National Park Service
U.S. Department of the Interior

Historic Architecture Program
Northeast Region

BATTERY POTTER, MORTAR BATTERY, AND BATTERY GUNNISON

Fort Hancock, New Jersey
Sandy Hook Unit
Gateway National Recreation Area

Historic Structure Report

BATTERY POTTER
MORTAR BATTERY
BATTERY GUNNISON

HISTORIC STRUCTURE REPORT

Sandy Hook Unit
Gateway National Recreation Area

By

James J. Lee III
Architectural Conservator
and
Lauren Laham
Architectural Historian

Historic Architecture Program
Northeast Region, National Park Service
U.S. Department of Interior
Lowell, Massachusetts

2007

CONTENTS

LIST OF FIGURES AND CREDITS xvii

ACKNOWLEDGEMENTS xxxiii

ABBREVIATIONS xxxiv

INTRODUCTION 1

EXECUTIVE SUMMARY 3

PURPOSE AND SCOPE 3

BRIEF DESCRIPTION OF BATTERIES 3

STATEMENT OF SIGNIFICANCE 4

RESEARCH CONDUCTED 5

RESEARCH FINDINGS 5

RECOMMENDED TREATMENT 6

ADMINISTRATIVE DATA 8

LOCATION OF SITE 8

NATIONAL REGISTER OF HISTORIC PLACES 8

NATIONAL HISTORIC LANDMARK 9

LIST OF CLASSIFIED STRUCTURES (LCS) INFORMATION 9

PROPOSED USE 12

RELATED STUDIES 13

DEVELOPMENTAL HISTORY: GENERAL 15

HISTORICAL BACKGROUND AND CONTEXT 17

INTRODUCTION 17

Location and Physical Description 17

History of Ownership 17

EARLY HISTORY (1776 – 1815) 19

National Trends 19

First and Second American Systems of Fortifications (1794 – 1815) 20

Sandy Hook 21

Revolutionary War (1776 – 1778) 21
War of 1812 (1812 – 1815) 22

EARLY FORTIFICATION OF SANDY HOOK (1817 – 1874) 23

National Trends 23

Third System of Fortifications (1817 – 1865) 23
Post-Civil War Period (1870 – 1875) 24

Sandy Hook 25

Fort at Sandy Hook (1857 – 1868) 25
Sandy Hook Proving Ground (1874 – 1919) 25

MODERN ERA OF COASTAL DEFENSE (1890 – 1909) 26

National Trends 26

Endicott System (1890 – 1905) 26
Taft System (1905 – 1910) 27

Coastal Defenses of Sandy Hook and the Establishment of Fort Hancock 28

Corps of Engineers 28

Coastal Defenses of Sandy Hook 28
Battery Potter (Constructed 1891 – 1895) 28
Mortar Battery (Constructed 1890 – 1894) 31

Establishment of Fort Hancock (1895) 32
Two Separate Operations: Fort Hancock and the Sandy Hook Proving Ground 33
Battery Gunnison (Constructed 1898, 1903 – 1907) 34
Other Batteries at Fort Hancock (1896 – 1909) 35

WORLD WAR I TO DEACTIVATION (1917-1974) 35

World War I Era 35

World War II Era 36

Korean War Era 36

Cold War Era 36

DEVELOPMENTAL HISTORY: BATTERY POTTER 53

CHRONOLOGY OF DEVELOPMENT AND USE 55

INTRODUCTION 55

BATTERY POTTER – CONSTRUCTION 55

Planning 55

Preparations at Sandy Hook 57

The Concrete Plant 58

Materials 59

Contracts for Masonry Materials 62

Masonry Construction 63

Defenses for Battery Potter 69

Natural Cover 69
Defensible Entrance 70
Flanking Defense 72

BATTERY POTTER – ARMAMENT 73

North Gun-Lift Mechanism 73

North Gun Carriage and Gun 75

Testing the North Gun-Lift 76

South Gun-Lift Mechanism 77

South Gun Carriage and Gun 78

Testing the South Gun-Lift 79

Rapidity Test 79

Ammunition Service 79

BATTERY POTTER – PERSONNEL 80

ORIGINAL APPEARANCE 99

INTRODUCTION 99

BATTERY POTTER – EXTERIOR ELEMENTS 99

BATTERY POTTER – INTERIOR ELEMENTS 102

First Story 102

Second Story 105

BATTERY POTTER – UTILITIES 107

ALTERATIONS 115

BATTERY POTTER – MAINTENANCE AND ALTERATIONS 115

The Period 1895 – 1906 115

Battery Potter is Disarmed, 1906 120

Gun-Lift Machinery Dismantled, 1907 – 1909 122

Post-Disarmament Maintenance and Alterations, 1906 - Present 123

1906 – 1915 123
Exterior Stairway, 1915 124
1920 – 1974 125
1974 – Present 126

BATTERY POTTER – ADDITION OF PRIMARY FIRE-CONTROL STATIONS 134

Background 134

Construction of Fire-Control Stations for the Mortar Battery 135

Plan 135
Foundation 136
Structural Framing 136
Exterior Elements 136
Interior Elements 137

Construction of Seven More Primary Fire-Control Stations 138

Plan 139
Foundation 139
Exterior Elements 139
Interior Elements 140
Completion 141

Maintenance and Alterations for the Primary Fire-Control Stations 142

BATTERY POTTER – RELATED STRUCTURES 144

Background 144

Central Powerhouse and Coal Shed 144

Switchboard Rooms 145

Battery Commander's Tower 146

Dormitories 146

CURRENT PHYSICAL DESCRIPTION 159

INTRODUCTION 159

BATTERY POTTER – EXTERIOR ELEMENTS 159

BATTERY POTTER – INTERIOR ELEMENTS 163

Overview 163
Floors 163
Walls 164
Ceilings 165
Doorways 166
Openings 167
Stairways 167
Equipment/Utilities 168

BATTERY POTTER – PRIMARY FIRE-CONTROL STATIONS 169

Exterior Elements 169
Interior Elements 170

DEVELOPMENTAL HISTORY: MORTAR BATTERY 189

CHRONOLOGY OF DEVELOPMENT AND USE 191

INTRODUCTION 191

MORTAR BATTERY – CONSTRUCTION 192

Planning 192

The Concrete Plant 193

Materials and Contracts 194

Construction Phase 195

Masonry 196
Lighting the Mortar Battery 201
Sand and Sod, Covering the Mortar Battery 201
Mortar Platforms 203

MORTAR BATTERY – ARMAMENT 205

Mortar Carriages and Mortars 205

Proof-Firing 206

Ammunition Tracks 207

ORIGINAL APPEARANCE 227

INTRODUCTION 227

MORTAR BATTERY – EXTERIOR ELEMENTS 227

Entrance 227

Counterscarp Wall and Galleries 228

Perimeter Ditch 229

Sand Cover 229

MORTAR BATTERY – INTERIOR ELEMENTS 229

North End 229

Entrance Gallery 230
Mortar Pits 230
Galleries 231
Magazines and Storage Rooms 231

South End 232

ALTERATIONS 233

UPGRADES AND MAINTENANCE, 1895-1901 233

NAMING THE MORTAR BATTERY 234

BATTERY TELEPHONE BOOTHS AND
BATTERY COMMANDER STATIONS....235

MORTAR BATTERY TOWER AND STATION....237

TROLLEY SYSTEM IMPROVEMENTS....237

MAINTENANCE OF DRAINAGE AND ELECTRICAL SYSTEMS....240

INSTALLATION OF VENTILATOR SHAFTS....241

DISARMING THE MORTAR BATTERY....241

SWITCHBOARD ROOM....242

HARBOR DEFENSE COMMAND POST (HDCP) AND WORLD WAR II....243

ANTIAIRCRAFT DEFENSES AT THE MORTAR BATTERY....247

AFTER WORLD WAR II....247

NATIONAL PARK SERVICE....248

CURRENT PHYSICAL DESCRIPTION....275

INTRODUCTION....275

MORTAR BATTERY – EXTERIOR ELEMENTS....275

Counterscarp Walls....275

Counterscarp Galleries....276

Perimeter Ditch....277

Sand Cover....277

MORTAR BATTERY – INTERIOR ELEMENTS....277

Overview....277

North End (Battery Alexander McCook) 278

North Entrance Gallery 278
Dynamo Room 278
Northwest Mortar Pit 278
North Transverse Gallery 279
Northeast Mortar Pit 280
North Longitudinal Gallery 280
West Storage Rooms and Magazine 281

South End (Battery John F. Reynolds) 281

South Entrance Gallery 281
Southwest Mortar Pit 282
South Transverse Gallery 282
Southeast Mortar Pit 282
South Longitudinal Gallery 282
East Storage Rooms and Magazine 283

Telephone Booths 283

Battery Commander Stations 284

DEVELOPMENTAL HISTORY: BATTERY JOHN GUNNISON 297

CHRONOLOGY OF DEVELOPMENT AND USE 299

INTRODUCTION 299

BATTERY GUNNISON – CONSTRUCTION 299

BATTERY GUNNISON – ARMAMENT 303

ORIGINAL APPEARANCE 307

INTRODUCTION 307

BATTERY GUNNISON – EXTERIOR ELEMENTS 307

Overview 307

Emplacements 308

Traverse (Main Block) 308

Battery Commander Station ... 310

BATTERY GUNNISON – INTERIOR ELEMENTS ... 311

Overview ... 311

Storage Battery Room ... 311

Guard Room ... 312

Office ... 312

Store Room ... 312

Shell Room ... 312

Cartridge Room ... 313

Powder Passage ... 314

Utilities ... 314

Speaking Tubes ... 314
Electrical System ... 315
Communication Systems ... 315

ALTERATIONS ... 323

1908 TO 1940 ... 323

1940 – 1945 ... 324

New Battery Peck ... 325

1945 – 1974 ... 328

1974 – PRESENT ... 329

CURRENT PHYSICAL DESCRIPTION ... 337

INTRODUCTION ... 337

BATTERY GUNNISON – EXTERIOR ELEMENTS ... 337

BATTERY GUNNISON – INTERIOR ELEMENTS ... 340

CHARACTER-DEFINING FEATURES AND RECOMMENDATIONS 351

INTRODUCTION 353

BATTERY POTTER 355

CHARACTER-DEFINING FEATURES 355

Exterior Elements 355

Design and Context 355
Materials 355

Interior Elements 356

Plan 356
Floors 357
Walls 357
Ceilings 357
Doorways 357
Stairways 357
Miscellaneous 358

RECOMMENDATIONS 358

Exterior Elements 358

Interior Elements 360

Plan 360
Floors 360
Walls and Ceilings 360
Doorways 361
Stairways 361
Miscellaneous 361

Accessibility 361

MORTAR BATTERY 362

CHARACTER-DEFINING FEATURES 362

Exterior Elements 362

Design and Context 362
Materials 362

Interior Elements 363

Plan 363
Floors 363
Walls 363
Ceilings 363
Doorways 364

RECOMMENDATIONS 364

Exterior Elements 364

Design and Context 364
Materials 365

Interior Elements 365

Plan 365
Floors 365
Walls 366
Ceilings 366
Accessibility 366

BATTERY GUNNISON 367

CHARACTER-DEFINING FEATURES 367

Exterior Elements 367

Design and Context 367
Walls 367
Fenestration 368
Stairways 368
Walkways 368

Interior Elements 368

Plan 368
Floors 368

Walls ... 368
Doorways ... 369
Utilities ... 369

RECOMMENDATIONS ... 369

Exterior Elements ... 369

Design and Context ... 369
Walls ... 370
Fenestration ... 370
Stairways ... 370
Walkways ... 371

Interior Elements ... 371

Plan ... 371
Floors ... 371
Walls ... 371
Doorways ... 372
Utilities ... 372

Accessibility ... 372

BIBLIOGRAPHY ... 373

APPENDICES ... 381

APPENDIX A. ... 383

Fiscal Year 1892 Annual Report for Fort at Sandy Hook, Mortar Battery No. 1, Gun Lift Battery No. 1, Sandy Hook, New Jersey

Lt. J.G. Warren to Lt. Col. George L. Gillespie, June 30, 1892. Fiscal Year 1892 Annual Report, p. 7. Miscellaneous Reports, 1892 - 1894, Engineer Bureau, Sandy Hook, New Jersey. United States Engineer Bureau, New York.

APPENDIX B ... 413

Fiscal Year 1893 Annual Report of the Chief of Engineers, Gun and Mortar Batteries, Mortar Battery No. 1, and Gun Lift Battery No. 1, Sandy Hook, New Jersey

Lt. Col. George L. Gillespie to Brig. General Thomas L. Casey, Chief of Engineers, July 8, 1893. File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; Record Group 77; National Archives Building, Washington, D.C.

APPENDIX C 435

Granolithic Pavement, Gun Lift Battery No. 1, Sandy Hook, New Jersey

Lt. J.G. Warren to Lt. Col. George L. Gillespie, Dec. 19, 1892. Miscellaneous Reports, 1892 - 1894, Engineer Bureau, Sandy Hook, New Jersey. United States Engineer Bureau, New York

APPENDIX D 441

General Description of Gun-Lift Battery No. 1, Sandy Hook, New Jersey

Lt. Robert McGregor to Lt. Col. George L. Gillespie, Dec. 24, 1894; File 9716, enclosure 2; General Correspondence 1894 -1923; Entry 103; Record Group 77; National Archives Building, Washington, D.C.

APPENDIX E 469

Report for the Mortar Platforms in Mortar Battery No. 1, Sandy Hook, New Jersey

Lt. Robert McGregor to Lt. Col. George L. Gillespie, March 5, 1894; File 1708, incl. 40; General Correspondence and Record Cards, 1893-94; Entry 98; Record Group 77; National Archives Building, Washington, D.C.

APPENDIX F 479

Report on the Proof Firing at Mortar Battery No. 1, Sandy Hook, New Jersey

Lt. Robert McGregor to Lt. Col. George L. Gillespie, June 23, 1894; File 1708, incl. 47; General Correspondence and Record Cards, 1893-94; Entry 98; Record Group 77; National Archives Building, Washington, D.C.

LIST OF FIGURES AND CREDITS

Historic maps, drawings, and photographs were reproduced from the Gateway National Recreation Area (GATE) Museum Collection at Sandy Hook, unless otherwise noted. Photographs from 2005 and 2006 were taken by author, James J. Lee III.

1. Map of Gateway National Recreation Area (left) and detail of the Sandy Hook Unit (right). Http://data2.itc.nps.gov/hafe/hfc/carto-detail.cfm?Alpha=GATE# 38

2. Fort McHenry (circa 1800): example of a First American System fortification. Http://www.nps.gov/fomc/photosmultimedia/photogallery%2Ehtm?eid=89661&root_aId=32#e_89661 39

3. Castle Williams (constructed 1807 – 1811): example of a Second American System fortification, showing the three levels of casemated gun emplacements unique to this system of fortifications. Historic American Buildings Survey photograph (HABS NY, 31-GOVI, 19-8) 39

4. Plan of Fort Gates (constructed circa 1812), built of wood and located about half a mile from the Sandy Hook Lighthouse. Fort Gates was the most noteworthy structure built during the War of 1812, and was constructed to deter the British from using Sandy Hook as a staging area from which they could attack New York City. Drawer 36, Sheet 19; RG 77; NACP 40

5. Aerial view of Fort Monroe, located in Hampton, VA. Fort Monroe was the first work of the Third System planned in its entirety, unlike other Third System fortifications that were adaptations of earlier fortifications from previous systems. Historic American Buildings Survey photograph (HABS VA, 28-HAMP, 2-45) 41

6. "Fort at Sandy Hook, N. J." Plan of main work and elevation of scarp wall, showing condition of work on June 30, 1869. Drawer 15, Sheet 65; RG 77; NACP 42

7. Battery Elon Farnsworth (constructed 1898): example of an Endicott System defense work. View is looking southeast, showing the rear of the battery and its two gun emplacements. Note that the battery is constructed of reinforced concrete, and is built into the surrounding topography, partially behind a large parapet of earth for disguise on the seaward front. Photograph by Glen Williford, October 2001; reprinted by permission 43

8. "Gun Lift Battery No. 1 for two 12-inch rifled guns at Sandy Hook, N.J. Isometric view showing condition of work June 30, 1895." Gateway NRA, Sandy Hook (GATE 10312) 44

9. Detail elevation of "defensible entrance." Gateway NRA, Sandy Hook (GATE 12020)..44

10. Battery Potter (constructed 1891 – 1895): north pit, showing 12-inch rifle upon its carriage and raised into firing position by the hydraulic lift elevator, August 29, 1892. Gateway NRA, Sandy Hook (GATE 7802)...45

11. Mortar Battery (constructed 1890 – 1894): photograph taken circa 1892 – 1893, showing the excavation and construction of one of the four firing pits. Gateway NRA, Sandy Hook (GATE 7862)..46

12. Major General Winfield Scott Hancock (1824-1886). Http://www.civilwarhome.com/hanbio.htm..47

13. Map of Fort Hancock circa 1900, showing buildings constructed. Drawn by J.M. Milton, Quartermaster General's Office. Original in RG 77; NAB. Copy at Gateway NRA, Sandy Hook 48

14. Battery Gunnison (constructed 1898, 1903 – 1907), showing the northern of two 6-inch counterweight guns (Model 1903, Serial No. 34) originally installed on disappearing carriage (Model 1903, Serial No. 57). Photograph taken 1937. Gateway NRA, Sandy Hook (GATE 7834) 49

15. Map of Sandy Hook Defenses, 1910. Drawer 45, Sheet 140; RG 77; NACP....................50

16. Detail of Sandy Hook defenses during World War II. From "Harbor Defenses of New York, Military Reservation, Location of Fortification Structures, General Map, Fort Hancock, New Jersey. U.S. Engineer Office, New York District, New York, N.Y. 29 July 1944." Gateway NRA, Sandy Hook (GATE 10009)..51

17. Image of Nike-Ajax missile similar to those that replaced the antiaircraft guns at Fort Hancock in 1954. Http://www.geocities.com/fort_tilden/nike.html..................52

18. Image of Nike Hercules missile, the second generation Nike missile used at Fort Hancock; it remained in active use until 1974, becoming largely obsolete by the 1960s. Http://www.geocities.com/fort_tilden/nike.html....................................52

19. "Lift-Gun Battery for Two 12 inch Rifled Guns, at Sandy Hook, New York Harbor." Original plans for Battery Potter. Prepared under the direction of Lt. Col. G.L. Gillespie, February 20, 1890. Drawer 45, Sheet 89 – 1; RG 77; NACP 82

20. "Map of Sandy Hook, N. J., Tracing made from survey map of Jan. 30, 1892, showing location of Gun Lift Battery and Mortar Battery and Track connection with Dock for hauling material." Prepared under the direction of Lt. J.G. Warren, Corps of Engineers, June 30, 1892. Copy at Gateway NRA, Sandy Hook.........83

21. “Gun Lift Battery No. 1, at Sandy Hook, N. J.” Plan of Battery Potter showing general layout of battery and concrete plant. Prepared under the direction of 1st Lt. J.G. Warren, June 30, 1892. Drawer 45, Sheet 89 – 11; RG 77; NACP 84

22. “Gun Lift Battery No. 1, at Sandy Hook, N. J.” Detail of concrete plant plan. Prepared under the direction of 1st Lt. J.G. Warren, June 30, 1892. Drawer 45, Sheet 89 – 11; RG 77; NACP 85

23. “Gun Lift Battery No. 1, at Sandy Hook, N. J.” Detail of concrete plant section. Prepared under the direction of 1st Lt. J.G. Warren, June 30, 1892. Drawer 45, Sheet 89 – 11; RG 77; NACP 85

24. Miners at natural hydraulic cement mine, New York State. Courtesy of Edison Coatings, Inc., Plainville, CT 86

25. Seal for Rosendale Cement Company with trademarked “Brooklyn Bridge” Brand. Courtesy of Edison Coatings, Inc., Plainville, CT 86

26. Section E-F through North Gun Lift; detail from “Lift-Gun Battery for Two 12 inch Rifled Guns, at Sandy Hook, New York Harbor.” February 20, 1890. Drawer 45, Sheet 89 – 1; RG 77; NACP 87

27. Section F-E through North Gun Lift, from “Gun Lift Battery No. 1, Sandy Hook, N.J.” Sheet No. 4, Sections through Lifts and Boiler Room, 1894. Drawer 45, Sheet 89 – 62; RG 77; NACP 87

28. “Gun Lift Battery No. 1, at Sandy Hook, N.J.” Color coded progress sheet, June 30, 1893. Drawer 45, Sheet 89 – 28; RG 77; NACP 88

29. Battery Potter, looking southeast; “View of Gun Lift Battery, July, 1893.” Photograph No. 22 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7811) 89

30. “Proposed Main Entrance to the Lift Gun Battery at Sandy Hook, N.J.” Detail from plans of Defensible Entrance for Battery Potter, prepared by 1st Lt. J.G. Warren, Jan. 14, 1892. Drawer 45, Sheet 89 – 3; RG 77; NACP 89

31. “Proposed Main Entrance to the Lift Gun Battery at Sandy Hook, N.J.” Plans, elevation and section of defensible entrance for Battery Potter, prepared by 1st Lt. J.G. Warren, Jan. 14, 1892. Drawer 45, Sheet 89 – 3; RG 77; NACP 90

32. “Internally Fired Return Tubular Boilers for the 12" Gun Lift at Sandy Hook, N.J., 9 ft. diam. x 12'-2" long x 5/8 thick, Corrugated furnaces, 36" I.D. x 9'-4", Jan. 22, 1982.” Boilers at the Continental Iron Works, Brooklyn, N.Y. Box 2, 45-89-5; RG 77F; NACP 91

33. Gun-lift cage for Battery Potter at the Continental Iron Works, Brooklyn, NY. Jan. 22, 1892. Box 2, 45-89-6; RG 77F; NACP 91

34. Battery Potter, Schneider & Co. gun carriage, pintle plate, and traversing circle. Photograph no. 1 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7796) 92

35. Battery Potter, Schneider & Co. gun carriage complete, rear view. Photograph no. 5 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7800) 92

36. "Frame Structure used in raising 12 in. B.L. Rifle. Gun Lift Battery. Sandy Hook, New Jersey, 1894." Drawer 45, Sheet 89-57; RG 77; NACP 93

37. Battery Potter, raising 12-inch B.L. rifle. Photograph o. 7 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7653)..94

38. Battery Potter, 12-inch B.L. rifle mounted on carriage, Aug. 27, 1892. Photograph no. 12 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7802) 94

39. Battery Potter, north emplacement; preparing for second shot, Sept. 12, 1892. Photograph no. 14 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7804) 95

40. Battery Potter, proof-testing the mechanism at the south emplacement, test number 5, March 7, 1894. Box 2, 44-87-1; RG 77F; NACP. Copy at Gateway NRA, Sandy Hook (GATE 7795) 95

41. "Lift Gun Battery No. 1 at Sandy Hook, N.J. Plans and sections showing arrangement of track and turntables for ammunition service." Prepared under the direction of 1st Lt. J.G. Warren, Corps of Engineers, Oct. 1, 1892. Drawer 45, Sheet 89-2; RG 77; NACP 96

