geology, prehistory and history of the forts and their importance to Salem.

2. Create visitors parking area with accessible parking.
3. Provide new interactive interpretive kiosks at main entry to fort.
4. Provide new plaque type interpretive signs at specific locations in existing stone.

Additional Research

Recommendations for additional research in high sensitivity areas that have not yet been tested archaeologically or where potentially significant resources are expected based on archival sources or other background information.

Recommendations relating to local ordinances and/or review procedures and management strategies

Guidance document that outlines appropriate steps to be followed by contractors or grantees for the city in the event unexpected historic or archaeological discoveries are made.

Appendix G

FORT PICKERING SUMMARY OF MAINTENANCE AND RESTORATION RECOMMENDATIONS

Short-Term

Goal:

- *Encourage civic participation in the management and protection of Fort Pickering.*
- *Develop a program for the stabilization and maintenance of the fort.*
- *Develop an implementation program that can be accomplished with current city personnel.*
- *Develop recommendations to assist the city personnel in the necessary and appropriate maintenance of these sites.*

1. Establish Friends of the Forts Committee and hold public participation meetings.
2. Add selected fill material to eroding areas and compact by hand.
3. Monitor erosion and replace soil wash.
4. Seed areas that are eroding.
5. Removal of selected surface vegetation for planning and site survey.
6. Contract for a complete topographic survey for use in planning and design.
7. Modify Restoration Master Plan as required with new information with new phases if appropriate.
8. Barricade path to prevent further erosion at entry stone rampart, Waikiki Beach and at Winter Island beach.
9. Barricade path through rampart.
10. Barricade path at bunker B.
11. Prepare technical specifications and working drawings for proposed restoration.

Mid-Term

Goals:

- *Develop ways to make the fort features more visible.*
1. Remove most of the vegetation that is over growing the fort and plant new stabilizing vegetation.
 2. Re-grade to create positive drainage where required.
 3. Remove fill between bunker A and B.
 4. Remove existing wooden telephone pole and abandoned conduits.
 5. Level and construct new paths from parking to viewing area.

Goal:

- *Create wheelchair accessibility.*
 - *Enhance the passive recreational uses of the fort area.*
1. Modify grades to create wheelchair accessible access to top of rampart.
 2. Reconstruct stonewall at Waikiki and reconstruct earth rampart wall at Winter Island beach.

Goal:

- *Develop ways that visitors may understand the stages of fort construction on the site.*
1. Repair rampart stone walls and recreate the earth fort at one section to allow full understanding of the fort construction.
 2. Drain moat to remove aircraft parts and other refuse and clean and repair the moats.

3. Repair all earth ramparts at bunkers.

Long-Term

Goal:

- *Develop ways to make the fort features more visible.*
- *Enhance the passive recreational uses of the fort area.*

1. Create a viewing platform and stair access to top of the Bomb Proof Magazine Bunker.
2. Re-grade earth rampart to restore original earth form.
3. Enlarge the grass entry area removing the entry drive and create Fort Pickering accessible and designated parking.
4. Create a main entry plaza with informational kiosk.
5. Provide new interactive interpretive kiosks at main entry to fort.
6. Provide new plaque type interpretive signs at specific locations.

Recommendations - North Moat Rip Rap

Retain both rip rap and causeway masonry as is. No substantial repairs appear needed.

Recommendations - North Entry Wall

Short term - Stabilization:

- West Face: Chink voids in joints to match existing chinking, and fill large void on left side with a single stone plus chinking. Restore soil cover to parade side flank. Remove graffiti.
- Moat Face: Rebuild with added chinking to match character of west face. Restore soil cover to top.

Recommendations - North Rifle Gallery Rear Wall

Short term - Stabilization:

- Rebuild corners at rifle gallery passage, and at west end as required to stabilize the flanking walls and retain soil. Rebuild remainder only as required to stabilize erosion and secure random loose stones. Maintain general existing appearance of wall, but use 1942 photo as guide for rebuilding the rifle gallery passage.

Recommendations - East End Walls @ North Moat

Short Term - Stabilization:

- Limited rebuilding and chinking of wall "A" as necessary to support an improved pathway and reset any loose stone. The extent of repair needed at wall "B" cannot be determined until the vegetation is removed.

Mid Term - Restoration:

- Fully rebuild both walls (A and B) to their original height and character with tight chinking.

Recommendations - West Moat

Short term - Stabilization:

- Remove existing vegetation along all banks and determine full extent and condition of rip rap. Assuming moat is to remain as is (i.e., not dug out and re-filled), repair only as necessary to stabilize the rip rap in its current state.

Long term - Restoration:

- Dredge and restore moat with reconstruction of any missing or badly deteriorated rip rap to match the rip rap at the north moat, including the berm at the south end. Restoration of the moat would also likely require opening a clear passage for water flow under the causeway from the north moat.

Recommendations - West rampart and Rifle Gallery

Short Term - Stabilization:

- Remove existing vegetation from walls.
- Recheck to secure any loose stones. Partially rebuild the northern portion where it bulges as required to stabilize it.

Mid-Term - Interpretation:

- Provide signage to interpret the archeological features at the southern end of the west rampart (rear rifle gallery wall, wood beam ends, chimney slot, and rifle gallery front foundation).

Long Term - Reconstruction:

- Reconstruct the entry end of the west rampart to match the contours documented in the 1864 drawing, including a section of the rifle gallery. The total length should be about 60' terminating at the former passage from the parade. This should be coordinated with the restoration of the west moat.
- Consider using the interior of the reconstructed rifle gallery as a visitor center.

Recommendations - South Ramparts

Short Term - Stabilization:

- Remove existing vegetation using care to not disturb any stones including those that appear to be lying at random.
- Recheck any loose or missing stones in the areas having organized stone parapet walls.

Mid-Term - Research and Testing:

- Carry out archeological testing at locations of former embrasures and gun emplacements for evidence of their construction detailing.
- Carry out additional document research at the National Archives and Coast Guard archives for details original construction and later changes.

Long Term - Restoration:

- Consider restoring more sections of organized stone parapet walls along the ramparts if further research and physical evidence indicates they were present.

Long Term - Reconstruction:

- Consider reconstruction of an embrasure and gun emplacement to further the interpretation of the fort, depending on the results of archeological testing and research.

Recommendations - Tidal Rip Rap

Short Term – Maintenance:

- Inspect rip rap every spring for loose or dislodged stone, and soil erosion at its top perimeter; repair any such defects as they occur.

Recommendations – Magazine A

Short Term – Maintenance:

- Clean modern debris and accumulated silt off the stairs and the corridor floor below.

Short Term – Stabilization:

- Regrade the surface area outside the entry and/or rework the door and threshold to direct surface runoff away from the staircase.
- Replace the missing lintel stone at the top of the entry.
- Include archeological recovery for any work that will remove existing soil. See text above for more detailed discussion.

Mid Term – Research and Testing:

- Examine existing newel area of stair and related period examples and literature to determine how best to restore the missing newel post. The study should include an engineering evolution of the the newel area and the masonry immediately above it, and sophisticated analysis of the historic mortar to design a suitable mortar formula for rebuilding work.

Long Term – Restoration:

- Restore the missing staircase newel post and related masonry including any broken or partially missing stair treads.

Long Term – Interpretation:

- Consider opening the interior of this magazine to guided public tours for small sized groups, assuming safety and liability issues can be resolved.

Long Term – Preservation:

- Monitor condition of interior masonry regarding spalled brick and eroded mortar joints on a yearly basis, but do not replace spalled brick or repoint masonry unless significant deep deterioration is detected.

Recommendations – Magazine B

Short Term – Maintenance:

- Clean modern debris and accumulated silt off the corridors, stairs and the magazine floor.

Short-Long Term – Research and Testing:

- Monitor magazine ceiling for any substantial increase in seepage (check yearly in spring after winter thaw, and after periods of prolonged heavy rain). Actively investigate roofing conditions from above and institute repairs only if leakage develops to an extent threaten that the integrity of the magazine.

Mid-Term – Preservation:

- Replace framing and sagging plywood floor at base of stone stair to provide a sound landing platform.

- Replaces missing lintel in doorway to magazine vault sized to match the void of the original lintel. Use rot resistant wood such as white oak or black locust instead of modern pressure treated lumber or common pine.