42. Battery Potter, carriage for ammunition hoist, Feb. 1893. Photograph no. 18 of 39 with F.Y. 1893 Annual Report. Box 2, 45-90-18; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7323) 97

43. Battery Potter, first-floor plan with room numbers. Original plan from *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*, May 2005. Not to scale 109

44. Battery Potter, second-floor plan with room numbers. Original plan from *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery,* May 2005. Not to scale...............................110

45. Battery Potter, terreplein, superior slope, and fire-control stations floor plan with room numbers. Original plans from *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery,* May 2005. Not to scale...111

46. Battery Potter, west elevation with defensible entrance, circa 1893. Copy at Gateway NRA, Sandy Hook (GATE 7813) 112

47. Battery Potter, main gallery/boiler room. Photograph no. 21 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7810) 113

48. Battery Potter, accumulator room pumps and operating platform, April 1893. Photograph no. 19 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7808) 113

49. Battery Potter, accumulator room pumps. Photograph no. 20 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7809) 114

50. Battery Potter, loading gallery, north lift. August 25, 1892. Photograph no. 16 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7806) 114

51. Battery Potter, west elevation and terreplein with 12-inch guns dismounted, circa 1906. Note range-finding platforms at northwest corner and at parapet wall. Gateway NRA, Sandy Hook (GATE 7818) 128

52. Battery Potter, terreplein with 12-inch guns and carriages dismounted, circa 1906. Note range-finding platform at parapet wall. Gateway NRA, Sandy Hook (GATE 7744) 128

53. “Plotting House, Battery Potter, Fort Hancock, N.J.” Note that the plotting house structure to be situated along the parapet wall between the north and south emplacements was apparently not built. Gateway NRA, Sandy Hook (GATE 10703) 129

54. Schematic plan of Battery Potter showing possible locations for exterior stairways and fire-control stations, 1914. Folder 4, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NYC) 130

55. “Fort Hancock, N.J., Iron Stairway to F.C. Stations, Battery Potter, Lower Flight and Platform Frame.” Exterior stairway situated at the southwest corner of Battery Potter, Sheet 1 of 2. Drafted by J.C. Letts, January 1915. Drawer 45, Sheet 89-81; RG 77; NACP 131

56. “Fort Hancock, N.J., Iron Stairway to F.C. Stations, Battery Potter, Upper Flight, Treads and Platform.” Exterior stairway situated at the southwest corner of Battery Potter, Sheet 2 of 2. Drafted by J.C. Letts, January 1915. Drawer 45, Sheet 89-82; RG 77; NACP 132

57. Battery Potter, terreplein depicting training of range finding personnel. Note the paving of the terreplein similar to extant paving. Gateway NRA, Sandy Hook (GATE 7551) 133

58. Battery Potter, meteorological personnel checking wind velocity from platform in northwest corner of terreplein. Gateway NRA, Sandy Hook (GATE 7549) 133

59. "Battery Potter, Fort Hancock, N.J. Plan Showing Proposed Location for Primary Stations. February 1903." Depicting location of stations for Mortar Battery and rear elevations of stations proposed by the "Harris Board." Drawer 45, Sheet 89-74; RG 77; NACP 148

60. "Fort Hancock, N. J. Plans and Sections of Primary Stations for Battery Reynolds. Located on the Platform of Battery Potter. March 1905." Gateway NRA, Sandy Hook (GATE 10705) 149

61. "Fort Hancock, N. J. Plans for Primary Fire Control Stations. Located on the terreplein of Battery Potter. Nov. 1906." Gateway NRA, Sandy Hook (GATE 10706) 150

62. "Fort Hancock, N. J. Construction Details for Primary Fire Control Stations" located on the terreplein of Battery Potter, Nov. 1906. Drawer 45, Sheet 89-78; RG 77; NACP 151

63. Battery Potter, view eastward, showing primary fire-control station building for Mortar Battery (top) and switchboard buildings (below), circa 1907. Gateway NRA, Sandy Hook (GATE 7815) 152

64. Battery Potter, interior of plotting room of one of two primary fire-control stations for Mortar Battery, circa 1907. Gateway NRA, Sandy Hook (GATE 7819) 152

65. Battery Potter, interior of plotting room of primary fire-control station, June 24, 1919. Gateway NRA, Sandy Hook (GATE 7831) 153

66. Battery Potter, west elevation, showing primary fire-control stations on terreplein and switchboard buildings in foreground, circa 1907. Gateway NRA, Sandy Hook (GATE 7814) 153

67. Battery Potter, view of west elevation, showing primary fire-control stations, radar towers, and switchboard buildings, 1951. Gateway NRA, Sandy Hook (GATE 3610) 154

68. Primary fire-control stations on Battery Potter, Dec. 1956. Gateway NRA, Sandy Hook (GATE 11214) 154

69. Signal Corps aerial view of Fort Hancock, N.J.: detail of Battery Potter and surrounding structures, circa 1919. Gateway NRA, Sandy Hook (GATE 7485) 155

70. Detail from map of Sandy Hook during World War II, showing Battery Potter "Primary Station Group" and surrounding structures. World War II files; File 6171; Sheet 1146; RG 77; NACP 155

71. Plan of switchboard rooms Type "A" and Type "C," constructed on the west side of Battery Potter. "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921"; RG 392; NARA - Northeast Region (NY) 156

72. Plan depicting Battery Potter and battery commander's station/tower. Detail from "Armament Sketch, Fort Hancock, New Jersey, December 31, 1901." Gateway NRA, Sandy Hook (GATE 4628) 156

73. Plan of officers' dormitory built west of Battery Potter. "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921"; RG 392; NARA - Northeast Region (NY) 157

74. Plan of enlisted men's dormitory built west of Battery Potter. "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921"; RG 392; NARA - Northeast Region (NY) 157

75. "Camp of Range Section at Fort Hancock, N.J. Oct. 25 -15." Temporary encampment west of Battery Potter, Oct. 1915. Library of Congress (image #5a47612u) 158

76. Battery Potter, view of east elevation, 2005 172

77. Battery Potter, view of west elevation, 2005 172

78. Battery Potter, exterior iron stairway, upper flight, 2005 173

79. Battery Potter, roof of defensible entrance, 2005 173

80. Battery Potter, view southward showing terreplein and primary fire-control stations, 2006 174

81. Battery Potter, south gun parapet, 2005 174

82. Battery Potter, view to the southwest, showing terreplein and extant elements of missing fire-control stations for Mortar Battery, 2005 175

83. Battery Potter, superior slope of roof in front of gun parapets, 2005 175

84. Battery Potter, southeast section of *chemin de ronde*, 2005 176

85. Battery Potter, parapet wall of *chemin de ronde*, 2005 176

86. Battery Potter, interior view from main gallery/boiler room (room 111) westward through entry gallery (room 104) to defensible entrance (room101), 2006 177

87. Battery Potter, interior view of north magazine gallery (room 113), looking west, 2006 177

88. Battery Potter, interior view of second-story north and south transverse galleries (rooms 203 and 205), and wooden bridge connecting them (room 204), 2006 178

89. Battery Potter, interior view of niche in wall of transverse gallery for auxiliary lantern lighting system, 2005 178

90. Battery Potter, interior view of north loading gallery (room 209), looking west toward concrete steps, 2006 179

91. Battery Potter, interior view of south loading gallery (room 213), looking west toward cast-iron ladder, 2006 179

92. Battery Potter, interior view of doorway and doors of defensible entrance (room 101), looking west, 2006 180

93. Battery Potter, interior view of doorway to north magazine gallery (room 113), looking east, 2006 180

94. Battery Potter, interior view of second story of defensible entrance (room 201), north tower and gun loops, looking northwest, 2006 181

95. Battery Potter, view of second story of defensible entrance (room 201), gun port in west wall, 2006 181

96. Battery Potter, interior view of north stairway (room 105) connecting first and second stories, 2005 182

97. Battery Potter, view of existing condition of iron steps of south stairway (room 108) connecting first and second stories, 2006 182

98. Battery Potter, spiral stairway from second-story connecting gallery (room 202) to terreplein, 2006 183

99. Battery Potter, view of concrete stairway (room 220) connecting north loading gallery (room 209) and terreplein, 2006 183

100. Battery Potter, view of south magazine gallery (room 116), showing gun-metal turntable for ammunition delivery system, 2006 184

101. Battery Potter, interior view of north shell magazine (room 114), showing overhead trolley bridge for ammunition delivery system, 2005 184

102. Battery Potter, primary fire-control stations, west elevation of southernmost station (rooms 313 and 314), 2005 185

103. Battery Potter, primary fire-control stations, east elevation of the east rooms (rooms 309, 311, 313) of the three southernmost stations, 2005 185

104. Battery Potter, east elevation of bulkhead (room 315) covering stairway (room 220) that connected second story with terreplein and primary fire-control stations, 2005 186

105. Battery Potter, view of typical primary fire-control station, showing observation room and interior partition, 2005 186

106. Battery Potter, typical primary fire-control station, showing interior of plotting room and west wall, 2005 187

107. Battery Potter, typical primary fire-control station, showing interior of plotting room and interior partition, 2005 187

108. "Northern Mortar Pits, Mortar Battery No. 1, Sandy Hook, N.J." File 1708, incl. 35; General Correspondence and Record Cards. 1893-94; Entry 98; RG 77; NAB 208

109. "Battery Reynolds, Fort Hancock, N.J. Showing Telephone Booths. Dec. 20, 1905." Battery McCook and Battery Reynolds added in handwritten script to identify re-designation of Mortar Batteries. Marshall to District Commander, Southern Artillery Dist. of N.Y., March 10, 1906; Folder 129, enclosure 1, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY) 209

110. Mortar Battery. Original plan from Einhorn, Yaffee, Prescott, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery* (not to scale) 210

111. "Plans and Sections of a Half Sunk Mortar Battery near Sandy Hook Light, Sandy Hook, New Jersey, October, 1890." Gateway NRA, Sandy Hook (GATE 10666) 211

112. "Mortar Battery at Sandy Hook, N.J., Plan showing general arrangement of working plant in use, June 30, 1892." Gateway NRA, Sandy Hook (GATE 10676) 212

113. Detail of concrete plant from "Plans and Sections of a Half Sunk Mortar Battery near Sandy Hook Light, Sandy Hook, New Jersey, October 1890." Gateway NRA, Sandy Hook (GATE 10666) 213

114. Concrete mixers in operation at Mortar Battery plant, Nov. 14, 1892. Photograph no. 26 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7859) 214

115. Mortar Battery, as seen from lighthouse, June 7, 1892. Photograph no. 24 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7856) 214

116. Northwest pit during construction, June 7, 1892. Photograph no. 25 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7858) 215

117. Commencing construction of counterscarp wall, near north entrance, July 29, 1892. Photograph no. 28 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F. Copy at Gateway NRA, Sandy Hook (GATE 7860) 215

118. Mortar Battery: Detail of counterscarp gallery, from sheet no. 4 of four completion drawings, 1895. Gateway NRA, Sandy Hook (GATE 10669) 216

119. "Mortar Battery No. 1, Sandy Hook, N.J. Maxim Automatic Machine Gun adapted for use in the Counterscarp Galleries of the Battery, September 1892." Drawer 45, Sheet 72c; RG 77; NACP 217

120. Construction of concrete slopes around the two northern pits, May 1, 1893. Photograph no. 36 of 39 with F.Y. 1893 Annual Report. Drawer 45, Sheet 91; Box 2; RG 77F; NACP 218

121. Mortar Battery, excavation and construction of foundations for mortar emplacements; note inverted cement barrels protecting bolt locations. Gateway NRA, Sandy Hook (GATE 7861) 218

122. "Mortar Battery No. 1, Sandy Hook, N.J. Plan of Battery." Sheet no. 1 of 4, 1895. Gateway NRA, Sandy Hook (GATE 10671) 219

123. "Mortar Battery No. 1, Sandy Hook, N.J. Horizontal Section at Reference (10.25)." Sheet no. 2 of 4, 1895. Gateway NRA, Sandy Hook (GATE 10670) 220

124. "Mortar Battery No. 1, Sandy Hook, N.J. Vertical Sections through Battery." Sheet no. 3 of 4, 1895. Gateway NRA, Sandy Hook (GATE 10667) 221

125. "Mortar Battery No. 1, Sandy Hook, N.J. Counterscarp Gallery, Main Entrance, and Mortar Platform." Sheet no. 4 of 4, 1895. Gateway NRA, Sandy Hook (GATE 10669) 222

126. Mortar Battery, moving sand to the superior slope, ca. 1892. Gateway NRA, Sandy Hook (GATE 7855) 223

127. Lancaster bucket grapple at work in east borrow pit, November 11, 1892. Photograph No. 27 of 39 with F.Y. 1893 Annual Report. Drawer 45, Sheet 92; Box 2; RG 77F; NACP 223

128. Mortar Battery, as seen from lighthouse, February 8, 1893; view shows covering of battery with sand. Photograph No. 32 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F; NACP. Copy at Gateway NRA, Sandy Hook (GATE 7857) 224

129. Mortar Battery, construction of mortar platforms; view shows granite base ring and steel roller path. Gateway NRA, Sandy Hook (GATE 7863) 224

130. Detail of mortar platform, from sheet no. 4 of four completion drawings, 1895. Gateway NRA, Sandy Hook (GATE 10669) 225

131. South end of Mortar Battery, as seen from the lighthouse, March 13, 1893; view shows counterscarp wall and trestle over wall during construction. Photograph No. 35 of 39 with F.Y. 1893 Annual Report. Box 2; RG 77F; NACP. Copy at Gateway NRA, Sandy Hook (GATE 7854) 226

132. Mortar Battery, view of mortar pit showing mortars mounted on carriages, June 30, 1894. Gateway NRA, Sandy Hook (GATE 7864) 226

133. Mortar Battery, north end (Battery McCook). Original plan from *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery;* not to scale 250

134. Mortar Battery, interior. Original plan from *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery;* not to scale 251

135. Mortar Battery, south end (Battery Reynolds). Original plan from *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery,* not to scale 252

136. "Fort Hancock Battery Reynolds Booth for West Pits." Ca.-1905 plans for Mortar Battery telephone booths for northwest and southwest pits. Gateway NRA, Sandy Hook (GATE 10673) 253

137. "Fort Hancock Battery Reynolds Booth for Pits A & B." Ca.-1905 plans for Mortar Battery telephone booths for northeast and southeast pits. Gateway NRA, Sandy Hook (GATE 10672) 254

138. Mortar Battery, telephone booth in northwest mortar pit, ca. 1920. Gateway NRA, Sandy Hook (GATE Bishop 62) 255

139. Mortar Battery, telephone booth in northwest mortar pit. Gateway NRA, Sandy Hook (GATE 7868) 255

140. "Fort Hancock, N.J., Concrete B.C. Station for Battery Alexander McCook, February 1906." Drawer 45, Sheet 134-1; RG 77; NACP 256

141. "Fort Hancock, N.J., Concrete B.C. Station for Battery Alexander McCook. February 1906." Note says: "A similar station will be built for Battery Reynolds..." Drawer 45, Sheet 134-2; RG 77; NACP 257

142. Detail of aerial photograph of Fort Hancock, ca. 1930: view of Mortar Battery, showing tower and station inside west counterscarp wall. Original at Hancock 3-32, Box 1061; Entry FH; RG 342; NACP. Copy provided by Glen Williford 258

143. Plan of meteorological station inside west counterscarp wall of Mortar Battery. "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921"; RG 392; NARA – Northeast Region (NY)] 258

144. "Fort Hancock, N.J., Proposed Modification of Batteries Reynolds and McCook, April 1907." Alterations for the improved trolley system. Gateway NRA, Sandy Hook (GATE 10864) 259

145. "Plan Showing Drainage and Electrical Systems, Battery Reynolds, Fort Hancock, N.J. Sept. 1910." Gateway NRA, Sandy Hook (GATE 10678) 260

146. "Plan Showing Drainage and Electrical Systems, Battery Alexander McCook, Fort Hancock, N.J., Sept. 1910." Gateway NRA, Sandy Hook (GATE 10686) 261

147. "Ventilating flues for Magazines, Batteries Reynolds and McCook, Fort Hancock, N.J., Oct. 1911." Gateway NRA, Sandy Hook (GATE 10674) 262

148. "Coastal Defenses of Sandy Hook, Fort Hancock, Batteries Reynolds and McCook, 16- 12-inch mortars." Plan of the Mortar Battery with serial numbers of guns and carriages, 1915. Entry 1009; RG 77; NACP 263

149. Mortar Battery, balloon aerial view circa 1919. Note that each pit has only three mortars; the fourth set of guns and carriages for each had been moved to the Navesink battery. Gateway NRA, Sandy Hook (GATE 7870) 264

150. "Fort Hancock, N.J. Fire Control Switchboard and Storage Battery Rooms. August 16, 1922." Drawer 45, Sheet 118-58; RG 77; NACP 265

151. Mortar Battery, interior of switchboard room, ca. 1922. Photograph was also included with plan (fig. 142). Gateway NRA, Sandy Hook (GATE 7872) 266

152. Mortar Battery, opening in counterscarp wall, ca. 1940. Gateway NRA, Sandy Hook (GATE 3522) 266

153. Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, General Layout, ca. 1944. Gateway NRA, Sandy Hook (GATE 10906) 267

154. Mortar Battery, switchboard room (room 112), ca. 1944. Gateway NRA, Sandy Hook (GATE 7116) 268

155. Mortar Battery, interior of switchboard room, ca. 1922. Photograph was also included with plan (fig. 142). Gateway NRA, Sandy Hook (GATE 7871) 268

156. "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Gasproof Piping Details, certified June 6, 1944." Gateway NRA, Sandy Hook (GATE 10894) 269

157. "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Gasproof Door Details, certified June 6, 1944." Gateway NRA, Sandy Hook (GATE 10890) 270

158. Mortar Battery, view of northwest pit with vehicles as described by Ed Biedermann, ca. 1944. Gateway NRA, Sandy Hook (GATE 1478) 271

159. Mortar Battery, sentry post at the southwest entrance to mortar pits, ca. 1944. Note observation tower at left side of photograph. Gateway NRA, Sandy Hook (GATE 3523) 271

160. Detail of generator room. From "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Generator Room Ventilating System, March 1944." Gateway NRA, Sandy Hook (GATE mortarbattery3) 272

161. Southwest corner of Mortar Battery, 1943; view from lighthouse during training exercises. Note netting and camouflage over battery on left side of photograph. Copy at Gateway NRA, Sandy Hook (GATE 1943-662) 273

162. Battery Reynolds, southwest entrance gallery (room 135), 1943. Note netting over battery at top of photograph. Copy at Gateway NRA, Sandy Hook (GATE 1943-438) 273

163. Detail from map of Sandy Hook, N.J. during World War II, showing Mortar Battery and surrounding structures. WWII files; File 6171; Sheet 1146; RG 77; NACP 274

164. Antiaircraft gun mounted on the top of the Mortar Battery. Lt. Brian P. Emerson, 245th Coast Artillery, instructs on the working of a 3-inch antiaircraft gun, ca. 1942. From Bearss, *The Sandy Hook Defenses, 1857 – 1948,* p. 502. Copy at Gateway NRA, Sandy Hook (GATE 7588) 274

165. Mortar Battery, exterior view of west side of counterscarp wall, 2006 285

166. Mortar Battery, view of counterscarp wall interior and southwest counterscarp gallery, 2006 285

167. Mortar Battery, exterior doorway to southwest counterscarp gallery, 2006 286

168. Mortar Battery, interior view of gun port embrasure in southwest counterscarp gallery, 2006 286

169. Mortar Battery, entrance gallery to southwest mortar pit, Battery Reynolds, 2006 287

170. Mortar Battery, extant light fixture in entrance gallery to southwest mortar pit, 2006 287

171. Mortar Battery, view of northwest mortar pit from top of battery, 2006 288

172. Mortar Battery, section of wall in mortar pit with rounded indentation to allow for swing of gun barrel, 2006 288

173. Mortar Battery, view of southwest mortar pit from top of battery, 2006 289

174. Mortar Battery, doorway and altered steel door from southwest mortar pit to transverse gallery, 2006 289

175. Mortar Battery, within Battery McCook, north end of longitudinal gallery (room 112), 2006 290

176. Mortar Battery, within Battery McCook, hollow-tile partition wall at north end of longitudinal gallery (room 112), 2006 290

177. Mortar Battery, within Battery McCook, battery corridor and storage area (room 113), 2006 291

178. Mortar Battery, within Battery Reynolds, east magazine gallery (room 122), 2006 291

179. Mortar Battery, within Battery Reynolds, south end of longitudinal gallery (room 126), 2006 292

180. Mortar Battery, within Battery Reynolds, west end of transverse gallery (room 131) and south air lock (room 130), 2006 292

181. Mortar Battery, telephone booth at southwest mortar pit, Battery Reynolds, 2006 293

182. Mortar Battery, telephone booth at southwest mortar pit, Battery Reynolds, 2006 293

183. Mortar Battery, supporting arches of telephone booth at southwest mortar pit, Battery Reynolds, 2006 294

184. Mortar Battery, telephone booth at southeast mortar pit, Battery Reynolds, 2006 294

185. Mortar Battery, battery commander station for Battery Reynolds, located on top of superior slope at south end of battery, 2006 295

186. Detail of 1901 Sandy Hook map, depicting railroad tracks and powder magazine near future site of Battery Gunnison. From RG 92; copy at Gateway NRA, Sandy Hook 305

187. Detail of 1905 Sandy Hook map, depicting railroad tracks and powder magazine near Battery Gunnison. From RG 92; copy at Gateway NRA, Sandy Hook 305

188. Battery Gunnison, north emplacement (no. 2) with 6-inch gun on disappearing carriage, August 11, 1932. Gateway NRA, Sandy Hook (GATE 7839)....306

189. "Drainage and Electrical Systems for Battery John Gunnison, Fort Hancock, New Jersey. October 1905." Plans showing emplacements and interior room layout and room designations. Drawer 45, Sheet 128-4; RG 77; NACP 317

190. "Battery Gunnison, Fort Hancock, New Jersey, Details of Steel Doors, Shutters, and Gratings for Two 6-inch R.F. Gun Emplacements. July 6, 1904." Drawer 45, Sheet 128-7; RG 77; NACP....318

191. Battery Gunnison, view of retaining wall of emplacement loading platform, showing recesses for ammunition, ca. 1930. Gateway NRA, Sandy Hook (GATE 4182)....319

192. Battery Gunnison, view of north emplacement loading platform and parapet wall, ca. 1930. Gateway NRA, Sandy Hook (GATE 4179) 319

193. Battery Gunnison, view of west elevation of traverse and battery commander station, ca. 1930. Gateway NRA, Sandy Hook (GATE 4181) 320

194. Battery Gunnison, view looking from south emplacement toward south elevation of traverse, showing battery roof with vent chimney and battery commander station, ca. 1940. Gateway NRA, Sandy Hook (GATE 13708)....320

195. Battery Gunnison, 1905 plan of battery with modern room numbers added. Copied from 1905 plan. Drawer 45, Sheet 128-4; RG 77; NACP 321

196. "Battery Gunnison, Schematic Communication Diagram." Battery Gunnison Emplacement Book; Entry 222; RG 392; NARA - Northeast Region (NY)....322

197. "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Fort Hancock, New Jersey, Feb. 16, 1943." Sheet no. 1 of 8. Gateway NRA, Sandy Hook (GATE 10689) 331

198. "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Structural Details No. 3, Fort Hancock, New Jersey, Feb. 16, 1943." Sheet no. 4 of 8. Gateway NRA, Sandy Hook (GATE 10684)....332

199. "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Gasproof Door and Shutter, Fort Hancock, New Jersey, Feb. 16, 1943." Sheet no. 7 of 8. Gateway NRA, Sandy Hook (GATE 10682) 333

200. Battery Gunnison, gun emplacement with 6-inch rapid-fire gun on barbette carriage. Gateway NRA, Sandy Hook (GATE 7835)....334

201. Battery Gunnison, gun emplacement after reinstallation of 6-inch guns on barbette carriages by park, 1977. Gateway NRA, Sandy Hook (GATE 7838) 334

202. Detail of Battery Gunnison/New Battery Peck and surrounding structures during World War II. From “Harbor Defenses of New York, Military Reservation, Location of Fortification Structures, Map No. 2, Fort Hancock, New Jersey. U.S. Engineer Office, New York District, New York, N.Y. 29 July 1944.” Gateway NRA, Sandy Hook (GATE 10010) 335

203. Battery Gunnison, view of sand embankment and north gun emplacement, looking south, 2006 343

204. Battery Gunnison, view of north emplacement from roof of traverse, 2006 343

205. Battery Gunnison, view of south emplacement, looking east, 2006. Note doorway to powder passage, located between traverse (at left) and emplacement (at right) 344

206. Battery Gunnison, view of north emplacement retaining wall and west stairway, looking east, 2006 344

207. Battery Gunnison, south gun mounted on barbette carriage, 2006 345

208. Battery Gunnison, west and south elevations of traverse of battery, 2006 345

209. Battery Gunnison, south-elevation “telephone” station; shows brass fixtures for speaking-tube system on east wall of booth, 2006 346

210. Battery Gunnison, brass fixture for speaking-tube system connecting to the shell room, 2006 346

211. Battery Gunnison, southwest corner of battery; shows cornice coping, downspout, and water damage, 2006 347

212. Battery Gunnison, gutter at south edge of roof, 2006 347

213. Battery Gunnison, 1943 shell-hoist shed for south emplacement, 2006 348

214. Battery Gunnison, 1943 air lock in storage room (room 101) for chemical-weapons service equipment, 2006 348

215. Battery Gunnison, 1943 plotting room, looking northwest, 2006 349

216. Battery Gunnison, shell hoist for north emplacement, 2006 349

217. Battery Gunnison, shell room (room 105), looking southeast, 2006 350

218. Battery Gunnison, cartridge/powder room (room 106), looking south, 2006 350

ACKNOWLEDGEMENTS

Battery Potter, Mortar Battery, Battery Gunnison – Historic Structure Report was co-authored by James J. Lee III and Lauren Laham of the Historic Architecture Program (HAP), Northeast Region, National Park Service. Lee researched and wrote sections for the individual batteries, as well as the sections "Introduction" and "Character Defining Features and Recommendations." Laham researched and wrote the "Historical Background and Context" section for the historic structure report (HSR), and assisted with research for other parts of the HSR. Sharon Ofenstein, HAP Publications Editor, reviewed the report and provided advice and consistency.

The preparation of this report would not have been possible without the assistance of the staff members of the Sandy Hook Unit, Gateway National Recreation Area. Richard Wells, Park Superintendent, provided useful comments during the project review meetings and the final review of the HSR. Lou Venuto, Chief of Interpretation and Cultural Resources, provided direction and coordinated the efforts of his staff. Thomas Hoffman, Park Historian, provided copies of existing records and documents, as well as oral histories of Fort Hancock and the batteries. Both Venuto and Hoffman conducted a guided tour of Battery Potter, the Mortar Battery, and Battery Gunnison. They also provided access to the batteries on a number of occasions. Also thanks to Venuto and Hoffman for their editorial comments on the draft of the HSR. Mary Rasa, Curator, provided access to historic photographs and maps in the Gateway NRA Museum Collection at Sandy Hook, as well as a copy of Ed Biedermann's oral history of the Mortar Battery during World War II.

* * * * * *

Research undertaken by Edwin C. Bearss in the 1980s proved extremely useful in determining where to conduct further primary source research. Research at the Northeast Region National Archives and Records Administration would not have been successful without the assistance of Archives Specialists Richard Gelbke and Joan Young. At the National Archives and Records Administration Washington, D.C., Jill Abraham, Old Military Records Archivist, provided guidance for research in the record groups pertaining to military records.

James J. Lee III

Lauren Laham

ABBREVIATIONS

The following abbreviations have been used in this report:

GATE	Gateway National Recreation Area
GMP	General Management Plan
HABS	Historic American Buildings Survey
HAP	Historic Architecture Program, Northeast Region, NPS
HSR	Historic Structure Report
NER	Northeast Region, NPS
NAB	National Archives Building, Washington, DC
NACP	National Archives at College Park, MD
NARA – Northeast Region (NY)	National Archives Northeast Region, New York, NY
NARA – Northeast Region (W)	National Archives and Records Administration Northeast Region, Waltham, MA
NPS	National Park Service
NRA	National Recreation Area
RG	Record Group
SAHO	Sandy Hook Unit, Gateway NRA

INTRODUCTION

EXECUTIVE SUMMARY

Purpose and Scope

This historic structure report was produced by the Historic Architecture Program of the National Park Service's Northeast Regional Office. The purpose of the report is to document the development and use of the Mortar Battery, Battery Potter, and Battery Gunnison at the Sandy Hook Unit , Gateway National Recreation Area , Fort Hancock, New Jersey. Furthermore, it is intended to inform and guide the rehabilitation of those historic structures.

The scope of this historic structure report includes a "thorough" investigation of Battery Potter, the Mortar Battery, and Battery Gunnison as defined by *NPS- 28*.[1] The HSR deals primarily with the subject structures and incorporates context and background information about Sandy Hook, Fort Hancock and the harbor defense installations. The HSR provides for each structure a developmental history, including a current description, and a list of character-defining features and treatment recommendations, in accordance with National Park Service standards. The report does not include an existing conditions assessment, nor does it include a record of treatment, which should be accomplished by the contractor after the treatment is completed.

The physical investigation of the batteries was limited to observation and recordation of existing conditions.

Brief Description of Batteries

In 1886 the Endicott Board, headed by the Secretary of War, General William C. Endicott, made a report on the deficiency of the nation's coastal defenses, which led to the establishment of a number of coastal defense installations. Thus what has become known as the Endicott System of defenses was established in the United States to guard important port and harbors.

Sandy Hook had long been recognized as key to the defense of New York Harbor. Under the Endicott System, the area saw a dramatic increase in activity and the construction of several new coastal defense emplacements.

[1] *NPS-28, Cultural Resource Management Guideline,* Release No. 5, 1997, and Director's Order #28, 1998.

Planning for and construction of Battery Potter began in 1890, and the emplacement was completed in 1895. Battery Potter, named for General Joseph Potter, was the first and only steam-powered hydraulic-lift gun battery. This innovation allowed the gun to be raised and lowered inside the protection of a concrete bunker, which in turn was encircled within an earthwork slope for protection and camouflage. This steam hydraulic system used for Battery Potter's gun-lift carriages was soon rendered obsolete by a new counterweight system for raising and lowering guns. The guns were removed in 1906, and the battery was adapted to serve as a tracking and observation station for other batteries at Sandy Hook.

Construction of the Mortar Battery, the first of its kind for American harbor defense, also began in 1890 and was completed in 1894. The battery consisted of four pits; each pit emplaced four 12-inch caliber mortars, for a total of 16 mortars that could fire half-ton armor-piercing projectiles. In 1903 the entire battery was named Battery Reynolds, in honor of Major General John F. Reynolds. In 1906 the battery designation was divided; the south half remained Battery Reynolds, and the north half was designated Battery McCook, after Major General Alexander McCook. The collective unit was generally referred to as the Mortar Battery. After World War I the structure was converted to a communications center, and it became the New York Harbor Defense Command Post during World War II.

Construction of the emplacement for Battery John Gunnison began in1898, but was halted due to its interference with Sandy Hook Proving Ground activities. Five years later, a new site was selected for the battery, and construction was resumed. Battery Gunnison, named for Captain John W. Gunnison, was completed in 1904 and mounted with 6-inch disappearing guns in 1905. During World War II the battery was modified and converted to hold two 6-inch guns mounted on barbette carriages. The guns that were installed and their carriages came from Battery Peck, and the emplacement was renamed New Battery Peck. In 1948 these guns were replaced with similar 6-inch guns that remain in place today.

The national significance of Battery Potter, the Mortar Battery, and Battery Gunnison is attributed to their association with the Endicott System of coastal defense and the New York Harbor defenses.

Statement of Significance

Battery Potter, the Mortar Battery, and Battery Gunnison are considered nationally significant structures. They are part of the Fort Hancock and the Sandy Hook Proving Ground Historic District, which includes approximately 110 historic buildings and 16 batteries. The district was listed on the National Register of Historic Places on April 24, 1980, having a period of significance spanning from 1859, through the 1950s and 1960s Cold War Era, until 1974. The nomination recognizes the importance of the defense installations at Sandy Hook in guarding New York City.[2]

[2] Richard E. Greenwood, "National Register of Historic Places Inventory - Nomination Form, Fort Hancock and the Sandy Hook Proving Ground Historic District," June 28, 1976, revised Nov. 9, 1982, item 7, p. 1 and item 8, p. 1.

Battery Potter, the Mortar Battery, and Battery Gunnison date from the Endicott period of coastal defenses and represent a significant period in Fort Hancock's history. The battery installations remained an important part of the New York harbor defenses from the 1890s through World War II. Of particular significance was the fact that two of the battery emplacements at Sandy Hook – the Mortar Battery and Battery Potter – were the first of their type in the country.

Research Conducted

This HSR documents the evolution of the Battery Potter, Mortar Battery, and Battery Gunnison through the physical investigation of extant materials, and documentary research using both primary and secondary sources. Repositories consulted and utilized for materials pertaining to the subject are as follows:

Boston Public Library, Boston, MA
Gateway National Recreation Area, Sandy Hook Unit, Fort Hancock, NJ, Gateway NRA Museum Collection
Monmouth County Historical Association, Freehold, NJ
National Archives and Records Administration, Archives I, Washington, DC
National Archives and Records Administration, Archives II, College Park, MD
National Archives and Records Administration, Northeast Region, New York, NY
NPS, Historic Architecture Program Library, Lowell, MA
NPS, Olmsted Center for Landscape Preservation, Brookline, MA
New Jersey State Archives, Trenton, NJ
New York Public Library, New York, NY

Research Findings

Review of the reports, photographs, maps, and drawings available in the Gateway NRA Museum Collection provided background for further research and physical investigation of Battery Potter, the Mortar Battery, and Battery Gunnison. Extensive research was undertaken by Edwin C. Bearss in the 1980s during the preparation of several historic resource studies for the Sandy Hook Unit, Gateway National Recreation Area. Mr. Bearss's reports, in particular *The Sandy Hook Defenses, 1857-1948,* proved extremely useful in determining where to conduct further primary source research.[3]

The National Archives and Records Administration proved fruitful for primary source material. Research at the National Archives Building, Washington, D.C., and the National Archives Northeast Region, New York, NY, provided more detailed information regarding the construction and alterations to the batteries. Correspondence between the Sandy Hook

[3] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857-1948, Sandy Hook Unit, Gateway National Recreation Area, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983).

Engineers, New York District Engineers, and the Chief of Engineers provided insight into the activities and decisions made regarding the batteries and the defenses for New York Harbor. The Chief of Engineers' Annual Reports for 1891, 1892, and 1893 provided a summary of the work during those critical years. The 1895 completion report for Battery Potter was found in the NAB ; this was accompanied by a set of 10 drawings of the battery, which is stored at the National Archives facility in College Park, MD. Additional plans for all three batteries were found at NACP, as well as historic photographs.

Monthly reports dating from September 1891 to March 1894 and sent by the Sandy Hook Engineers to the New York District Engineer document the construction of Battery Potter and the Mortar Battery. The reports were transcribed into two journals that are stored at the New York Public Library, New York, NY. The reports provide detailed descriptions of the monthly progress, the labor force employed, and the machinery used, as well as other details about the batteries. Those reports were invaluable to the understanding of the construction and original appearance of Battery Potter and the Mortar Battery.

Overall, the documentary materials provided important information about the construction and use of Battery Potter, the Mortar Battery, and Battery Gunnison. Less information was found regarding the construction of Battery Gunnison, but the research did provide a better understanding of the changes made to that battery in the 1940s, which produced many of the extant features of Battery Gunnison. Future research should include further review of the "Report of Completed Works – Seacoast Fortifications; Sandy Hook, Fort Hancock, N.J.," which may yield further information regarding the batteries in the 1920s and 1940s. Future research should also include the papers and photographs of General Gage, which are stored at the U.S. Army Military History Institute, Carlisle, PA.

Recommended Treatment

The NPS has determined that the Fort Hancock and the Sandy Hook Proving Ground Historic District should emphasize the continuum of history throughout the period of significance, which spans from 1859 until 1974.[4] A significant part of that objective is the preservation and interpretation of the historic resources within the historic district. The goal for structures within the Fort Hancock and the Sandy Hook Proving Ground Historic District, as stated in planning documents for Gateway NRA, is rehabilitation and interpretation.

It is recommended that Battery Potter, the Mortar Battery, and Battery Gunnison be rehabilitated in accordance with the Gateway NRA General Management Plan (GMP), completed in 1979, and *The Secretary of the Interior's Standards for Rehabilitation*. Furthermore, as stated in the 1990 GMP Amendment, it is recommended that the batteries be

[4] Greenwood, "Nomination Form," item 8, p.1.

interpreted to the public with a focus on their historic functions, and the changes in coastal defenses during Fort Hancock's history.[5]

The rehabilitation of the gun batteries would entail the removal of invasive vegetation as well as an extensive condition and structural analysis of each structure. At a minimum, preserving and rehabilitating these batteries will involve the stabilization and repair of the concrete structures, the addition of lighting, and the repair and construction of railings and walkways.

The rehabilitation of Battery Potter, the Mortar Battery, and Battery Gunnison would greatly increase the park's ability to interpret the Endicott System of defense installations at Sandy Hook, as well as the history of coastal defenses through World War II and into the Cold War. Furthermore, the rehabilitation would mitigate public safety hazards associated with the batteries, and allow greater public access to these historic structures.

[5] *General Management Plan Amendment: Development Concept Plan and Interpretation Prospectus: Sandy Hook Unit, Gateway National Recreation Area, New York/New Jersey* (U.S. Department of the Interior, National Park Service, January 1990), p. 13.

ADMINISTRATIVE DATA

Location of Site

Fort Hancock and the Sandy Hook Proving Ground are part of the approximately 2,044-acre Sandy Hook Unit, which is part of the Gateway National Recreation Area. Both are located in Monmouth County, Middletown, New Jersey, on a peninsula that begins east of the town of Highlands and extends north to the Sandy Hook Channel, which was the original natural channel to Lower New York Harbor. On October 27, 1972, President Nixon signed the legislation for Public Law 92-592, which established the Gateway National Recreation Area. Under this law Fort Hancock (including the former Proving Ground) was transferred from the Department of Defense to the Department of the Interior after the deactivation of the post in 1974.[6] Battery Potter, the Mortar Battery, and Battery Gunnison are located within the Fort Hancock and the Sandy Hook Proving Ground Historic District, along the eastern shore of Sandy Hook.

National Register of Historic Places

The Fort Hancock and the Sandy Hook Proving Ground Historic District was listed on the National Register of Historic Places on April 24, 1980. The "National Register Inventory - Nomination Form for the Fort Hancock and the Sandy Hook Proving Ground Historic District" ascribes a portion of the area's significance to the defense installations guarding New York City. The area was recognized for a period of significance spanning from 1859 when construction of the granite "Fort at Sandy Hook" was begun, through the 1960s when the Nike defense system became obsolete, until 1974 when the U.S. Army left Sandy Hook.[7]

> The Sandy Hook Defenses (Fort Hancock) for nearly 80 years were the key fortification guarding the approaches to America's most important harbor and its largest metropolis. It was during these years that the United States defeated Spain and emerged as a world power; tipped the scales against the Central Powers in World War I; retreated into the isolation of the 1920s and 30s; and emerged from World War II as a super power.[8]

---

[6] Barry Sulam and John B. Marsh, *Historic Structure Report, Architectural Data Section (Volume IV), The Sandy Hook Proving Ground, 1874-1919, Sandy Hook Unit, Gateway National Recreation Area, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, Denver Service Center, Aug. 1988), p. 1.

[7] Greenwood, "Nomination Form," item 7, p. 1.

[8] Greenwood, "Nomination Form - Statement of Significance," item 8, p. 1.

National Historic Landmark

The Fort Hancock and the Sandy Hook Proving Ground Historic District was listed as a National Historic Landmark (NHL) on December 17, 1982. The NHL nomination acknowledges the history of the coastal defense system and Fort Hancock as a significant period for Sandy Hook.

> Fort Hancock and the Sandy Hook Proving Ground Historic District reflects the history of a vital defense guarding New York City and its harbor from 1895 to 1974. This landmark played a key role in the development of advanced weaponry and radar....[9]

List of Classified Structures (LCS) Information

Battery Potter, the Mortar Battery, and Battery Gunnison are among 16 gun emplacements at Sandy Hook. These three batteries are representative of the Endicott System defense installations at Fort Hancock and the history of coastal defense at Sandy Hook.

The LCS file information for Battery Potter is as follows:

Preferred Structure Name:	Fort Hancock-Battery Potter
Other Structure Names:	No records
Park Structure Number:	SH-264
LCS ID Number:	008547
National Register Status:	Entered - Documented
National Register Date:	04/24/1980
National Register Reference #:	80002505
National Historic Landmark Date:	12/17/1982
Significance Level:	National
Short Significance Description:	First Endicott-period emplacement in country to be built & fully (partially) armed. Only example of steam-powered hydraulic 12" gun lift battery. Built to replace antiquated stone fort & muzzle-loading guns inadequate for threat posed by new dreadnought warships.
Long Significance Description:	Construction of Battery Potter began in 1891, and both guns were emplaced by 1895. The hydropneumatic system used for the battery’s gun lift carriages was soon rendered obsolete and replaced with a new counterweight system. The

[9] “Statement of Significance,” National Historic Landmark Program website (http://tps.cr.nps.gov/nhl/detail.cfm? ResourceId=1828&ResourceType=District).

Long Significance Description (continued):	guns were removed in 1906 and the battery was adapted to serve as a tracking and observation station for other batteries at Sandy Hook. A wooden/concrete fire control station was constructed on top of battery between 1905-1907 and demolished sometime after 1954. The Fort Hancock and the Proving Ground Historic District includes approximately 110 significant historic buildings and 16 Batteries dating from the last quarter of the 19th century through the first half of the 20th century. These structures are significant under National Register Criteria A because they reflect the history of the U.S. Army's Ordnance Department Proving Ground and Fort Hancock Military Reservation, a vital defense installation guarding New York City from 1895 through the 1950s and 60s Cold War era until 1974. The Fort Hancock and Proving Ground Historic District should also be considered significant under National Register Criteria C as many structures in the district embody distinctive characteristics of a particular period and type of construction.
Management Category:	Must Be Preserved and Maintained
Management Category Date:	08/25/2006 [10]

The LCS file information for the Mortar Battery is as follows:

Preferred Structure Name:	Fort Hancock – Batteries McCook and Reynolds, 349
Other Structure Names:	Mortar Battery
Park Structure Number:	SH – 349
LCS ID Number:	008587
National Register Status:	Entered - Documented
National Register Date:	04/24/1980
National Register Reference #:	80002505
National Historic Landmark Date:	12/17/1982
Significance Level:	National
Short Significance Description:	First concrete mortar battery in United States. Mortars reflected philosophy of indirect fire weapons as superior for coastal defense. Coastal defenses at Sandy Hook built to meet threat posed by new dreadnought warships.

[10] *List of Classified Structures – Gateway National Recreation Area, Sandy Hook Unit* (NPS website http://www.hscl.cr.nps.gov/reports/summary.asp?REPORTID=100704).

Long Significance Description:	The Fort Hancock and the Proving Ground Historic District includes approximately 110 significant historic buildings and 16 Batteries dating from the last quarter of the 19th century through the first half of the 20th century. These structures are significant under National Register Criteria A because they reflect the history of the U.S. Army's Ordnance Department Proving Ground and Fort Hancock Military Reservation, a vital defense installation guarding New York City from 1895 through the 1950s and 60s Cold War era until 1974. The Fort Hancock and Proving Ground Historic District should also be considered significant under National Register Criteria C as many structures in the district embody distinctive characteristics of a particular period and type of construction. In 1903 the entire battery was designated Battery Reynolds, in honor of Major General John F. Reynolds. In 1906 the battery designation was divided; the southwest half remained Battery Reynolds and the northeast half was designated Battery McCook, after Major General Alexander McCook. The collective unit was generally referred to as the Mortar Battery. After World War I the structure was converted to a communications center and it became the New York Harbor Defense Command Center during World War II.
Management Category:	Must be Preserved and Maintained
Management Category Date:	08/25/2006 [11]

The LCS file information for the Battery Gunnison is as follows:

Preferred Structure Name:	Fort Hancock-Battery Gunnison
Other Structure Names:	No records
Park Structure Number:	SH-337
LCS ID Number:	008578
National Register Status:	Entered - Documented
National Register Date:	04/24/1980
National Register Reference #:	80002505
National Historic Landmark Date:	12/17/1982
Significance Level:	National

[11] *List of Classified Structures – Gateway National Recreation Area, Sandy Hook Unit*.

Short Significance Description:	Construction of Battery Gunnison began in 1898 during the Endicott Era. Halted due to its obstruction of the Proving Ground activities. 1903 battery was relocated and construction began again. Named after Capt. John W. Gunnison, was completed in 1904. Mounted with 6-inch disappearing guns in 1905.
Long Significance Description:	Prior to World War II the battery was modified and converted to hold two 6-inch guns mounted on barbette carriages. The 6-inch guns and their carriages were moved from Battery Peck to Battery Gunnison and the emplacement was renamed New Battery Peck/Battery Gunnison. In 1948 these guns were replaced with similar 6-inch guns which remain in place today. The Fort Hancock and the Proving Ground Historic District includes approximately 110 significant historic buildings and 16 Batteries dating from the last quarter of the 19th century through the first half of the 20th century. These structures are significant under National Register Criteria A because they reflect the history of the U.S. Army's Ordnance Department Proving Ground and Fort Hancock Military Reservation, a vital defense installation guarding New York City from 1895 through the 1950s and 60s Cold War era until 1974. The Fort Hancock and Proving Ground Historic District should also be considered significant under National Register Criteria C as many structures in the district embody distinctive characteristics of a particular period and type of construction.
Management Category:	Must Be Preserved and Maintained
Management Category Date:	08/25/2006 [12]

Proposed Use

The 1979 General Management Plan (GMP) and the 1990 GMP Amendment for Gateway NRA discuss the creation of the Fort Hancock Gateway Village at the Sandy Hook Proving Ground and Fort Hancock Historic District. The GMP Amendment states that the area should "retain the integrity of the historic scene," with the goal of "rehabilitation of historic structures."[13] It also proposed the establishment of a Coastal Fortification Zone within the

[12] *List of Classified Structures – Gateway National Recreation Area, Sandy Hook Unit*.
[13] *General Management Plan Amendment*, p. 9.