Mid-Term – Restoration:

- In magazine vault Restore 2 ventilation slots where the brick is missing using matching water struck brick and a 1:1:6 mortar mix (Type S hydrated lime:white Portland cement:sand) tinted to match adjacent mortar.
- At exterior entry cut and repoint capstone joints and open wall joints using 1:1:6 mortar.
- At exterior sidewall fill in areas of missing stone with new stone similar in general size, shape, and finish to the existing, and rechink entire wall without using mortar.

Long-Term – Restoration:

- If the magazine is to be opened for limited public tours, consider restoring the wood floor in the magazine vault to match the existing 2" plank floor, applying whitewash to the masonry, and redoing the electric lighting.

Recommendations – Magazine C

Short Term – Maintenance:

- Clean modern debris and accumulated silt off the corridors, stairs and the magazine floor.

Short Term – Stabilization:

- Restore the soil cover over the exposed vault masonry above the entry corridor.
- Take steps to discourage people from climbing up the mound at this location.

Short-Long Term – Research and Testing:

- Monitor spalled brick in magazine wall for any substantial increase in seepage (check yearly in spring after winter thaw, and after periods of prolonged heavy rain). Actively investigate conditions and institute repairs only if leakage develops to an extent threaten that the integrity of the magazine.

Mid-Term – Preservation:

- Replace missing brick over current metal entry door.
- Replaces missing lintel in doorway to magazine vault sized to match the void of the original lintel. Use rot resistant wood such as white oak or black locust instead of modern pressure treated lumber or common pine.

Mid-Term – Restoration:

- At exterior entry cut and repoint capstone joints and open wall joints using 1:1:6 mortar.
- At exterior sidewall fill in limited areas of missing stone and open mortar joints with new stone similar in general size, shape, and finish to the existing, using 1:1:6 mortar mix.

Long-Term – Restoration:

- If the magazine is to be opened for limited public tours, consider restoring the wood floor in the magazine vault to match the existing WWII flooring, applying whitewash to the masonry, and redoing the electric lighting.

Recommendations – North Bastion Masonry (Igloos)

Short Term – Stabilization:

1. Fully excavate the rear side of a vertical panel under the joint direction of an archeologist and an architectural conservator in order to determine:

- a. The construction detailing of the rear side of the panels and assess the feasibility of replacing severely spalled vertical panels.
- b. The extent that replacement of individual vertical panels would impact potential remaining archeological features of the bastion.

2. Clear all woody vegetation from the top of the bastions. At a minimum the area within 4' of the concrete panels should be cleared. Woody roots should be physically removed adjacent to the panels assuming their removal will not affect archeological features, will not further damage the panels, and that the soil surface will be immediately treated to prevent further erosion.

3. Provide fill to bring the soil surface level to the top of the panels.

4. Remove and store for future reinstallation any of the top igloo panels that are in danger of falling, or reset them to make them secure.

5. Remove graffiti (leaving it in place is an open invitation for more extensive graffiti).

6. Clean out drainage swale on the inner side of the concrete roadway.

Medium- Long Term - Preservation: (in prioritized order)

7. Replacement of the 16 missing or severely spalled 4' panels over the igloos, along with minor patching and realignment of the remaining 14 sound units (many of this units are severely dislodged). Note that this will require 3 distinct casting patterns, and will also require the fabrication of at least 40 bronze retaining clips in at least two different configurations (1 at the tops and 1 at the lower sides).*

8. Plastic patching repair of edge spalls at the igloos (14 individual repairs)*

9. Plastic repair to shallow surface spalls at the igloos (12 locations)*

10. Replacement of severely spalled vertical panels (9 panels total, 5 being on the south wall)*

11. Plastic patching repair and/or replacement of vertical panels having moderate spalls, together with realignment of severely dislodged vertical units.

12. Incipient spalls; postpone repair until spalling becomes more fully developed, at which time carry out plastic patching.

13. At the roadway carry out plastic patching repairs to any areas where the surface spalling has deepened to become a hazard to pedestrian usage; treat the patched surface to reproduce the original brushed surface texture.

* The number of repairs listed in the above recommendations are estimates of current conditions based on a very brief survey. The execution of plastic repairs and replacement of deteriorated units should be preceded by a resurveying the units on a detailed level, and the preparation of detailed technical specifications based on the literature cited in the appendix.