Gateway Village. The purpose of this zone is to interpret and communicate the importance of the military history of the harbor defenses and of the Sandy Hook Proving Ground.

The planning documents for Gateway NRA propose that Battery Potter, the Mortar Battery, and Battery Gunnison be rehabilitated according to *The Secretary of the Interior's Standards for Rehabilitation*. Upon rehabilitation these structures will be more accessible to the public, and will be interpreted as part of the Coastal Fortification Zone.

Battery Potter will be the focal point for interpreting coastal defenses. The proposed rehabilitation of this structure will provide increased visitor access and enhance the park's historic attractions and programs.

The proposed rehabilitation of the Mortar Battery will allow the interior of the battery to be open to the public and increase the park's ability to interpret the history of this structure. The interpretive program will include the Endicott System defenses, as well as the important of the battery as a communications center for the New York Harbor defenses.

Battery Gunnison is the only battery at Gateway NRA with coastal defense guns mounted in position. Much of the battery is currently closed to the public. The proposed rehabilitation will improve visitor access to both the interior and exterior of the battery, and further assist in the interpretation of the coastal defenses at Sandy Hook.

The rehabilitation of Battery Potter, the Mortar Battery, and Battery Gunnison will be preserved as part of the Coastal Fortification Zone, and will increase visitor access to and awareness of this vital part of Sandy Hook's history.

Related Studies

Several publications identified in the Cultural Resources Management Bibliography were consulted in the preparation of this report. Some of these publications provide more background information about the history of the Sandy Hook Proving Ground and Fort Hancock. Any reader desiring a broader discussion of the military presence at Sandy Hook should consult the publications listed here.

> Michael Adlerstein, Kay Roush, David Turello et al., *General Management Plan, Gateway National Recreation Area, New York / New Jersey* (U.S. Department of the Interior, National Park Service, Aug. 1979).
>
> *Amendment to the General Management Plan, Great Kills Park, Staten Island Unit, Gateway National Recreation Area, New York / New Jersey* (U.S. Department of the Interior, National Park Service, Denver Service Center, Oct. 1990).
>
> Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857-1948, Sandy Hook Unit, Gateway National Recreation Area, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983).

------, *Historic Resource Study, The Sandy Hook Proving Ground, 1874-1919, Sandy Hook Unit, Gateway National Recreation Area, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983).

------, *Historic Resource Study, Fort Hancock, 1895-1948, Gateway National Recreation Area, New York/New Jersey* (Denver: U.S. Department of the Interior, National Park Service, May 1981).

------, *Historic Resource Study, Fort Hancock, 1948-1974, Gateway National Recreation Area, New York/New Jersey* (Denver: U.S. Department of the Interior, National Park Service, November 1982).

Clough, Harbour & Associates LLP, *Section 02080 Asbestos Removal, Gateway National Recreation Area, Sandy Hook Unit, Batteries Mortar & Potter* (Albany, NY: Clough, Harbour & Associates LLP for Einhorn, Yaffee, Prescott, September 2005).

Marie Ennis, PE, *Structural Conditions Assessment, Mortar Battery Tunnel Complex*, Sandy Hook, New Jersey (New York, NY: Einhorn, Yaffee, Prescott, February 2006).

Richard E. Greenwood, National Register of Historic Places Inventory - Nomination Form, “Fort Hancock and the Sandy Hook Proving Ground Historic District,” June 28, 1976.

------, National Register of Historic Places Inventory - Nomination Form, “Fort Hancock and the Sandy Hook Proving Ground Historic District,” revised November 9, 1982.

Emanuel Raymond Lewis, *Seacoast Fortifications of the United States, An Introductory History* (Annapolis, MD: Naval Institute Press, 1993 reprint).

Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery, Sandy Hook Unit, Gateway NRA, New Jersey (New York, NY: Einhorn, Yaffee, Prescott, May 2005).

DEVELOPMENTAL HISTORY:

GENERAL

HISTORICAL BACKGROUND AND CONTEXT

Introduction

Location and Physical Description

Fort Hancock is located on a peninsula of land known as Sandy Hook in Monmouth County, Middleton, New Jersey. Sandy Hook, a barrier beach peninsula, is on the northern tip of the New Jersey shore and approximately 6.5 miles from New York Harbor. The peninsula includes 7 miles of beaches, salt marshlands, a network of hiking trails, and a holly forest.[1] Fort Hancock and the Sandy Hook Proving Ground are located on the northern end of the peninsula, south of the U.S. Coast Guard station (fig. 1). They are currently owned and occupied by the National Park Service, and constitute one of the three units of Gateway National Recreation Area.

History of Ownership

The first known discovery of the Sandy Hook peninsula was by Henry Hudson, a 17th -century English explorer and navigator. In January 1609, Hudson was hired by the Dutch United East India company to search for a passage north of Russia to the Orient. Eventually, Hudson instead sailed west to the New World, in hopes of finding the long-sought northwest passage to the Orient, i.e., north of North America. It was during this expedition that Hudson and his crew entered Sandy Hook Bay on September 2, 1609.[2]

In its earliest history, the lands of Sandy Hook were involved in a struggle between the Dutch and the British. The Dutch, having been first to discover the land in 1609, attempted in 1663 to construct a fort on the Navesink Highlands to hold and secure the area from the British. They reported that "the English from Gravesend (now Brooklyn) and some other vagabonds intend to go to the Newesinghs in the spring and take possession of the land there."[3] A fort was never built, and later that year, Peter Stuyvesant, the last Dutch governor of New Amsterdam (now New York), surrendered all of the New Netherlands (which encompassed

---

[1] "Visiting Sandy Hook,"Sandy Hook Unit, Gateway National Recreation Area website (http://www.nps.gov/gate/shu/shu_home.htm).

[2] Ian Chadwick, "Henry Hudson: Henry Hudson's Third Voyage 1609: The New World" (http://www.ianchadwick.com/hudson/hudson_03.htm).

[3] John P. King, "The British were the first Europeans in the Highlands" (http://www.highlandsnj.com/news/html/NewsDocs/Eurpoean%20Settlers.html).

parts of what are now the states of New York, New Jersey, Pennsylvania, Maryland, Connecticut and Delaware) to the British Deputy Governor, Richard Nicolls, per order of Charles II, King of England.[4]

Governor Richard Nicolls issued the first recognized land transfer of Sandy Hook via the Monmouth Patent in April 1665. The Monmouth Patent was issued to 12 patentees, and included the land of Sandy Hook as well as land to the west and south. This land was previously occupied by American Lenape Indians, and was bought from them by the British in three separate purchases for a value of 850 pounds sterling, paid largely in part by wampum, cloth, wine, powder, and other commodities.[5]

However, the Monmouth Patent was found to be void. Charles II, the King of England, granted land in the area to his brother James, the Duke of York, at the same time he granted land to Governor Richard Nicolls, therefore making the transfer of land within the Monmouth Patent invalid. As Richard Nicolls was transferring his land through the Monmouth Patent, the Duke of York granted this land to Lord Berkley and Sir George Carteret. This grant included all the land the Duke of York was granted between the Hudson and Delaware Rivers south of 40 degrees 40 feet north latitude. Governor Philip Carteret, appointed Governor of this new land (known as New Jersey) by Lord Berkley and Sir George Carteret, on May 28, 1872, confirmed this land unto James Grover, John Brown, Jonathan Holmes, James Ashon, John Hause, and Richard Hartshorne.[6] Richard Hartshorne, who came from London in 1669, is considered to be one of the first inhabitants on the land that now includes the Sandy Hook peninsula.

The U.S. government acquired the lands of Sandy Hook in a series of four different tracts. These four tracts were obtained at different times. Two of the four tracts were acquired from a descendent of Richard Hartshorne, as follows:

1. A tract of 4 acres, on which the main lighthouse now stands, granted by the State of New York by its act of February 3, 1790. Jurisdiction over this tract was ceded by act of New Jersey, of November 16, 1790.
2. That portion of Sandy Hook "lying on the north side of a line drawn East to West through the present lighthouse, acquired by deed of R. Hartshorne, et al., dated February 26, 1806; consideration $3,750. Jurisdiction over this tract was ceded by the act of New Jersey of March 1, 1804.
3. All of Sandy Hook north of a line running east from the mouth of Youngs Creek to the sea, excepting two tracts previously conveyed to the United States, acquired by deed of R. Hartshorne and wife, dated June 17, 1817. Jurisdiction over this tract for military purposes was ceded by act of New Jersey of March 12, 1846, which act described the land over which the jurisdiction was ceded as all that portion of Sandy Hook owned by the United States lying north of an east and west line through the mouth of Youngs Creek at low water, and extending across the island or Cape of Sandy Hook from shore to shore and bounded on all other sides by the sea and Sandy Hook Bay. This cession of jurisdiction therefore overlapped and included tracts 1 and

[4] King, "The British were the first Europeans in the Highlands."
[5] "History of Fort Hancock and of the Defenses of Sandy Hook"; Entry 317; RG 392; NARA - Northeast Region (NY).
[6] "History of Fort Hancock and of the Defenses of Sandy Hook."

2, over which jurisdiction had already been ceded by the acts of November 16, 1790, and March 1, 1804, respectively.
4. Twenty-two lots, forming a tract 2200 feet long and extending from the Atlantic Ocean to Shrewsbury River, and the railroad track thereon, acquired by deeds as follows: The Atlantic Highlands Association, dated July 29, 1892; and the New Jersey Southern Railway Co., dated May 1, 1893; total consideration $25,000. [7]

Ever since the acquisition of the Sandy Hook lands, the United States government has maintained a presence on the peninsula. During the 19th century, the peninsula was occupied by the U.S. Army, the U.S. Lighthouse Service, the U.S. Life-Saving Service, the U.S. Army Corps of Engineers, the U.S. Army Ordnance Department, the U.S. Army Corps of Artillery, and the Western Union Telegraph Service. The 20th century saw the continued occupation of the U.S. Army, as well as the occupation of the U.S. Army Signal Corps, the Women's Auxiliary Army Corps, the U.S. Coast Guard, and the U.S. Army Air Defense Command.[8] The Sandy Hook peninsula is now occupied by the U.S. Coast Guard as well as the National Park Service, which presently owns and operates Gateway National Recreation Area.

Early History (1776 – 1815)

National Trends

The U.S. government has maintained an intermittent military presence on the Sandy Hook peninsula from the days of the American Revolution until today, through the presence of the U.S. Coast Guard, Sandy Hook Station. The Sandy Hook Proving Ground was established on the peninsula in 1874 and continued until 1919. The Fort Hancock military reservation was formally established in 1895; it was deactivated and reactivated several times, with a final deactivation date of August 15, 1974. The proximity to New York Harbor, as well as the topography of the peninsula, made Sandy Hook an ideal location to assist in the national coastal defense of the United States. Many "firsts" took place here that contributed to the United States being an unmatched national defense superpower, as well as being on the forefront of advanced military technology. In order to comprehend this great contribution made by both the Sandy Hook Proving Ground and the Fort Hancock military reservation, it is useful to understand how coastal defense was envisioned and developed at a national level.

The study of American systems of coastal defense has been largely undertaken and outlined by Emanuel Raymond Lewis in his book titled *Seacoast Fortifications of the United States, An Introductory History*. In this work, Lewis outlines various generations of seacoast fortifications that were constructed to defend the United States when war threatened. The following information relies heavily on this work, since Lewis is considered an expert in this area of United States military history.

---

[7] "History of Fort Hancock and of the Defenses of Sandy Hook."

[8] James J. Lee III, *Officers Club Building No. 114, Sandy Hook Unit, Gateway National Recreation Area, Fort Hancock, New Jersey, Historic Structure Report* (Lowell, MA: U.S. Department of the Interior, National Park Service, Northeast Region, Historic Architecture Program, 2006), pp. 15-16.

First and Second American Systems of Fortifications (1794 – 1815)

At the close of the 18th century, America – still in its infancy as a new nation – undertook its first program of national defense. Concentrating heavily on the importance of its coastlines, America began what has been referred to as the First American System of fortifications. On February 28, 1794, a special committee of the House of Representatives prepared a statement with estimates on proposed coastal defense works and anticipated locations. Henry Knox, as the first Secretary of War, immediately devised the general characteristics that the seacoast fortifications should possess, but left the detailed specifications in the hands of the engineer stationed at each locality.[9]

At 16 commanding locations, the fortifications constructed under the First American System of fortifications were relatively primitive and frail. Because only general characteristics of these fortifications were outlined by Knox, there existed a large degree of variation among the overall design of each structure. These open works were generally built of unsupported earth, sodded or planted with knotgrass or some type of herbaceous binding, and were constructed to allow for the emplacement of eight to several dozen guns. In several of these structures, enclosed earthen redoubts with light cannon were emplaced to guard the landward sides of the fortification. The defense armament of this era consisted largely in part of iron and brass cannon, mostly remnants of the Revolutionary War. Little monetary support was appropriated by the government for the continuance of construction for the First System fortifications, and the monies that were provided were concentrated for maintenance on three or four locations considered of utmost importance and priority. Only a few of the First American System fortifications survive today (fig. 2).[10]

In November 1807, a new program of national defense was initiated, and within the next five years, more than $3 million was funded by the government for its implementation. This program, which was well underway by the outbreak of the War of 1812, is known as the Second American System of fortifications. The overall types of works constructed in the Second System can be broken down into three major categories: open batteries, masonry-faced earth forts, and all-masonry forts.

The Second System was similar to the First System in that the design and planning of works was not coordinated on a national level, and showed a good deal of variation in both architectural style and armament. However, the Second System displayed several significant improvements over the First System of fortifications, and so represented a turning point in the sophistication of American coastal defense design.

---

[9] Emanuel Raymond Lewis, *Seacoast Fortifications of the United States: An Introductory History* (Washington D.C.: Smithsonian Press, 1970), p. 21.

[10] Lewis, *Seacoast Fortifications,* pp. 21 – 25.

The open-battery defense works built in the Second System were small and low to the ground, and were generally constructed as support structures to a major fort. However, the hallmark of the Second System was masonry-faced forts, which frequently included elliptical and circular features in their design.[11] The implementation of the casemated gun emplacements also began with the Second System; this allowed the cannons to be mounted behind and within the walls of the fortification, rather than on top of the structure. Having casemated gun emplacements not only afford additional protection from enemy fire, but because the casemates could be constructed in tiers, it allowed a fort to have two to three levels of firing guns on one or more sides of the fortification. This new technology was a major contribution to America's advancement in military technology and design (fig. 3).[12] A third significant difference between the systems was that the design and planning of Second System fortifications was carried out solely by American engineers, whereas the First System works were primarily designed by French engineers.[13]

Seacoast armament was not systemized until the 1840s, so the Second System of fortifications did not experience any great difference in armament from the First System of fortifications. Few Second System forts are still extant as conceived and constructed in their original form, since most were altered and incorporated into emplacements built during America's Third System of defense (fig. 3).[14]

At the end of 1815, the United States had managed to construct approximately 60 coastal defense structures on the most important seaports of America's coast. Both the First and Second Systems had been conceived as a response to impending military conflict, and each came to a somewhat abrupt halt when its threat of conflict dissipated.[15] Although the fortifications varied greatly from one to another in both design and planning, both systems of defense identified America's response to imminent conflict from abroad between the years 1794 – 1815.

Sandy Hook

Revolutionary War (1776 – 1778)

The Sandy Hook peninsula experienced its first military involvement during the American Revolutionary War in 1776. The British used the Sandy Hook Lighthouse as a navigational aid to assist them in entering New York Harbor while transporting their invasion army. During the war, the British realized the strategic location of Sandy Hook and used the land as an assembly point for their troops. It was during this time that the first known military defense work was known to have been built on the peninsula. The British built a stockade surrounding Sandy Hook Light, and used the grounds at Sandy Hook as a staging area during

---

[11] Lewis, *Seacoast Fortifications,* pp. 25-26.
[12] Lewis, *Seacoast Fortifications,* p. 31.
[13] Lewis, *Seacoast Fortifications,* p. 25.
[14] Lewis, *Seacoast Fortifications,* pp. 26-32.
[15] Lewis, *Seacoast Fortifications,* p. 36.

the conflict with the Americans. Also maintained on the peninsula was a refugees camp for local men who sympathized with the King, and this became known as Refugees Town.[16]

War of 1812 (1812 – 1815)

The next military engagement that occurred on Sandy Hook was during the War of 1812. The United States wanted to avoid another British occupation of the peninsula, as happened during the Revolutionary War, and so immediately stationed troops at Sandy Hook. Temporary fortifications were constructed, and guns were emplaced to deter the British from using Sandy Hook as a staging area from which they could attack New York City.[17] The most noteworthy temporary structure was Fort Gates (fig. 4). This structure was constructed of wood, and was located about half a mile from the Sandy Hook Lighthouse. Within the walls of this wooden stockade were: merlons (labeled A), a flagstaff (labeled B), a furnace (labeled C), a magazine (labeled D), and a traverse (labeled E). A merlon was the "the portion of a battlemented parapet that rises up from a wall (e.g., the solid part of a parapet between the crenels)."[18] The purpose of the furnace was to heat the cannon balls to red-hot temperatures in an attempt to set sailing warships on fire. The magazine's function was to store the ammunition. The traverse was "a work similar to a caponier, consisting of a gun looped passage way which traversed a dry ditch of a fortification, and was used to sweep the ditch of the enemy as they tried to cross the ditch."[19]

The United States succeeded in barring the British from the peninsula, and at the close of the war, American troops were withdrawn. Fort Gates and other temporary structures were left to deteriorate into the landscape. However, it was at this point that the United States fully realized the importance of the Sandy Hook peninsula, and so purchased for $20,000 two tracts of land from Richard Hartshorne in 1817 that encompassed the majority of the peninsula.[20]

[16] "History of Sandy Hook Proving Ground." Entry 1537,Vol. 1 , July 22, 1909, p. 1; General Records; SHPG, 1889-1919; RG 156; NARA – Northeast Region (NY).

[17] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983), p. 1.

[18] *Illustrated Dictionary of Historic Architecture,* Cyril M. Harris, ed. (New York: Dover Publications, Inc., 1977), p. 351.

[19] *A Dictionary of Military Architecture Fortification and Fieldworks from the Iron Age to the Eighteenth Century* (http://www.angelfire.com/wy/svenskildbiter/madict.html#Traverse).

[20] "History of Fort Hancock and of the Defenses of Sandy Hook."

Early Fortification of Sandy Hook (1817 – 1874)

National Trends

Third System of Fortification (1817 – 1865)

Unlike the First and Second Systems of fortifications, the Third System began during a somewhat calm state of affairs, and for the first time was directed by an authority that oversaw all aspects of the design, planning, and implementation. In 1816, a board was organized; since it was led by Simon Bernard, a French military engineer and fortifications expert, it has come to be known as the Bernard Board. The creation of this board marked the first time in American military history that a unified and strategic doctrine was devoted to American coastal defense.[21] The new works of the Third System were built in a variety of forms. The design of each structure depended on numerous factors, such as the remoteness from a populated area, the surrounding landscape and topography, the importance and size of the port it would defend, and the state of military technology and development at the time each fort was constructed.[22]

The Third System displayed the most impressive structures produced from any era of military history. The majority of Third System fortifications were polygonal in plan, and they were often built with brick or stone (sometimes both) with earth used as a supporting and binding material. Due to the fortification's masonry construction, a single wall could contain arched tiers of casemates, typically employed on the seaward front. The external walls of the fortifications varied in thickness, with a minimum of five inches, particularly around the embrasures. The roof was typically comprised of barbette emplacements that surmounted each exterior wall.[23] Some fortifications had four sides, while some had as many as seven, and the length of the perimeter could range from 200 feet to more than a mile (fig. 5). Armament also varied greatly, from 50 guns to more than 400. The least impressive and simplest structure constructed during this system was the detached battery, which was often built in areas of secondary importance where the protection of a major fortification was not warranted.

Major improvements in armament came after 1840 with respect to power, size, and reliability. For the first time in American military history, all heavy armament was designed and produced within the United States. The primary improvement in this era of armament advancement came with the redevelopment and refinement of the cannon. Two elements of the cannon were the subject of scrutiny – the external shape of the cannon, and the manner in which the cannon was cast. Ornamentation such as the patterning of shapes, as well as unnecessary knobs and handles on the artillery, was removed. Also, the shape of the cannon was altered, which was based on the distribution of gas pressures within the piece during its manufacturing. The manner in which the iron was cooled was also altered, which greatly

[21] Joe C. Freeman et al., *Seacoast Fortifications Preservation Manual* (San Francisco, CA: Golden Gate NRA, 1999), NPS Online Archives (http://www.nps.gov/archive/goga/history/seaforts/ toc.htm).
[22] Lewis, *Seacoast Fortifications,* p. 45.
[23] Lewis, *Seacoast Fortifications,* pp. 39 – 45.

improved the strength of the cannon. Thomas J. Rodman, an Army Ordnance officer, was responsible for determining that the process of hardening and cooling greatly affected the strength of the iron used to make cannons. The normal sequence of hardening and cooling typically began at the outer surface of the material and progressed toward the interior. This process created a pattern of stress that caused the exterior of the cannon to be extremely vulnerable upon firing. Rodman simply reversed this pattern of stress by solidifying his casting in the opposite direction, cooling from the interior to the exterior.[24] With these advancements, both the safety and structural reliability was improved. The standardization of gun carriages also appeared during this era, for which detailed specifications are extant, unlike that of the previous two systems. More than 30 Third System fortifications were built during this era, and nearly all remain in existence, constituting the oldest surviving body of major military structures in the United States. This era produced this most systematized and impressive structures of the time, and was unsurpassed anywhere in the world.[25]

Post-Civil War Period (1870 – 1875)

Shockingly, during the post-Civil War period, the impressive structures of the Third System of defense became obsolete almost overnight due to a single advancement in armament that was introduced during the Civil War: the rifling of guns. Rifling of guns allowed for greater accuracy and power in armament, and a single shell could do significant damage. Because of this, reliance on the strength of masonry was greatly diminished. It was discovered that works made of earth or sand could withstand shelling from a rifled gun better than works of masonry. If a work made of earth was fired upon by a rifled gun, the hole it produced was simply filled in with collapsed earth, whereas a masonry work hit by a rifled gun ran the risk of collapse. Because of this drastic change in armament, military engineers and authorities were reluctant to move forward with a new set of designs for the next generation of fortifications. There was sufficient evidence to suggest that major advancements in armament were imminent, which would dictate the design of later works.[26]

However, construction of new coastal defense works did commenced, which were significantly different than their predecessors. Instead of constructing massive fortifications to defend American harbors, the United States began to invest in a system of smaller dispersed structures on a piece of land that collectively formed a fort. Separate batteries were to serve as the primary elements of coastal defense. These works were built of both earth and masonry, and could be situated, designed, and constructed in any size to conform to the topography of a given site. As it happened, the development of new weapons proceeded more slowly than anticipated, and the new batteries were equipped with same type of armament used in the previous systems of fortifications.[27] Many of these works are still extant today.

---

[24] Lewis, *Seacoast Fortifications,* p. 60.
[25] Lewis, *Seacoast Fortifications,* pp. 45 – 66.
[26] Lewis, *Seacoast Fortifications,* p. 67.
[27] Lewis, *Seacoast Fortifications,* pp. 69 – 70.

Sandy Hook

Fort at Sandy Hook (1857 – 1868)

By the 1850s, the United States had built a system of fortifications to protect New York's inner harbor. However, a technical revolution in the areas of steam-powered ships and longer-range artillery soon made defending the outer portions of the New York harbor a priority. Chief Engineer Joseph G. Totten, a fortification expert in the United States at that time, reviewed the Second and Third Systems of fortifications defending New York Harbor. His conclusion was that a fortification on Sandy Hook was absolutely necessary.[28] In 1857, the U.S. Army Corps of Engineers devised a plan to erect a five-bastioned granite fort with three sea fronts and two land fronts on the peninsula of Sandy Hook. This would allow the United States to command the channels that skirted the Sandy Hook peninsula, as well as to prevent enemy ships from entering into Sandy Hook Bay for an attack on the city of New York. Two years later in 1859, ground was broken for the construction of the fort, known as the "Fort at Sandy Hook" (fig. 6). An appropriation of $250,000 was made by Congress for this defense at Sandy Hook.[29]

Spurred by the onset of the Civil War in 1861, troops were assigned to Sandy Hook to man the weaponry and safeguard the public property.[30] The advent of rifled artillery during the Civil War, however, made granite forts obsolete. As previously mentioned, the accuracy and strength of rifled artillery meant that a single shot could cause immense damage to a masonry fortress such as that at Sandy Hook. Consequently, construction on the fort halted in 1868.[31]

Sandy Hook Proving Ground (1874 – 1919)

The U.S. government was becoming increasingly aware of the way in which rapid advances in technology, due largely to the Industrial Revolution, were affecting all areas of the military, especially ordnance. In August 1874, the U.S. Army Ordnance Department took the initial steps to establish the Sandy Hook Proving Ground. Colonel S. Crispin, Commanding Officer of the U.S. Ordnance Agency and New York Arsenal, sent a letter dated August 3, 1874, to General S.V. Benet, Chief of Ordnance, Washington, D.C., submitting estimates for funds for the erection of "suitable (temporary) appointments for experimental and proof ground for heavy ordnance at Sandy Hook, N.J."[32] The letter called for four wooden platforms, one "proof butt," a building for a chronoscope, wires and other apparatus, and two wooden casemates for covering guns, for a total of $4,000. The Sandy Hook peninsula was chosen as a favorable site because "ranges from 1,500 to 2,000 yards can readily be obtained in this

---

[28] Bearss, *The Sandy Hook Defenses*, p. 6.
[29] Bearss, *The Sandy Hook Defense,* pp. 1-8.
[30] Naomi D. Kroll and Sharon K. Ofenstein, *Historic Structure Report, Building 25, Enlisted Men's Barracks, Fort Hancock, New Jersey, Sandy Hook Unit, Gateway National Recreation Area* (Lowell, MA: U.S. Department of the Interior, National Park Service, Northeast Region, Building Conservation Branch, February 2002), p. 17.
[31] Bearss, *The Sandy Hook Defenses,* p. 2.
[32] "History of Fort Hancock and of the Defenses of Sandy Hook."

reservation; and if deemed important, these distances can be considerably extended within the limits of the reservation."[33] Plans were approved, and in late October of the same year, the first round was fired from the temporary proof battery.

By the mid-1880s, Congress realized that other countries were also benefiting from the technical revolution, and were improving their military capabilities, as well. Large expenditures quickly began to be appropriated for the state-of-the-art rifled artillery to be emplaced in the nation's coastal defense structures. The role of the Sandy Hook Proving Ground in this effort can not be overestimated, since it was here that all of the experiments for artillery for seacoast defenses took place. As stated by Edwin C. Bearss in his *Historic Resource Study, The Sandy Hook Proving Ground, 1874 – 1919*:

> After a model had been accepted by the Ordnance Board and placed in production, all the guns and carriages manufactured by the Army Gun Factory, other arsenals, or private contractors were shipped to Sandy Hook to be proof fired before being sent to the site where they were to be emplaced.[34]

By 1917, the suitability of the Sandy Hook Proving Ground was declining, for reasons stated by one Colonel Ruggles in a letter to Chief of Ordnance Crozier: "(a) danger to personnel and property at Fort Hancock; (b) limitations on tests imposed by a restricted beach range; (c) impossibility of using planes of fire segmented by 180 degrees; (d) interference with fire to the seaward by fog, hog [?], and shipping; (e) unavailability for use in event of war with a major naval power; and (f) expense of prosecuting work during inclement weather because of interruptions to outside work necessitated by the severe winters."[35] Therefore, in 1919, the Sandy Hook Proving Ground began to be phased out, and the program was soon relocated to the Aberdeen Proving Ground in Maryland.

Modern Era of Coastal Defense (1890 – 1909)

National Trends

Endicott System (1890 – 1905)

Concern over the deteriorating conditions of existing fortifications caused alarm among many, both in Congress and in the armed forces. Therefore, in 1885 President Grover Cleveland assembled a special board to assess the state of our nation's coastal defenses, and to make recommendations for their improvement, specifically in response to newly developed weapons. The board was headed by William C. Endicott, Cleveland's first Secretary of War, and was known as the Endicott Board. In 1886, this board called for a

[33] "History of Fort Hancock and of the Defenses of Sandy Hook."
[34] Bearss, *The Sandy Hook Defenses,* p. 1.
[35] Bearss, *The Sandy Hook Defenses,* p. 257.

substantial number of new defensive works, armed with the newly developed weapons. This program was called the Endicott System, and its first works were begun in the early 1890s.[36]

Continuing with the trend that the post-Civil War period had begun, the Endicott System was largely characterized by a number of smaller, detached batteries, as opposed to the construction of large fortifications. Unlike the design and construction of the fortifications of the Third System defenses, the structures of the Endicott System were built of reinforced concrete, and were blended into the surrounding topography as much as possible by being built partially behind large parapets of earth (fig.7). However, the most radical change that occurred in the Endicott period was not in the physical construction of the structures, but rather in the armament and weaponry contained therein.[37]

One major advancement in weaponry during this system was the manufacturing of steel for iron in gun manufacturing, which allowed for the production of lighter, stronger, longer, and more powerful guns. Another significant development during the Endicott System was the introduction of breech-loading weaponry. Breech-loading allowed the first complete utilization of rifling, which permitted the manufacturing of extremely sophisticated and powerful guns. This advancement allowed guns to be mounted on a new type of gun carriage that would lower the gun on the recoil energy of the gun's firing. The gun would then disappear behind the wall from which it was mounted, permitting reloading by men both quickly and safely from behind the battery wall. This weaponry produced in the early 1890s was four times as heavy, and could fire distances two to three times as great, as previous armament; it was second to none in both its power and accuracy.[38]

Taft System (1905 – 1910)

A similar group to the Endicott Board was convened in 1905 by President Roosevelt to review the Endicott Board's program and bring it up to date. The chairman of the board was William Howard Taft, President Roosevelt's Secretary of War, so it was known as the Taft Board. Unlike that of the previous systems, the Taft Board did not focus on the fortifications or its armament, but rather on accessory harbor defense equipment. Although the Taft Board proposed new defenses for a few neglected U.S. harbors, and extensive new construction for America's newly acquired foreign possessions such as the Philippine Islands, the board did not propose as much new domestic construction as did previous boards. The board's most significant contribution was the acceleration of the modernization of the projects that had been initiated by the Endicott Board.

[36] Lewis, *Seacoast Fortifications,* p. 77.
[37] Lewis, *Seacoast Fortifications,* p. 78.
[38] Lewis, *Seacoast Fortifications,* p. 75.

Coastal Defenses of Sandy Hook and the Establishment of Fort Hancock

Corps of Engineers

A U.S. Army Corps of Engineer Office responsible for the fortification of New York Harbor was extant in New York City as early as 1843. From 1866 to 1910, the New York Engineer Office had management and command over the river and harbor fortification work in New York City, the southern shore of Long Island Sound, and northeastern New Jersey (the Sandy Hook vicinity). In the 1890s, three distinct groups of Engineer projects began to form within the district: New York River and harbor projects, the harbor and fortifications of New York City, and river and harbor projects in New Jersey. Formally recognized in 1911, these three distinct groups became known as New York Districts 1, 2, and 3, and they supervised all harbor fortification projects in New York State, New York City, and New Jersey.[39]

Coastal Defenses of Sandy Hook

Battery Potter (Constructed 1891 – 1895)

One of the most significant structures that the U.S. Army Corps of Engineers built on the Sandy Hook peninsula was Battery Potter, the first and only Endicott emplacement of its type to be constructed and armed. Construction plans for Battery Potter were begun in fiscal year 1890 by Brig. Gen. J.C. Duane, and were later modified by Col. Henry C. Abbott. The Board of Engineers' estimated cost of this project was projected to be $457,530, which included the cost of both the masonry and sand and two immense hydraulic gun-lift mechanisms. The estimated cost did not include the two 12-inch rifles to be loaded onto the gun-lift mechanisms. A site was selected for this new gun-lift battery by Lt. Col. George L. Gillespie; it was located about 1,000 feet south of the southeast bastion of the old fort.[40]

Funds were drawn from allocations made both August 18, 1890, and February 24, 1891, for a total of $283,000 to cover the expense of the masonry. The gun-lift mechanism was funded by the Armament of Fortifications allocation made on September 22, 1888, for $112,500. The construction plant was in position by the fall of 1890, and ground was broken in January 1891. Brig. General Thomas L. Casey, Chief of Engineers, gave clear instructions to Gillespie "to build the northern half of the battery only." Work progressed at a steady pace, and by June 30 of the same year, foundations for the north half of the battery and most of the south half were completed. The materials were purchased under contractual agreements, and the work was completed by hired day labor.[41]

---

[39] Finding Aid; RG 77; NARA - Northeast Region (NY), p. 20.
[40] Bearss, *The Sandy Hook Defenses,* p. 86.
[41] Bearss, *The Sandy Hook Defenses*, pp. 87-89.

Unique to the construction of this gun-lift battery was its massive "defensible entrance." Plans were submitted by Lt. Col. Gillespie to the department and reviewed by Chief Engineer Casey (fig. 8). Casey recommended that a defense of the entire flank of the battery be considered, not just the entrance. Both Gillespie and his assistant 1st Lt. James G. Warren investigated this idea of a complete flank defense, and concluded that it was not possible due to both the position and trace of the battery. However, they did find that a *chemin de ronde* would provide a suitable defense of both the entrance and sides of the battery.[42] A *chemin de ronde* is "a sentry path or a passage around the revetment of a rampart which was provided with a small parapet." The position was used by soldiers keeping an eye on the glacis so as to prevent the placement of scaling ladders by the enemy. Both Gillespie and Warren felt that if a *chemin de ronde* was placed on the curved part of the battery located on the superior slope, the battery would be provided with a sufficient defense. However, its usefulness was later negated by its susceptibility to artillery fire.[43] Instead, the "defensible entrance" was built with two towers using the old granite blocks from the Civil War-era "Fort at Sandy Hook" (fig. 9). In July 1898, three months after the United States declared war on Spain, three Gatling guns were mounted within the "defensible entrance" – one in the center of the two towers, and one on each side of the towers[44]

Lt. Col. Gillespie was very pleased at both the pace with which the work was proceeding and the quality of the work. His next order of business was to devise a suitable lighting system for the interior of the battery. He received permission from Chief Engineer Casey to construct an electric light plant, similar to those used on the nation's modern warships. Gillespie contracted with General Electric Company on November 23, 1892, for the installation of the lighting plant. The estimate for this plant was $3,788; it was accepted on March 10, 1893.[45]

With the majority of the construction completed and the electric plant approved, the rifle for the north gun emplacement was ready to be emplaced. The north rifle, Model No. 1888, No. 11, weighing 52 tons, was placed on its gun carriage on August 29, 1892, and raised to its firing position by the hydraulic lift (fig. 10). With the loading of this north rifle, the gun-lift battery became the first Endicott emplacement to be partially armed. Test-firing began on September 12, 1892, in the presence of a Special Board of Engineers. Testing continued through May 31, 1893, with a total of 24 rounds being fired. the testing included not only the gun and the operation of the gun-lift mechanism, but also the amount of stress on the structure itself. The testing illustrated the immense stability of the structure, with only a few minor changes needing to be made.[46]

Gillespie, confident with the successful test firing of the north rifle on the north gun-lift emplacement, made an allotment on January 26, 1893, of $63,000 from the appropriations of February 24, 1891, and July 23, 1892, for the construction of the south gun lift. It was hoped that this south rifle would be emplaced by the fall of 1894. The north carriage and rifle were temporarily transferred to the south side of the battery in order to test the south gun-lift mechanism. Nine rounds were fired during the test. The carriage for the south gun-lift was

---

42 Bearss, *The Sandy Hook Defenses*, p. 95.
43 *A Dictionary of Military Architecture Fortification and Fieldworks from the Iron Age to the Eighteenth Century* (http://www.angelfire.com/wy/svenskildbiter/madict. html#Cheminderonde).
44 Bearss, *The Sandy Hook Defenses*, p. 115.
45 Bearss, *The Sandy Hook Defenses*, p. 95.
46 Bearss, *The Sandy Hook Defenses*, pp. 106 – 107.

delivered by the Ordnance Department on May 17, 1895. Gun Model 1888, No. 12, was mounted on June 5, 1895, thus completing the construction and armament of the gun-lift battery. A final test for rapidity of fire on both the north and south guns was made by the Ordnance Department on August 7, 1895. The battery was transferred to the Artillery Corps by Lt. Col. Gillespie on March 22, 1898, one month before the onset of the Spanish-American War.[47]

The gun-lift battery was finally named on May 25, 1903, as Battery Potter, in honor of Brig. Gen. Joseph H. Potter. Potter had graduated from the U.S. Military Academy as 23rd in the class of 1843. Potter was commissioned a brevet 2nd lieutenant and assigned to the 1st U.S. Infantry, posted to Fort Des Moines. During the Mexican War, Potter was transferred to the 7th U.S. Infantry in the autumn of 1845. As a member of the Mormon expedition, Potter spent the next 12 years at several posts on the Arkansas-Indian Territory frontier. Potter served as captain at Fort McLane during the Civil War. He was then promoted to brigadier general on April 1, 1886, and he retired on October 12, 1886.[48]

Despite its distinction of being the earliest Endicott emplacement of its type ready for service, Battery Potter's technology nevertheless soon became obsolete. It was determined that the hydro-pneumatic gun-lift mechanism was not as efficient as the newly developed counterweight system used by the Buffington-Crozier disappearing carriage. Discussion on disarming Battery Potter commenced on May 13, 1904, between Lt. Col. William Marshall and Fort Hancock commander Lt. Col. Peter Leary. As a result of their conversation, several disadvantages and advantages were identified pertaining to Battery Potter. A major disadvantage was that only one civilian engineer understood the operation of the battery and the guns, whereas this process needed to be understood by all artillerists at the post. However, a major advantage to Battery Potter was that it was the only Endicott emplacement at the post to have an unlimited field of fire. In addition, the gun-lift mechanism had only been out of order once in 11 years. If Battery Potter was to be disarmed, it was agreed that Endicott battery would be used as a location for primary range- and position-finding stations.[49]

Thus, a building housing two primary fire-control stations – serving Batteries McCook and Reynolds – was built on top of Battery Potter during the late spring and summer of 1905. The wooden building was positioned on the southeast corner of the battery's terreplein. On July 29, 1906, it was officially decided to disarm Battery Potter, and to use the emplacement for additional range- and position-finding stations. In mid-August, the two 12-inch rifles were removed from the north and south gun-lifts and transferred to the commanding officer of the Sandy Hook Proving Ground. Construction of new concrete range- and position-finding stations on the old emplacement began in the spring of 1907, supervised by Assistant Engineer Lt. Hurlbut. By November 15, Lt. Col. Marshall reported to Chief Engineer MacKenzie that seven primary fire-control stations and one secondary station had been completed.[50] Two primary stations were housed in one building, and five primary stations were located in the other building.

---

[47] Bearss, *The Sandy Hook Defenses*, pp. 108-115.
[48] Bearss, *The Sandy Hook Defenses*, pp. 117-118.
[49] Bearss, *The Sandy Hook Defenses*, p. 128.
[50] Bearss, *The Sandy Hook Defenses*, pp. 141-145.

During the 1920s and 1930s, all nine fire-control stations became obsolete – some because the batteries they served were disarmed, some because newer stations were built elsewhere. During World War II, the two stations in the 1905 wooden building became an advanced Harbor Entrance Control Post. The two stations in the 1907 duplex building were converted into a signal station and a meteorological station, respectively. The five stations in the other 1907 building became a Group Command Post and Observation Post.[51]

Battery Potter's significance to not only Fort Hancock, but also U.S. military history, can not be overstated. Battery Potter earned the distinction of being the first Endicott emplacement to be constructed and armed. Even though the technology of Battery Potter's gun-lift mechanism was rendered obsolete not long after its construction, it set the stage for the multitude of the other Endicott emplacements the United States would begin to construct to defend our coastal shores.

Mortar Battery (Constructed 1890 – 1894)

The Mortar Battery was likewise a very significant structure, being one of the first Endicott System mortar batteries to be constructed, armed, and test-fired. It was the prototype on which other mortar batteries in the United States were modeled for the next 28 years. On September 20, 1888, the Board of Engineers approved plans and detailed specifications for the construction of the battery; Chief Engineer Casey made an allotment of $201,000 on August 18, 1890, for the construction of a 16-gun mortar battery. The Engineer Board also designated the site selection for the Mortar Battery to be located southeast of and adjacent to the Sandy Hook Lighthouse.[52]

Construction, overseen by Lt. Col. Gillespie and his assistant 1st Lt. Harry Taylor, commenced in November 1890. As with battery Potter, it proceeded by hired labor, with the construction materials purchased under contractual agreements. The first order of business was to excavate the site; this was completed by June 30, 1891. By June 30, 1892, 55% of the masonry work was completed (fig. 11); and by June 30, 1894, most of the construction was complete in all four pits, and all but one mortar in the southwest pit was mounted.[53] The total cost of the construction of the battery, including the plant for construction, the battery itself, and platforms for 16 carriages, was $269,752.67, as stated in Lt. Col. Gillespie's completion report on May 7, 1895. Gillespie also included in the completion report the total cost of the armament – 16 cast-iron mortars and 16 mortar carriages – to be $264,000.[54]

The first gun to be test-fired took place on June 22, 1894, on the southeast mortar in the northeast pit. As at Battery Potter, the mortar itself, its carriage, and its platform were being tested, along with the effect of the blasts upon the firing pit's vertical walls and interior slopes. The test included five rounds of firing with the mortar elevated at a 45-degree angle, and the direction of fire being south 60 degrees east. The Mortar Battery was the first Endicott emplacement of this type to be completed, and to have its ordnance fired and tested, marking a significant moment in military history. By November 25, 1894, the last mortar in

[51] Bearss, *The Sandy Hook Defenses,* p. 159.
[52] Bearss, *The Sandy Hook Defenses*, p. 161.
[53] Bearss, *The Sandy Hook Defenses*, pp. 161 -163.
[54] Bearss, *The Sandy Hook Defenses*, p. 179.

the southwest mortar pit was emplaced and the proof-firing of each mortar was completed. The final battery firing took place on April 11, 1895.[55]

General Order No. 78, issued by the War Department in 1903, designated the Mortar Battery as Battery Reynolds, in honor of Major General John F. Reynolds, an honored military figure. Reynolds was a graduate of the U.S. Military Academy, and had served with the 3rd Artillery in the Mexican War. Reynolds went on to serve as major general of volunteers, commanding the I Corps in the Army of the Potomac during the Civil War. On July 1, 1863, Reynolds was killed at Gettysburg while leading his troops.

In 1906, the mortar battery was divided into two separate commands. The southeast half of the battery remained Battery Reynolds, while the northeast half was designated Battery McCook, after Alexander McCook. McCook graduated from the U.S. Military Academy in 1852; he was commissioned as a 2nd lieutenant in the 3rd U.S. Infantry, and by 1861 he was an instructor of tactics at West Point. In 1862, McCook became a major general in the Army of Ohio, leading a corps of soldiers. McCook was promoted to lieutenant colonel of the 26th U.S. Infantry, and continued to serve in the U.S. Army until 1895, when he retired as a major general. McCook died in June 1903 in Dayton, Ohio.[56]

A new emplacement for a four-gun mortar battery was constructed on the Navesink Highlands during World War I. Four 12-inch mortars were removed from Batteries Reynolds and McCook and transferred to the new emplacement in the summer of 1917. Batteries Reynolds and McCook were declared obsolete in 1919; their remaining mortars were removed in 1920 and sold as salvage. However, the battery emplacement remained, and the Army saw new uses for it. On April 6, 1921, the Chief of Engineers allocated $20,000 to construct a "protected fire control switchboard room" in the longitudinal gallery of the battery; this was completed by the summer of 1922. During 1940-1941, the Harbor Defense Command Post (HDCP) was installed in the unoccupied bombproof magazines and galleries.[57]

Establishment of Fort Hancock (1895)

As evidenced by the construction of both the Mortar Battery and Battery Potter, the Sandy Hook peninsula was home to some of the nation's most advanced military artillery and technology. It was apparent by 1895 that an official fort needed to be established. Fort Hancock was designated by a general order signed by the Secretary of the War Department on October 30, 1895. Fort Hancock was named in honor of Major General Winfield Scott Hancock, a contemporary military figure best known for his leadership during the Civil War (fig. 12).[58] The Sandy Hook Proving Ground , which had existed on the southern half of the peninsula for almost 21 years (since 1874), would continue to be operated by the Ordnance

---

55 Bearss, *The Sandy Hook Defenses*, pp. 177 – 178.

56 Bearss, *The Sandy Hook Defenses*, p. 183.

57 Bearss, *The Sandy Hook Defenses*, pp. 192-195.

58 Judith Q. Sullivan, *Building 32, Quartermaster's Storehouse, Historic Structure Report, Fort Hancock, New Jersey, Sandy Hook Unit, Gateway National Recreation Area* (Lowell, MA: U.S. Department of the Interior, National Park Service, Northeast Region, Historic Architecture Program, 2004), p. 19.