Appendix H

ADDITIONAL RESEARCH AND PRESERVATION ISSUES

Recommendations for additional research in high sensitivity areas that have not yet been tested archaeologically or where potentially significant resources are expected based on archival sources or other background information.

Recommendations relating to local ordinances and/or review procedures and management strategies

Guidance document that outlines appropriate steps to be followed by contractors or grantees for the city in the event unexpected historic or archaeological discoveries are made.

Preservation Issues Both Forts

1. *Social Paths*: Barricades placed to discourage traffic in at-risk locations, deeply eroded paths should be filled and planted with sod or appropriate ground cover to consolidate the earthwork surface; appropriate paths should be marked to encourage their use, and improved to prevent further erosion. Improvements could include surfacing with gravel or mulch, placement of paths on gentle slopes, construction of stairs or ramps where paths ascend steep slopes, and construction of water diversions.
2. *Mature Trees*: Mature trees should be selectively cut. Care should be taken because, though large trees may detract from the historical setting of the fort, they contribute to the feeling of the more recent historic park setting.
3. *Bicycles and Motor Bikes*: Bicycles and motor bikes should be banned. Barricades should be placed at the path entrances. Educational signs should be posted explaining the preservation issues, and pamphlets made available. The site should be monitored by park personnel.
4. *Inappropriate Plantings*: More appropriate locations for gardens should be offered, possibly within the park.
5. *Inappropriate Activities*: Clearly worded guidelines developed with an eye towards long term preservation of the fort's fabric. Signs and pamphlets may be useful for disseminating this information. Park staff should be educated as to the issues involved, and should enforce the guidelines.

Preservation Issues Fort Pickering

1. *Shore Line Erosion*: The situation should be monitored and appropriate steps taken to slow the loss of the fort as necessary.

Preservation Issues Forts Lee

1. *Looting*: Signs should be posted to educate the public concerning the law and good stewardship. This information could also be disseminated through pamphlets. Park personnel should be trained as to the issues involved, and should monitor the site.
2. *General Erosion of Earthworks*: Shade tolerant ground cover should be planted to consolidate the rampart surface. Removal of shade trees should be considered (see mature trees, above).

- Barricades should be placed to discourage traffic in at-risk locations.
- Deeply eroded paths should be filled and planted with sod or appropriate ground cover to consolidate the earthwork surface
- Appropriate paths should be marked to encourage their use, and improved to prevent further erosion. Improvements could include surfacing with gravel or mulch, placement of paths on gentle slopes,
- Construction of stairs or ramps where paths ascend steep slopes
- Construction of water diversions.
- Brush should be removed and replaced with sod or appropriate ground cover. Vegetation that is rampant, or threatens to become rampant, should be removed. Species include Staghorn Sumac (*Rhus typhina*), Multiflora Rose (*Rosa multiflora*), Japanese Knotwood or "bamboo" (*Fallopia japonica*); Sycamore Maple (*Acer pseudoplatinus*); Asiatic Bittersweet (*Celastrus orbiculata*); honeysuckle (*Lonicera* sp.).
- Mature trees should be selectively cut. Care should be taken because, though large trees may distract from the historical setting of the fort, they contribute to the feeling of the more recent historic park setting.
- More appropriate locations for gardens should be offered, possibly within the park.
- Bicycles and motorbikes should be banned.
- Barricades should be placed at the path entrances.
- Educational signs should be posted explaining the preservation issues, and pamphlets made available.
- The site should be monitored by park personnel.
- Signs should be posted to educate the public concerning the law and good stewardship. This information could also be disseminated through pamphlets. Park personnel should be trained as to the issues involved, and should monitor the site.
- Shade tolerant ground cover should be planted to consolidate the rampart surface. Removal of shade trees should be considered (see mature trees, above).
- Clearly, worded guidelines should be developed with an eye towards long-term preservation of the fort's fabric.
- Signs and pamphlets may be useful for disseminating this information to the public.
- Park staff should be educated as to the issues involved, and should enforce the guidelines.

Management Recommendations For Fort Lee and Fort Pickering

General Suggestions

- Place the administration of Fort Lee under that of Winter Island to simplify management of these two closely related historic sites.
- Clarify land ownership and legal rights and responsibilities for the two sites.