Department. Fort Hancock, which was to be located on the northern half of the peninsula, was to be operated by the U.S. Army Corps of Artillery, independent of the Proving Ground. To ensure that each facility remained independent, each had its own commanding officer.[59]

Plans and site selection for the new fort were the responsibility of the Office of the Quartermaster General. In May 1896, Captain Arthur Murray – under the authority of the Quartermaster General's Office – selected the new site. His plans, which included both a central and secondary parade ground juxtaposed to one another, were greatly influenced by the architectural firm of John M. Carrere and Thomas Hastings. Plans were approved by Secretary of War Lamont for a total of $339,600 for both site preparation and construction. The initial plans called for the construction of 32 permanent buildings for the post, including barracks, officers' quarters, storehouses, a hospital, a guardhouse, and an administration building. Work was scheduled to begin March 1, 1897; however, due to delays in contracting the work and difficulty in receiving materials, work was eight months overdue by the spring of 1898. By September 27, 1898, seven of the 32 originally contracted buildings were complete and officially accepted at the post. Sixteen additional buildings were complete, seven near completion, and nine were half-finished by January 25, 1899. By September 1899, all of the 32 structures had been officially accepted at Fort Hancock – almost two years overdue (fig. 13).[60]

The main function of the fort in its early years was to provide coastal artillery defense and the training of the troops assigned to these defenses. Between the years of 1900 – 1914, an additional 25 buildings were added to the post, which garrisoned four to six companies of U.S. Coast Artillery responsible for the care, maintenance, and operation of the land and coastal fortifications, including those of the submarine mine and torpedo defenses.[61]

Two Separate Operations: Fort Hancock and the Sandy Hook Proving Ground

As previously mentioned, Fort Hancock and the Sandy Hook Proving Ground operated under two separate divisions of the U.S. Army, and were run by two different commanding officers. Fort Hancock operated under the authority of the U.S. Army Corps of Artillery, and the Proving Ground operated under the authority of the U.S. Army Ordnance Department. As logical as this division was, conflict between the two operations was unavoidable. A letter from the Chief of Ordnance to the Commanding Officer of Fort Hancock dated December 11, 1901, stated that the "Proving Ground should be considered a permanent establishment and requested that correspondence be sent back indicating the clear demarcation of Proving Ground property and the buildings thereon as well as any future buildings that will be constructed."[62] A response letter was sent on December 30, 1901, that included a map showing clear lines of demarcation between the Proving Ground and Fort Hancock. In the commanding officer's response, he concurred that these two operations should remain separate and run as independent from one another as possible. A statement dated January 19, 1900, from the Board of Ordnance concurred with the Commanding Officer's drawings.[63]

---

[59] Sullivan, *Building 32*, p. 18.
[60] Sullivan, *Building 32*, pp. 21-25.
[61] Sullivan, *Building 32*, p. 26.
[62] "History of Fort Hancock and of the Defenses of Sandy Hook."
[63] "History of Fort Hancock and of the Defenses of Sandy Hook."

Battery Gunnison (Constructed 1898, 1903 – 1907)

On April 25, 1898, $16,000 was allocated by Chief Engineer Wilson for construction of a gun battery to that would mount two 6-inch rapid-fire guns on the Sandy Hook peninsula. A site was selected, and work began in July of the same year. A temporary suspension of the work was ordered by Chief Engineer Wilson on August 8, since it was discovered that the selected site for the new battery interfered with operations at the Proving Ground. At this time approximately one-third of the concrete work was complete. Wilson transferred the balance of the monies that were originally allocated for this project to another project.[64]

Five years later, in April 1903, the project resumed, and plans for a rapid-fire gun battery were drawn up by Major Marshall's department. Marshall felt strongly that the battery should be constructed southeast of the originally selected site, so that it would be positioned to command the southern approach to Sandy Hook. This would also solve the problem of the new battery interfering with the Proving Ground. Plans were submitted by Marshall on August 2, 1903, with a cost estimate of $45,000.[65]

The construction plant was positioned in March 1904, and by June of the same year it was apparent to Marshall that he had underestimated the cost of construction. He alerted the department that the project would require another $20,000, which was approved by General Mackenzie, who had replaced Gillespie as Chief Engineer. The construction of the emplacements was complete by the autumn of 1904 and ready to be armed. In January 1905, a 6-inch gun (Model 1903, Serial No. 5) on a disappearing carriage (Model 1903, Serial No. 52) was placed on top of emplacement number one. Emplacement number two also received a 6-inch gun (Model 1903, Serial No. 34) on a disappearing carriage (Model 1903, Serial No. 57 (fig. 14). The battery was now completed, and on December 5, 1905, Marshall conducted a final inspection and then officially transferred the battery to the Coast Artillery.[66]

By a General Order issued by the War Department on December 27, 1904, the rapid-fire gun battery was named Battery Gunnison, in honor of John W. Gunnison. John W. Gunnison was from New Hampshire, and graduated second in the class of 1837 from the U.S. Military Academy. Gunnison had a successful career in the military, eventually earning the rank of captain in 1853. He was killed by Indians near Sevier Lake, Utah Territory, on October 26, 1853, while in charge of a survey party mapping a central route for a railroad to Pacific Coast.[67]

Starting in 1908, several changes and improvements were made to Battery Gunnison. One of the guns was temporarily removed from one of the emplacements to allow a niche to be cut in the emplacement wall to house a terminal booth. In 1909, a plotting room was constructed below the battery commander's station. In 1918, Battery Gunnison was assigned to the Mine Command of the Sandy Hook Defenses, and this remained the battery's main mission through the 1930s, while its secondary purpose was to defend New York Harbor against enemy naval attack. Considering the altered role that Battery Gunnison now filled, the armament mounted on the battery was not ideal for this new function. The disappearing

[64] Bearss, *The Sandy Hook Defenses*, p. 336.
[65] Bearss, *The Sandy Hook Defenses*, p. 337.
[66] Bearss, *The Sandy Hook Defenses*, pp. 338-339.
[67] Bearss, *The Sandy Hook Defenses*, p. 339.

rapid-fire guns had a limited field of fire, and the guns could not be served very quickly. It was decided that the guns should be removed and replaced by guns *en barbette*, specifically those located on top of Battery Peck. The disappearing guns and carriages were removed on May 10, 1943, and during the same month the additional improvements and modernizing of the battery were completed. Because Battery Gunnison now emplaced the *en barbette* guns from Battery Peck, the emplacements then became known as New Battery Peck. In 1948, these guns were removed and were replaced by two 6-inch guns, Nos. 22 and 23, which had been transferred from Fort Hamilton's Battery Livingston. These guns remained in place until the 1960s, but were soon removed thereafter and transferred to the Smithsonian Institution's Silver Hill in Maryland.[68]

Other Batteries at Fort Hancock (1896 – 1909)

Although both Battery Potter and the Mortar Battery were outstanding in their significance as the first Endicott emplacements of their type, several additional emplacement were constructed at Fort Hancock between the years of 1890 and 1910 (fig. 15). These emplacements were a direct result of the Endicott Board recommendations that outlined the implementation of high-powered and rapid-fire guns and mortars, underwater mine fields, concrete batteries, and dynamite guns. Between the years of 1896 and 1909, 11 batteries were constructed at Fort Hancock, including Batteries Alexander, Bloomfield, Richardson, Granger, Halleck, Arrowsmith, Engle, Urmston, Peck, Morris, and Gunnison.

World War I to Deactivation (1917 – 1974)

World War I Era

During World War I (1917 – 1918), Fort Hancock played a very active role as a training facility for troops bound for Europe – specifically as a training base for artillery units before they were sent to France. The population at the post swelled, necessitating the construction of temporary wooden cantonments. At the height of the war, Fort Hancock's population reached 4, 043. When the war ended in November 1918, Fort Hancock's troops started to demobilize, with the population falling to 2,324; by June 1919, the population had fallen to 370, which included eight officers and 362 men comprising four companies. The temporary cantonments were demolished, and the activity level at Fort Hancock was considerably reduced. This was evidenced by the small population at the post during the 1920s and 1930s, which fluctuated between 300 and 700 men, and the construction of only seven buildings.[69] The Sandy Hook Proving Ground was deactivated in 1919, with its role transferred to Aberdeen, Maryland.

[68] Bearss, *The Sandy Hook Defenses*, pp. 340-342. Silver Hill is the Smithsonian's restoration and storage facility for historically significant air and space craft.
[69] Sullivan, *Building 32,* pp. 26-27.

World War II Era

With the advent of World War II (1941 – 1945), America's focus turned to the defense of its major metropolitan ports and cities by way of coastal and antiaircraft defense. Fort Hancock (fig. 16) joined what was known as the Joint Defense Plan, under which it had the mission of "maintaining a close surveillance of all beaches, resisting hostile landings, providing antiaircraft defense, and establishing a liaison between all elements of the command – the navy and units in adjacent subsectors."[70] During this time, Fort Hancock also served as a training base for forces to be sent oversees, so its population skyrocketed once again. The population fluctuated between 7,000 and 12,000 military and civilian personnel between the years of 1942-1943. To accommodate such a large number of people, many temporary structures were constructed, including barracks, mess halls, latrines, recreation halls, infirmaries, nurses' quarters, garages, and warehouses. This great swell of population was short-lived, as the Allies went on the offensive during 1943. Preparations began for the invasion of Europe in 1944, and large numbers of Fort Hancock personnel were transferred. By March 1944, the number of troops assigned to Fort Hancock was reduced to 2,010 people, which included 71 officers, 22 warrant officers, and 1,917 enlisted men.[71]

Korean War Era

Fort Hancock and its coastal defense structures became obsolete following World War II, due to a drastic decline in defense spending, and the United States' military shift from high-powered guns to innovations in both air power and radar. Fort Hancock was deactivated on June 25, 1950, but the crew of the Sandy Hook Coast Guard Station and the keeper of the Sandy Hook Lighthouse were retained. With the advent of the Korean War (1950 – 1954), Fort Hancock was reactivated to provide antiaircraft defense for the New York metropolis.

Cold War Era

Soon after the war ended, Fort Hancock was again deactivated on May 1, 1953. However, the 1225th Army Service Unit remained there to provide both logistical and administrative support to the remaining radar and antiaircraft installations at Fort Hancock. Late in World War II, it became evident that current antiaircraft defenses were not adequate to defend against high-flying bombers. Consequently, planning was begun for a new type of surface-to-air missile, known as a Nike missile. The first Nike missile was known as the Nike Ajax missile; it was capable of maximum speeds of more than 1,600 mph, and could reach targets at altitudes of up to 70,000 feet (fig. 17).[72] In1954 the antiaircraft guns at Fort Hancock were

---

[70] Sullivan, *Building 32*, p. 27.
[71] Sullivan, *Building 32*, p. 27.
[72] Donald E. Bender, "The Nike Missile System, A Concise Historical Overview" (http://alpha.fdu.edu/~bender/N-view.html).

replaced by Nike Ajax surface-to-air missiles, and Fort Hancock was reactivated once again on July 1, 1956.

A second generation of Nike missiles was developed and became known as the Nike Hercules missile (fig. 18). The Nike Hercules missile had improved speed, range, and altitude, as well as the capability to be armed with a powerful atomic warhead to ensure the destruction of a target aircraft.[73] Although this missile remained in active use until 1974, it was largely obsolete by the late 1960s. By 1956, the number of soldiers stationed at Fort Hancock totaled 1,375, including antiaircraft missile battalions, military police, radar signal detachments, and the 1225th Army Service Unit.

President Nixon authorized the establishment of Gateway National Recreation Area on October 27, 1972, which included Fort Hancock. The tenants remaining at Fort Hancock included the U.S Coast Guard, the U.S. Navy Reserve, a First Army Recreation Area, the U.S. Department of Commerce, and the Electronics Support Command. On December 31, 1974, Fort Hancock was officially deactivated and transferred to the jurisdiction of the Department of the Interior on January 1, 1975.[74]

[73] Bender, "The Nike Missile System."
[74] Sullivan, *Building 32,* pp. 29-30.

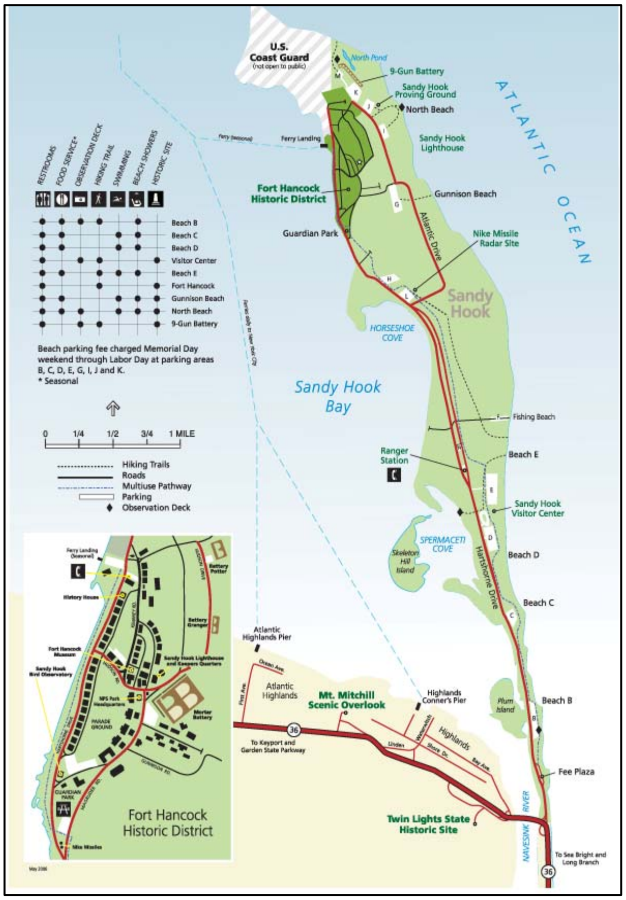


Figure 1.
Map of Gateway National Recreation Area (left) and detail of the Sandy Hook Unit (right).

Figure 2. Fort McHenry (circa 1800): example of a First American System fortification.

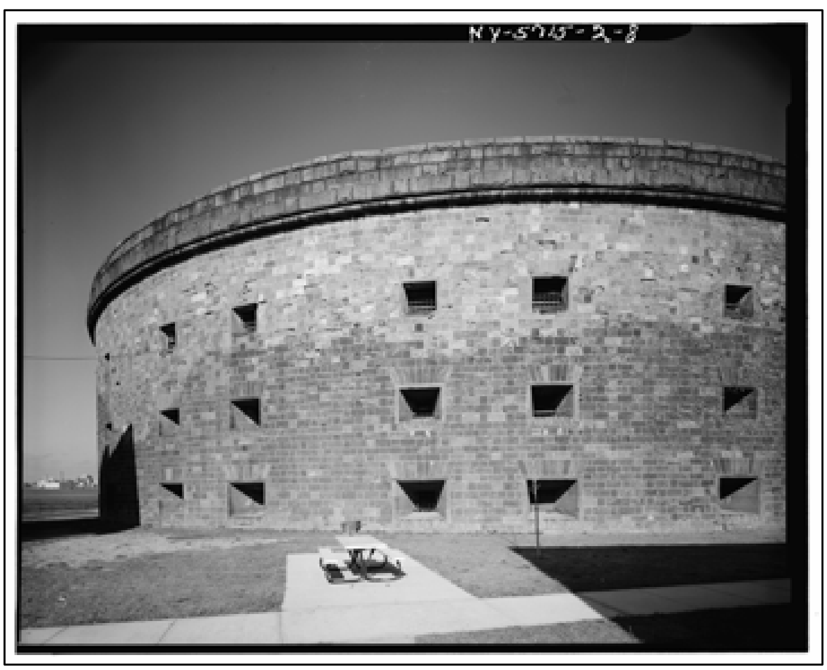


Figure 3. Castle Williams (constructed 1807 – 1811): example of a Second American System fortification, showing the three levels of casemated gun emplacements unique to this system of fortifications.

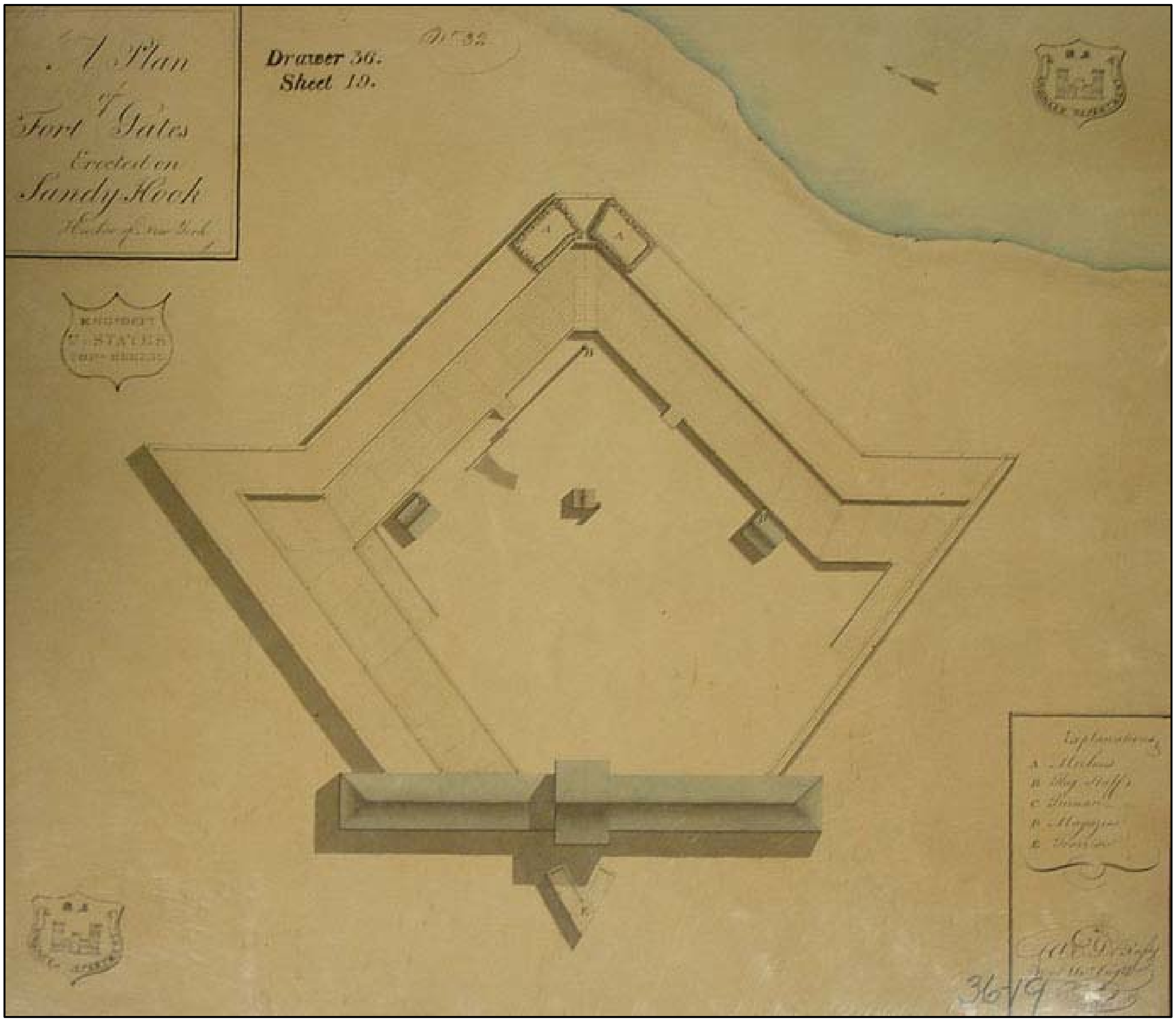


Figure 4. Plan of Fort Gates (constructed ca. 1812); structure was built of wood and located about half a mile north of the Sandy Hook Lighthouse. Fort Gates was the most noteworthy structure built during the War of 1812, and was constructed to deter the British from using Sandy Hook as a staging area from which they could attack New York City.

Figure 5. Aerial view of Fort Monroe, located in Hampton, VA. Fort Monroe was the first work of the Third System planned in its entirety, unlike other Third System fortifications that were adaptations of earlier fortifications from previous systems.

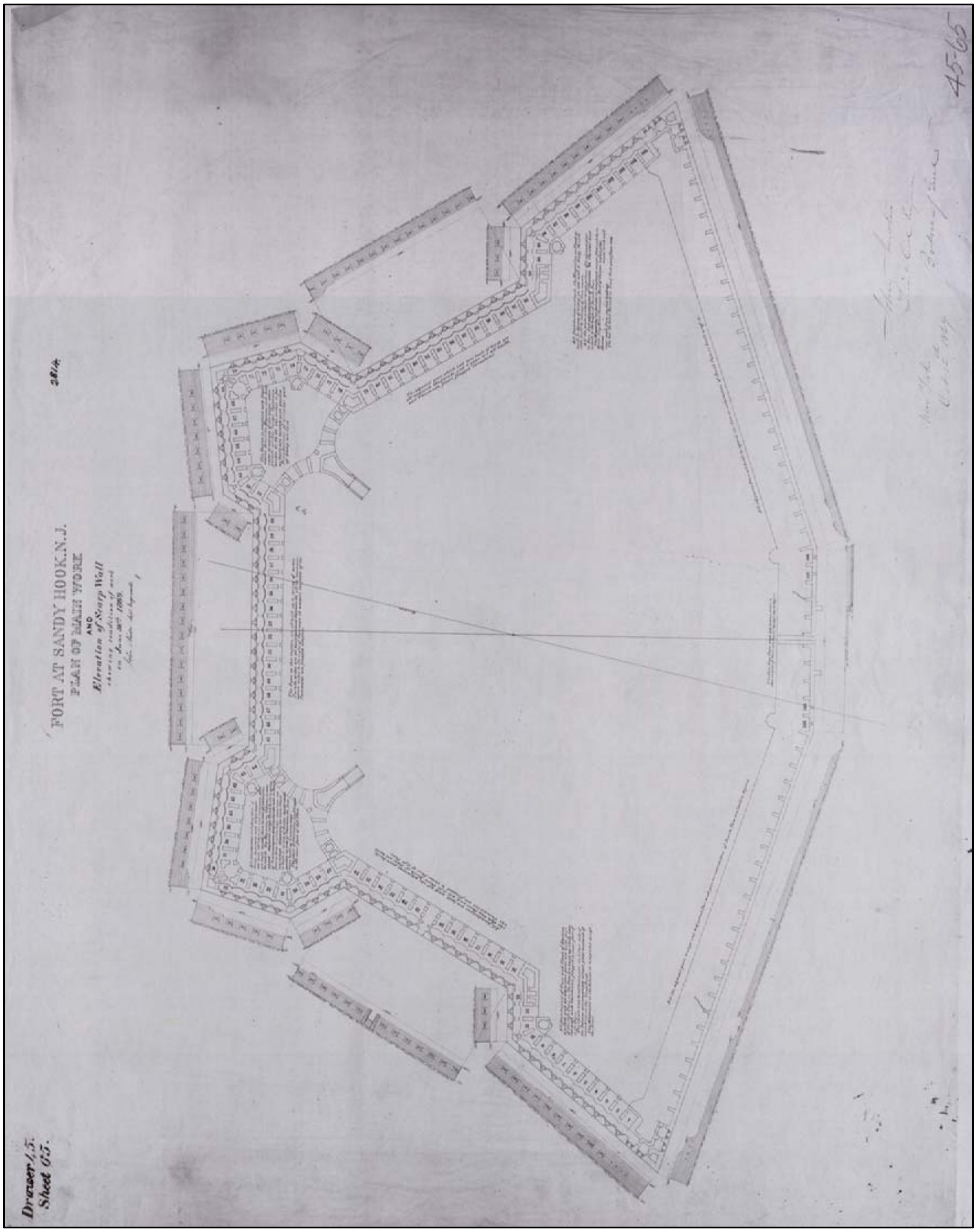


Figure 6. "Fort at Sandy Hook, N.J." Plan of main work and elevation of scarp wall, showing condition of work on June 30, 1869.

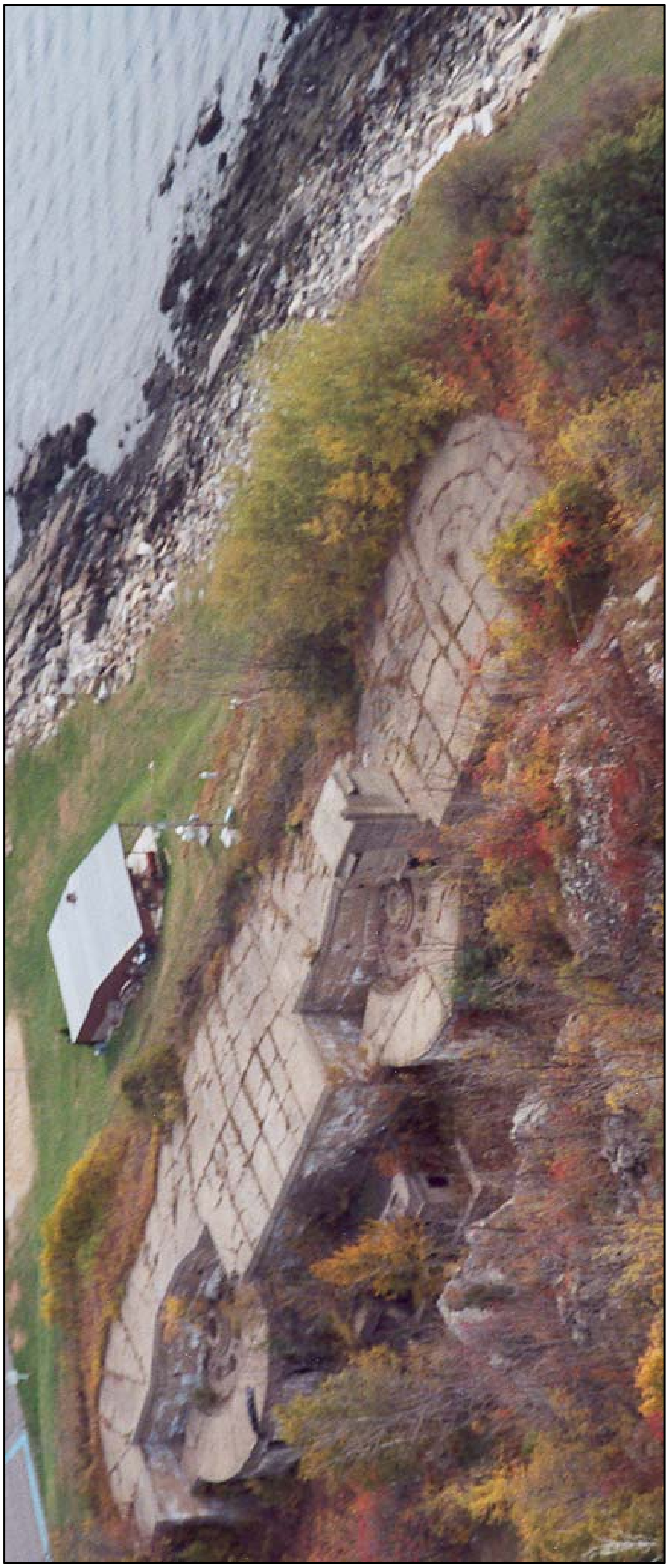


Figure 7. Battery Elon Farnsworth (constructed 1898): example of an Endicott System defense work. View is looking southeast, showing the rear of the battery and its two gun emplacements. Note that the battery is constructed of reinforced concrete, and is built into the surrounding topography, partially behind a large parapet of earth for disguise on the seaward front.

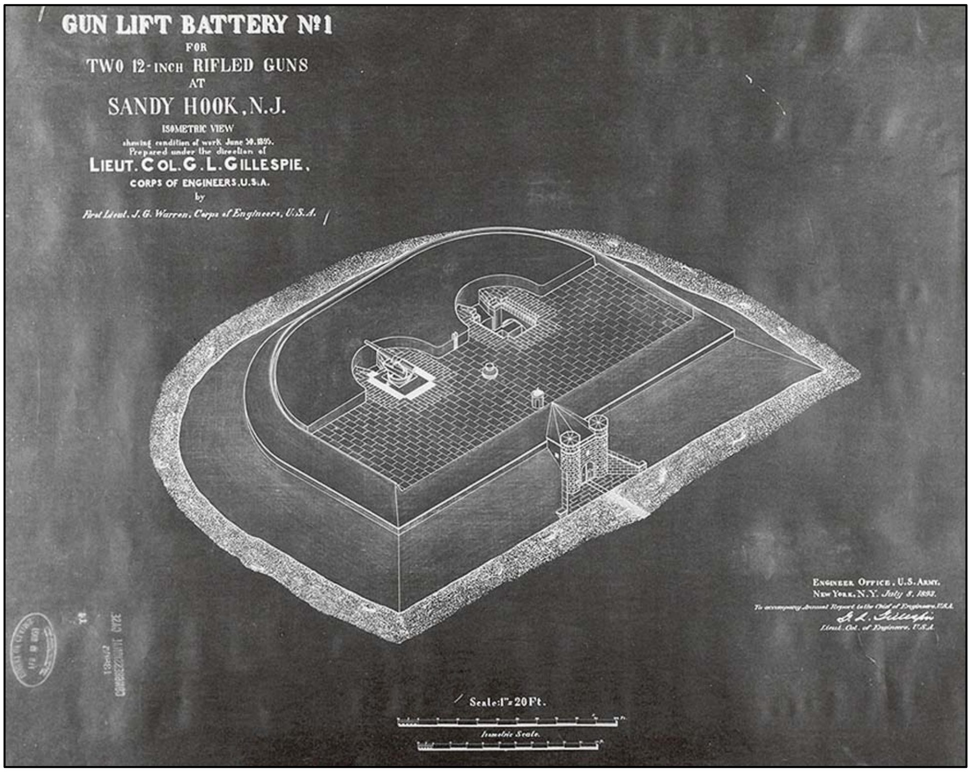


Figure 8. "Gun Lift Battery No. 1 for two 12-inch rifled guns at Sandy Hook, N.J. Isometric view showing condition of work June 30, 1895."

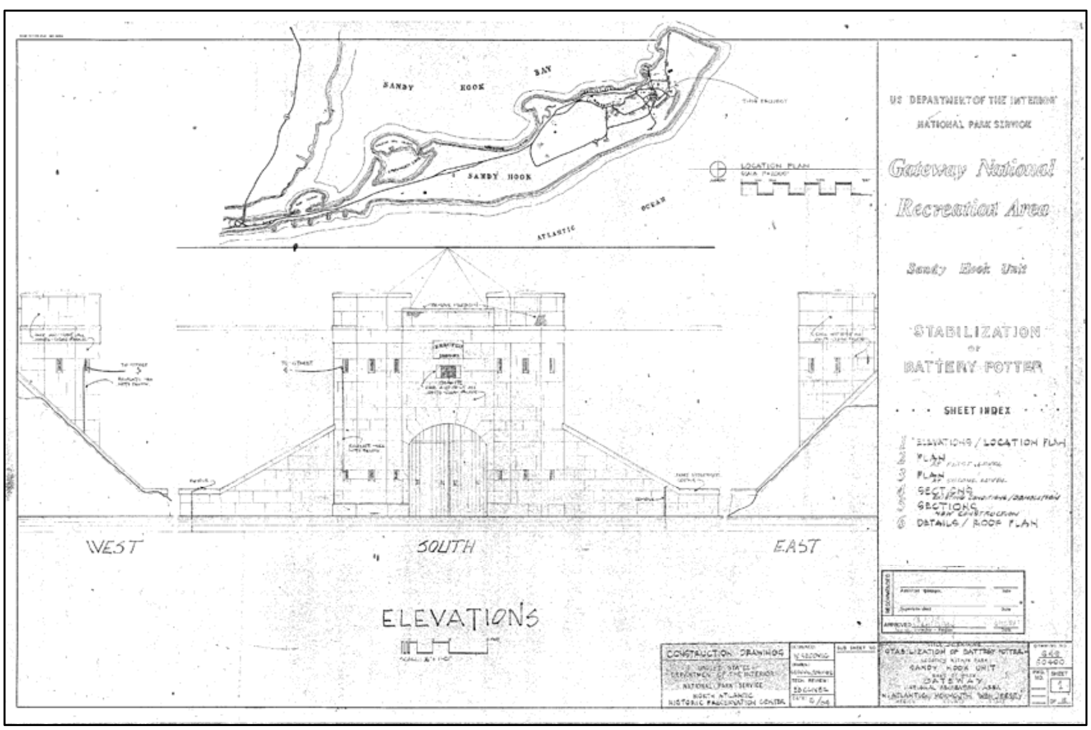


Figure 9. Detail elevation of "defensible entrance."

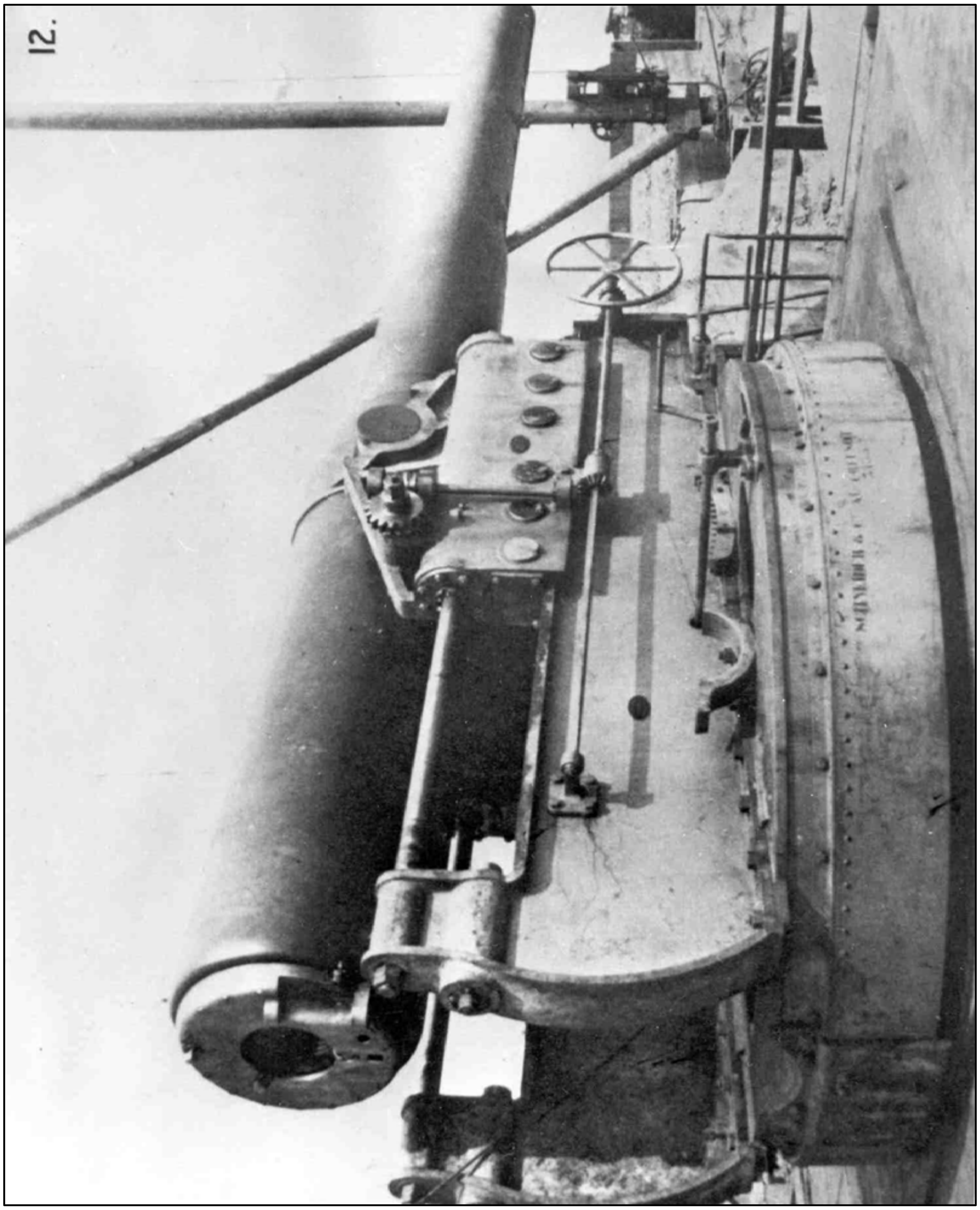


Figure 10. Battery Potter (constructed 1891 – 1895): north pit, showing 12-inch rifle upon its carriage and raised into firing position on a hydraulic lift elevator, August 29, 1892.

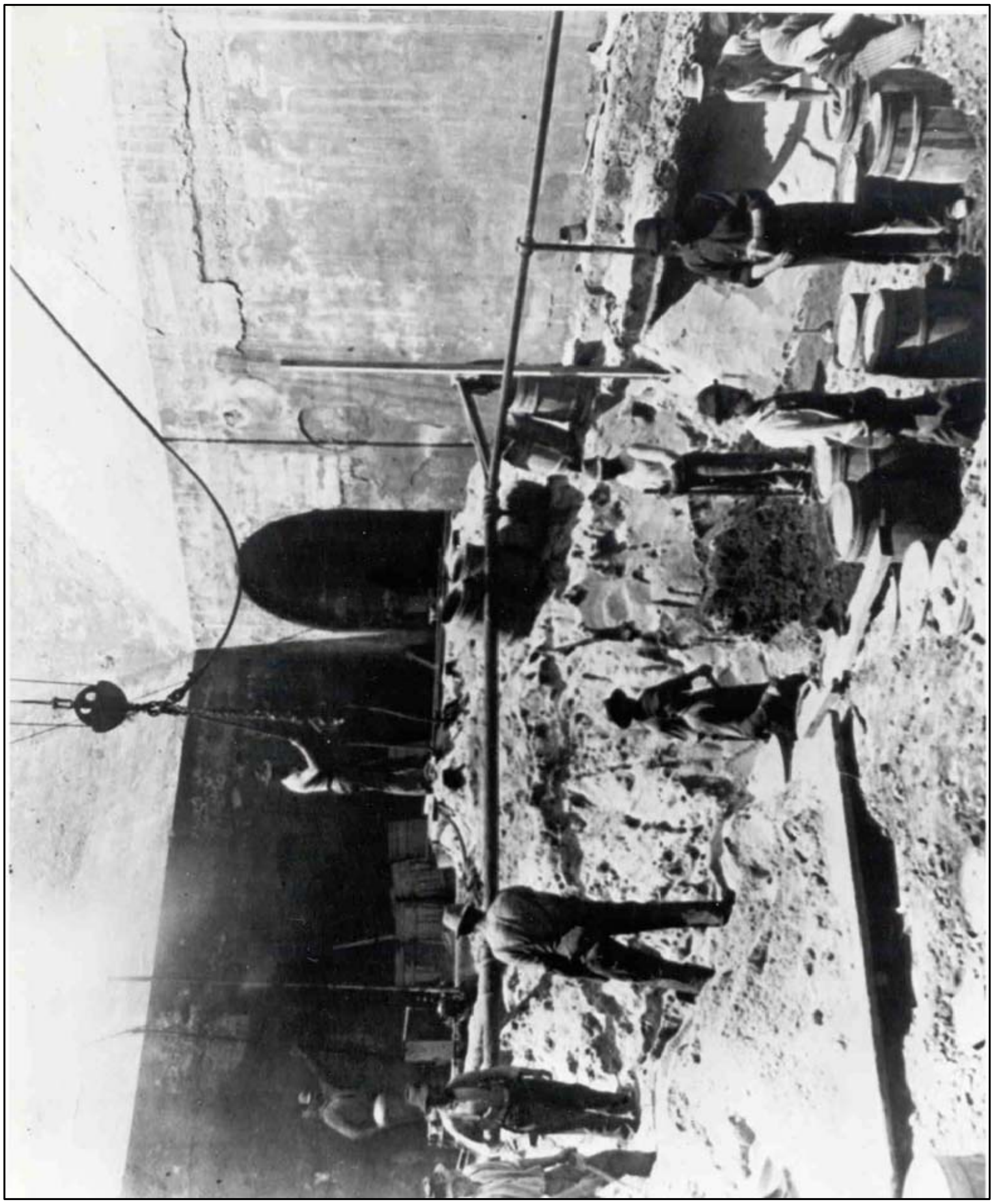


Figure 11. Mortar Battery (constructed 1890 – 1894): photograph taken circa 1893, showing the excavation and construction of one of the four firing pits.

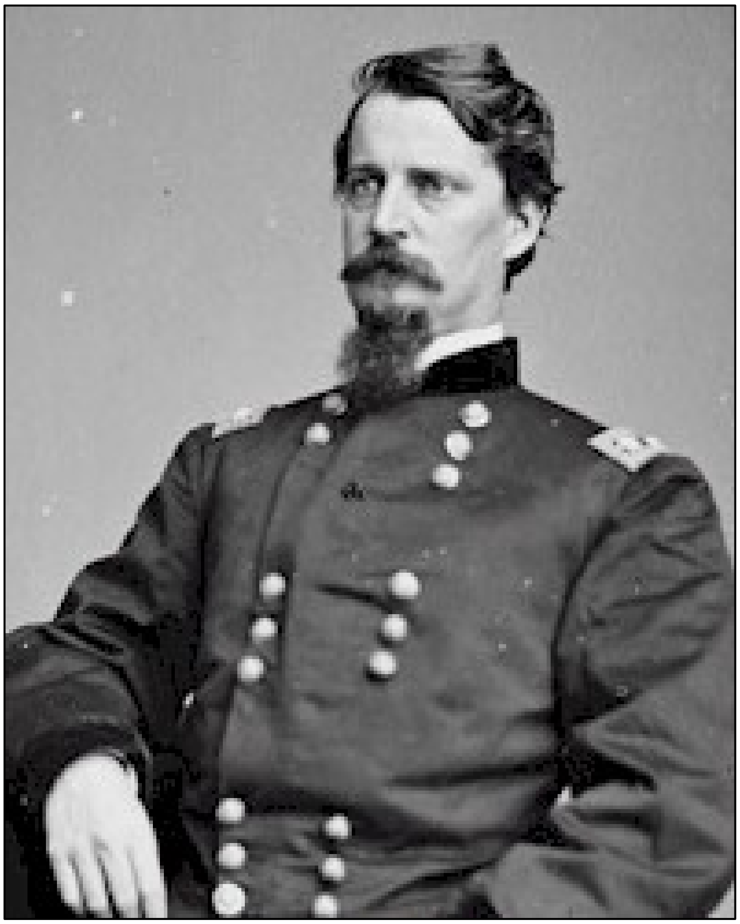


Figure 12. Major General Winfield Scott Hancock (1824-1886).

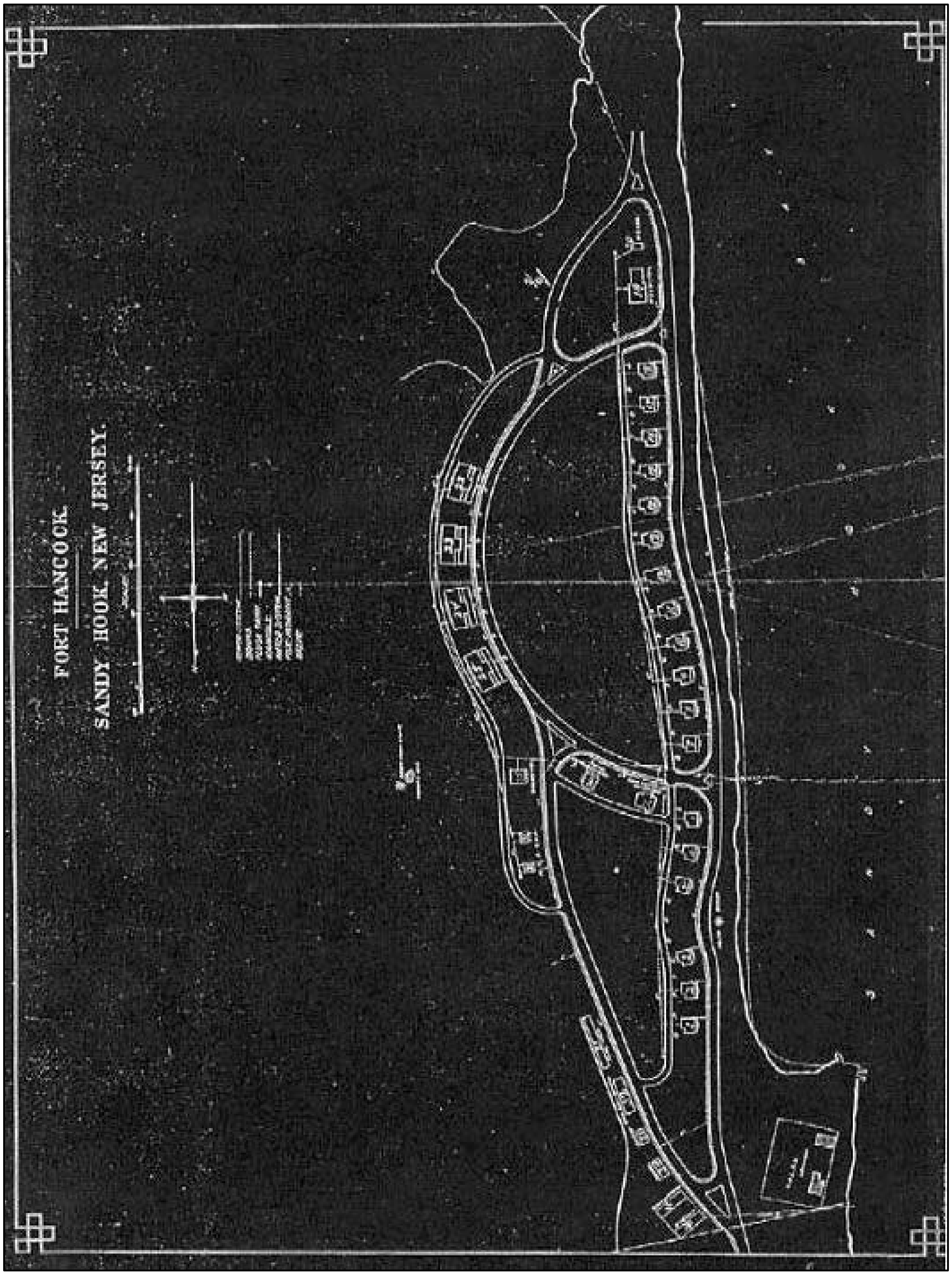


Figure 13. Map of Fort Hancock circa 1900, showing buildings constructed. Drawn by J.M. Milton, Quartermaster General's Office.

Figure 14. Battery Gunnison (constructed 1898, 1903 – 1907), showing the northern of two 6-inch counterweight guns (Model 1903, Serial No. 34) originally installed on a disappearing carriage (Model 1903, Serial No. 57). Photograph taken 1937.