Fort Pickering * may require archaeological testing

- *Build an ADA compliant path to the parade and ramp to an observation platform on the east water front with signs to explain features that are visible from the platform

- *Assess earth-covered magazines as to their structures and maintenance (floors removed or replaced, repointing, rewiring). Open magazines to the public if they can be made safe and be protected from vandalism.
- Construction of an information kiosk at the entrance to the fort.
- *Creation of a formal Visitor's Center for the Forts to be placed in an existing building (current office, barracks, portion of hangar).
- No mortar pointing of dry laid walls.
- *Interpretive signs
- The existing paths are ok, but barricades should be placed on deeply eroded rampart on the south side of the fort and also on the earth covered magazines.
- Park employees should be trained on preservation issues and responsibilities: obtaining clearance from the MHC before performing maintenance that requires excavation.

Fort Lee

- *may require archaeological testing
- *To be ADA compliant, installation of one Wheelchair accessible path that goes from the road level to the fort's parade and ramp to observation deck on the platform. Install signs to explain features visible from the platform. Path should be of an appropriate surface material and will probably need switchbacks due to the slopes.
- Regular patrols of the site by a Park Ranger.
- Construction of a bathroom facility in space previously graded for parking lot to avoid archaeological issues.
- *Construct a Formal entrance with an information kiosk.
- Clearly mark the boundaries of the fort.
- Place picnic tables on the terraces below the fort.
- *Placement of interpretive signs.
- Park employees should be trained on preservation issues and responsibilities: obtain clearance from MHC before performing maintenance that requires excavation.
- Barricades should be placed to block inappropriate paths (ie pathway filled with brush, steep ends of ramparts and faces of earth-covered magazines).
- Bicycles and dirt bikes should be banned and bike racks should be installed at the foot of the hill.

Appendix I

	Fort Pickering (William)	Fort Lee
1600-1700	1643 - earliest known date fort was in existence	
		1690 - The heights were first fortified with breastworks.
1701-1800	1699 - Fort named for King William III	
	1704 - Fort renamed for Queen Anne but was still known locally as Fort William	
	1706 - Fort Anne was ordered to be repaired by the Governor of Massachusetts but the town of Salem declined to make the repairs because of the cost	
	1735 - General Court ordered that Fort Anne should be repaired so that 15 cannon could be mounted. 600 pounds was granted to fund this repair.	
	1760 - barbecues at the fort	
		1742 - Fort Lee was improved with platforms for sixteen guns and ramparts close to seventy feet above sea level.
	1774 - Fort served as a garrison for the 59 th British Regiment under the command of Colonel Hamilton	
		1775 - August - British Ship "Falcon" chased Salem schooners into Cape Ann Harbor and captured one of the ships. British sloop-of-war Nautilus chased a Beverly privateer into the harbor and grounded on the flats - men of Salem and Beverly shot at the Nautilus. These attacks prompted the Town of Salem to vote on October 23 rd 1775 to block the harbor channel with hulks and to put the forts in order - including building Fort Lee.
	1776 - Fort strengthened	1776 - constructed to improve defenses of Salem Harbor
	1776-1780 - Revolutionary War, Fort was garrisoned and protected the large fleet of privateers operating out of Salem Harbor	
		1790 - Richard Gridley, the American Army's first Chief Engineer, directed the forts rebuilding.
1801-1900	1794 - Fort ceded to the United States by Salem - new fort constructed under the direction of S. Rochefontaine	
	1799 - Fort was repaired and renamed Fort Pickering	
		1812 - Fort was repaired and remodeled during War of 1812
	1861 - United States Government allocated monies to repair and rebuild	
	1863 - present structures were built by the Department of War	1863 - Alterations made to accommodate four heavy guns
1901-2000	1898 - Fort was garrisoned during the Spanish American War and then later abandoned	
	1934 - U.S. Coast Guard Facility created on Winter Island	
	1969 - Winter Island Coast Guard Facility decommissioned.	
	1976 - Restorations by the Salem Bicentennial Commission	1976 - Restorations by the Salem Bicentennial Commission
2001 - 2003	1998 - Preliminary Restoration study completed for Fort Pickering and Light House.	
	2003 - Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan	2003 - Conditions Assessment, Cultural Resources Survey, and Maintenance and Restoration Plan