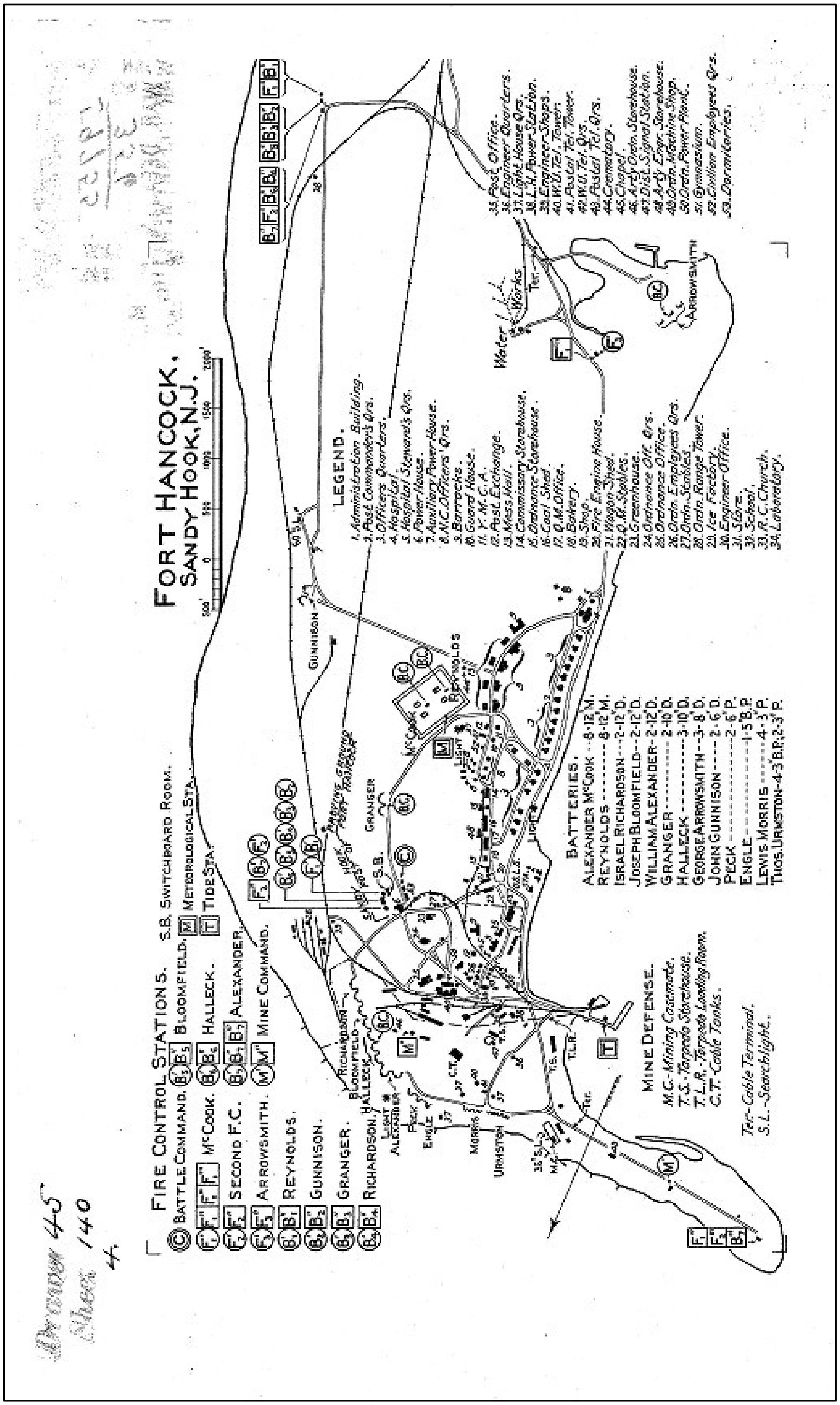


Figure 15. Map of Sandy Hook Defenses, 1910.

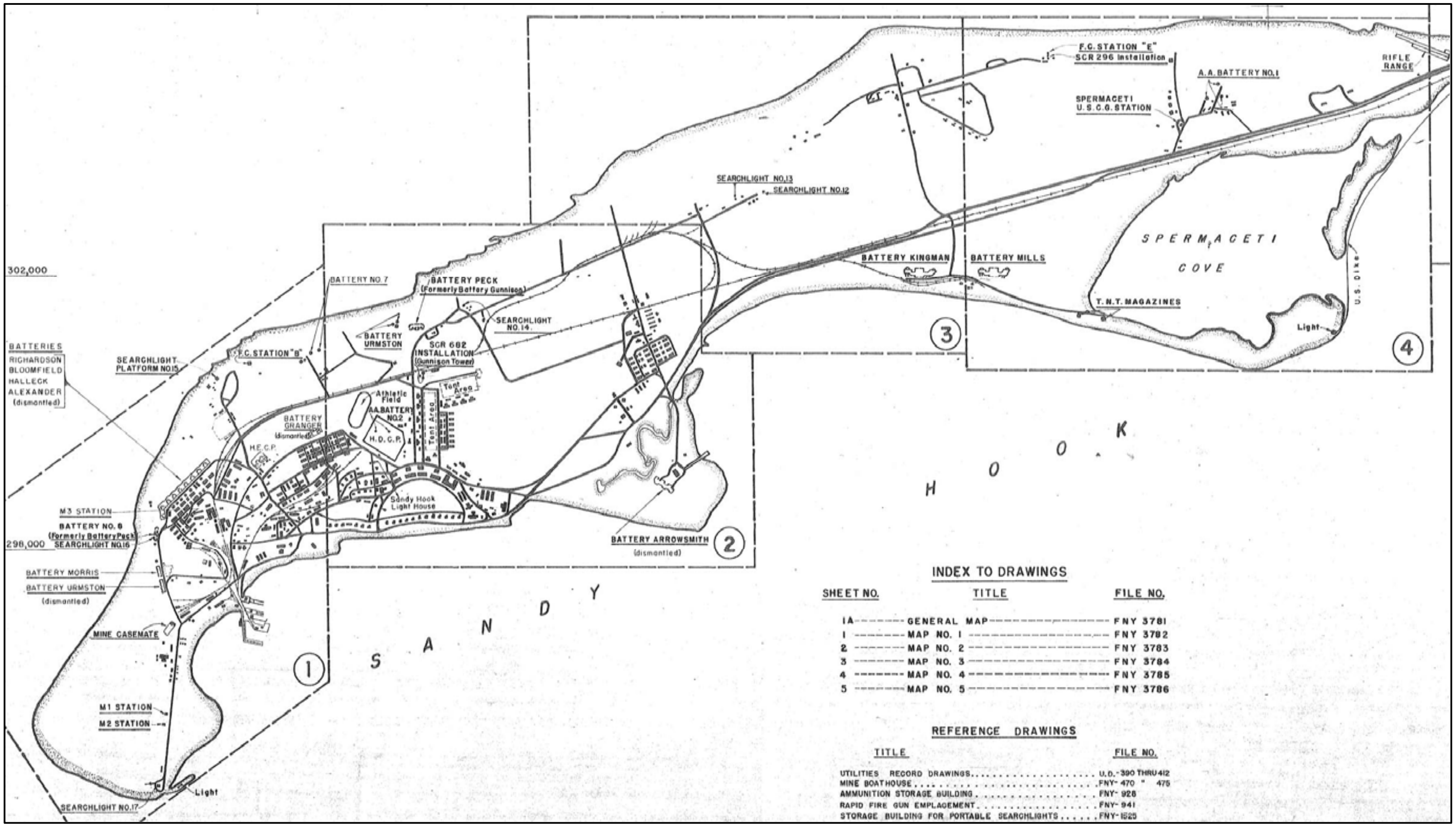


Figure 16. Detail of Sandy Hook Defenses during World War II. From "Harbor Defenses of New York, Military Reservation, Location of Fortification Structures, General Map, Fort Hancock, New Jersey. U.S. Engineer Office, New York District, New York, N.Y.

Figure 17. Image of Nike-Ajax missile similar to those that replaced the antiaircraft guns at Fort Hancock in 1954.

Figure 18. Image of Nike Hercules missile, the second-generation Nike missile used at Fort Hancock; it remained in active use until 1974, becoming largely obsolete by the 1960s.

DEVELOPMENTAL HISTORY:

BATTERY POTTER

CHRONOLOGY OF DEVELOPMENT AND USE

Introduction

The construction of Battery Potter is extremely interesting from several points of view. As previously discussed, Potter was the first and only hydraulic gun-lift battery to be completed under the Endicott System. Thus, the work at Battery Potter was setting the precedent for other batteries of its type. Research of the construction of this emplacement also revealed the role of the Corps of Engineers with respect to the construction of concrete defenses, as well as how the construction of this particular emplacement adapted to the changes in technology of the period. One aspect that was unique to Sandy Hook was the coordination of the Corps of Engineers with the Ordnance Department at the Sandy Hook Proving Ground. All of these factors, as well as others, make the history of Battery Potter one of great interest and national significance.

The subsequent sections on the development and use of Battery Potter discuss the history of the structure from planning and construction to present condition.[1] Previous reports, specifically those by Edwin Bearss, cover some of the same information, as well as additional details; these should be consulted in addition to this report. Research for this report uncovered detailed reports on the construction of Battery Potter, as well as correspondence between the important parties in the planning and construction of the battery. Annual reports from important years of the construction phase and completion reports from 1895 are included as appendices to this report. Detailed specifications for the mechanism for the hydraulic gun-lift written by 2nd Lt. Robert McGregor are included under separate cover with this report, as are 10 sheets of completion drawings for Battery Potter dated 1894. These reports and drawings should prove as useful to the reader as they were to the author.

Battery Potter – Construction

Planning

The Endicott Report heralded a new era in the construction of seacoast and harbor defenses. A significant part of defending the United States was the defense of large metropolitan areas,

[1] Note that the descriptions of the construction and original appearance of Battery Potter will often use reference marks as a means of measurement. The reference mark is given relative to the mean low water line, which was 0 as defined in the documentation by the Corps of Engineers.

which included New York City. Sandy Hook had always played an important role in the defense of New York Harbor, and was to be part of the new system envisioned by the Secretary of War William C. Endicott and the crafters of the Endicott Report.

Preparation of the Endicott System fortifications began soon after Congress decided to act on the findings of the Endicott Board. The Board of Engineers began planning emplacements at Sandy Hook for the defense of New York Harbor in 1887.

Lt. Col. George L. Gillespie, U.S. Army Corps of Engineers, submitted plans and estimates for the gun-lift battery at Sandy Hook to the Chief of Engineers on May 27, 1890 (fig. 19). Lt. Col. Gillespie's initial estimate for Battery Potter was $418,000 for two guns, or $221,000 for one gun.[2]

While the Board of Engineers was reviewing the plans for the gun-lift battery and making preparations for other coastal defense systems, Congress continued to allot funds for Endicott System fortifications. Appropriations in the amount of $1,221,000 were authorized by the Fortifications Act of August 11, 1890. Included in this act was an allotment of $736,000 for the defenses of New York City.[3] An Act of Congress on August 18, 1890, entitled the "Gun and Mortar Batteries Act," allocated funds for the construction of the gun-lift battery at Sandy Hook.[4]

Chief of Engineers Brig. Gen. Thomas L. Casey notified Lt. Col. Gillespie that on September 8, 1890, the Secretary of War had approved the construction of one 12-inch gun-lift battery at Sandy Hook. Another letter, dated September 13, 1890, stated that the sum of $164,000 had been allotted for the battery, and that Lt. Col. Gillespie would be in charge of construction.[5]

Changes to the original plans for the lift-gun battery allowed Lt. Col. Gillespie to reduce the estimated costs (see the subsequent section "Masonry Construction"). The Annual Report for F.Y. 1891 documented the following appropriations:

> From the appropriations of August 18, 1890, and February 24, 1891, for Gun and Mortar Batteries, allotments of $154,000 and $129,000, respectively, were made for the construction of the masonry; and from the appropriation of September 22, 1888, for Armament of Fortifications, an allotment of $112,500 was made for the construction of the mechanism.[6]

[2] Lt. Col. George L. Gillespie to Brig. Gen. Thomas L. Casey, Chief of Engineers, May 27, 1890; Letters Sent; Vol. I, p. 4; Entry 815; RG 77; NARA - Northeast Region (NY).

[3] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983), p. 59.

[4] Gillespie to Casey, Sept. 10, 1890; Letters Sent; Vol. I, p. 5; Entry 815; RG 77; NARA - Northeast Region (NY).

[5] Gillespie to Casey, Sept. 25, 1890; Letters Sent; Vol. I, pp. 7-9; Entry 815; RG 77; NARA - Northeast Region (NY).

[6] Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.

Preparations at Sandy Hook

Lt. Col. Gillespie's first task was to improve the infrastructure of Sandy Hook. In his correspondence with the Chief of Engineers, he stated that "Sandy Hook possesses at present few facilities for beginning work of this kind, and many preparatory expenditures must be incurred for the erection of this battery [Battery Potter], as well as for that of the proposed mortar battery, of which plans are now being made."[7] Among the improvements Gillespie was planning to make was the extension of the wharf, and improvement of the quarters for housing laborers, as well as the construction of storage sheds for cement and concrete mixers at both Battery Potter and the Mortar Battery. The work would also require the construction of a railroad and purchase of a locomotive and box cars to move supplies from the wharf to the batteries. Lt. Col. Gillespie proposed to procure the necessary materials – which included large quantities of cement, broken stone, lumber, tools and other supplies – through sealed bids invited by public advertisement.[8] The colonel informed the Chief of Engineers:

> It is expected that all measures preparatory to construction will be completed, and sufficient materials of construction delivered in time to begin operations April 1, 1891.[9]

In order to achieve his goal, Lt. Col. Gillespie began by inviting bids for the railroad track, locomotive, and other supplies. The advertisement, which ran in the *New York Tribune* as well as other newspapers, read:

> U.S. ENGINEER OFFICE. Room 62, Army Building, New York, Oct. 1, 1890. – Sealed proposals, in duplicate, will be received at this office until 12 o'clock noon, Tuesday, October 21, 1890, for the purchase of supplies deliverable at Sandy Hook, N. J., comprising materials for building one mile of railroad track; 1 narrow gauge locomotive; 12 dump cars; 4 dumping coal tubs; 2 hoisting engines; 2 Knowles pressure pumps; 2 cubical concrete mixers; 25 pulley blocks and sheaves, and 2000 feet wire hoisting rope. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332 and vol. 24 page 414, Statues at Large. For specifications, blank forms and all information apply to the undersigned. G. L. GILLESPIE, Lieut. Col. of Engineers.[10]

[7] Gillespie to Casey, July 9, 1891.
[8] Gillespie to Casey, July 9, 1891.
[9] Gillespie to Casey, July 9, 1891.
[10] *New York Tribune*, October 18, 1890, p. 10, col. 1. Boston Public Library, Microtext AN2 – N7N525, Reel 161, September – October 1890.

Lt. Col. Gillespie also invited public bids for additions to the wharf on the western shore of Sandy Hook, known as the Engineer Dock or Wharf. Waldo Danforth of New York City was awarded the contract for the wharf extension for the sum of $4, 139.55.[11] The project commenced in December 1890. When the project was completed on January 24, 1891, the wharf had been extended 198 feet to the west, and the final cost was $4,343.34.[12]

Danforth was contracted a second time to widen the bridge of the extension to the dock in September 1891.[13] In conjunction with improvements to the wharf, a storehouse for the barrels of cement delivered to the wharf was completed on October 21, 1891.[14] The storehouse was capable of holding one barge load of cement, consisting of about 1,500 barrels.[15]

The wharf project included removing the existing railroad tracks, and the laying of new rails to better handle materials from both sides of the dock. The railway had three parallel tracks on the wharf, which merged at the end of the dock and then split with spurs servicing both battery sites as well as the Sandy Hook Proving Ground. The railroad tracks for the construction of the batteries, as depicted by Gillespie's assistant 1st Lt. James G. Warren (fig. 20) led from the wharf to the sites for Battery Potter and the Mortar Battery.

Lt. Col. Gillespie procured from H. K. Porter & Co. Locomotive No. 20, which was a narrow-gauge locomotive. On the behalf of Lt. Col. Gillespie, 1st Lt. Harry Taylor requested that H. K. Porter & Co. letter the cab "General Casey" and the tank "U. S. Engineer Department."[16] The rolling stock used in the construction of the batteries included 18 rotary side dump cars of 3 cubic yards capacity, two rotary side dump cars of 1½ cubic yards capacity, and 21 flat cars.[17]

The Concrete Plant

Concurrent with the multitude of preparations for the construction of the batteries at Sandy Hook was the planning of the facilities for emplacing both Battery Potter and the Mortar Battery. The construction at the wharf included the erection of a storage shed and stone bins at the southern end of the pier. These were temporary storage sites for the materials that were off-loaded at the Engineer Dock. In addition, both sites required cement storage sheds,

---

[11] Gillespie to Casey, Oct. 27, 1890; Letters Sent; Vol. I, p. 23; Entry 815; RG 77; NARA - Northeast Region (NY).

[12] Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.

[13] Lt. J.G. Warren to Gillespie, September 1891; *Lift Gun Battery, Sandy Hook, New Jersey* (New York: United States Engineer Bureau). [Note: This is a bound volume of monthly reports from Sept. 1891 through March 1894, sent from Sandy Hook to Col. Gillespie at the N.Y. Engineer Office.]

[14] Warren to Gillespie, October 1891; *Lift Gun Battery*.

[15] Warren to Gillespie, June 30, 1892, p. 20; Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894, Engineer Bureau, Sandy Hook, New Jersey* (New York: United States Engineer Bureau).

[16] 1st Lt. Harry Taylor to H.K. Porter & Co., Oct. 28, 1890; Letters Sent; Vol. I, p. 24; Entry 815; RG 77; NARA - Northeast Region (NY).

[17] Warren to Gillespie, June 30, 1892, p. 20; Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894*.

stone bins, and concrete mixers, as well as the laying of the rail lines for hauling the materials from the wharf to the site. Lt. Col. Gillespie's monthly report to Chief of Engineers Casey for February 1891 reported that the railroad track to the gun-lift battery had been finished, and that preparations had been made for the construction of the cement shed, stone bins, and the mixers (fig. 21).[18]

The concrete plant, consisting of the cement shed, stone bin, and mixers, was complete by March 1891 (figs. 22 -23).[19] The cement shed was a rectangular storage building measuring approximately 30 by 80 feet; the stone yard was an open structure adjacent to the shed that had trap doors set at intervals. Broken stone could be delivered through the trap doors to the dump cars below, which ran on the rails beneath the structure. The dump cars were then hauled under the mixing platform where cement, sand, and water were added to the stone.

The concrete mixers were cubes 4 feet square, constructed of quarter- inch steel and 3-inch angle irons. The dry ingredients for the concrete were added to the mixer, where water was introduced through a hollow center shaft. The rotating hollow shaft would gradually introduce water while the mixer was being turned. As it turned out, Ernest L. Ransom held an 1884 patent (number 306522) for "manufacture of concrete," which included a rotating hollow shaft. The Engineer Department was notified of the patent infringement by Mr. Ransom's attorney, and Lt. Col. Gillespie arranged to pay royalties of $100 for each of the three mixers to Mr. Ransom.[20]

Lt. Warren's map of Sandy Hook from June 1892 illustrates the location of some of these structures, as well as the rail line and the wharf (fig. 20). The plan of Battery Potter from that same month depicts the cement shed, stone bin, and mixer for the battery in more detail (fig. 21). The operation at the Mortar Battery was similar to that at Battery Potter, except that Potter's plant had twice the mixing capacity of the Mortar Battery's. With these structures in place, Lt. Col. Gillespie was within his target date of April 1891 to begin construction of Battery Potter.

Materials

Lt. Col. Gillespie submitted the following advertisement inviting sealed bids for the delivery of natural cement and broken stone to Sandy Hook to the *New York Tribune, New York Scientific American,* and the *Boston Advertiser,* among others, on October 29, 1890:

> U.S. ENGINEER OFFICE. Room 62, Army Building, New York, October 29, 1890. – Sealed proposals, in triplicate, will be received at this office until 12 o'clock noon, Monday, December 1, 1890, for delivery at Sandy Hook, N. J., of 41,000 cubic yards of Broken Stone

[18] Gillespie to Casey, Feb. 1891; Letters Sent; Vol. I; Entry 815; RG 77; NARA - Northeast Region (NY).

[19] Gillespie to Casey, March 1891; Letters Sent; Vol. I; Entry 815; RG 77; NARA - Northeast Region (NY).

[20] Gillespie to Casey, Dec. 6, 1890; Letters Sent; Vol. I, p. 65; Entry 815; RG 77; NARA - Northeast Region (NY).

> (granite, trap or limestone) and 62,000 barrels of Rosendale Cement. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332 and vol. 24 page 414, Statues at Large. For full information apply to G. L. GILLESPIE, Lieut. Col. of Engineers.[21]

It is interesting to note that Lt. Col. Gillespie's specifications called for the use of "Rosendale Cement" in the construction of the battery. Rosendale, NY, was among the earliest areas mined for natural cement rock in the United States in the 1820s, and the name "Rosendale" was often used as a generic term to refer to natural hydraulic cement. The use of natural hydraulic cement had been introduced in England during the late 18th century, and deposits of natural hydraulic cement were first discovered in upstate New York during the construction of the Erie Canal.[22]

The manufacture of natural hydraulic cement required the mining of natural cement rocks (fig. 24), which were then burned in kilns to drive out the carbon dioxide contained in the rock. The resulting calcined lumps were then crushed into a fine powder that was stored in airtight, waterproof barrels.[23] The properties of natural cement that made it hydraulic was that it could set and harden in water.[24] The Consolidated Rosendale Cement Company, which manufactured the "Brooklyn Bridge" brand of natural hydraulic cement (fig. 25), was one of several companies in New York State producing natural cement during the period.[25] The Consolidated Rosendale Cement Company did submit a bid for the work at Sandy Hook, specifying their "Brooklyn Bridge" brand of cement, but the firm was outbid by the Lawrence Cement Company.[26]

The reasons for using natural hydraulic cement for the batteries at Sandy Hook appear to have been two-fold. Both economic and climactic reasons were given in a letter from 1st Lt. Taylor to Capt. William L. Marshall:

> All of our concrete has been made at Sandy Hook with Rosendale cement. By using a large proportion of cement (1: 2) we get a very good concrete, much cheaper than we could get an equally good concrete with Portland and as it is always wet or damp at Sandy Hook the conditions for its retaining it strength are most favorable as it has been deemed best to use the Rosendale.[27]

While a majority of the structure was constructed with concrete made with natural cement, Portland cement was also used in the construction of Battery Potter. Reports from the construction of Battery Potter indicate that both Alsen and Duryea Portland cement were

---

[21] *New York Tribune*, November 1, 1890, page 12, column 4. Boston Public Library, Microtext AN2 – N7N525, Reel 162, November – December 1890.

[22] Harley J. McKee, *Introduction to Early American Masonry: Stone, Brick, Mortar, and Plaster* (Washington, D.C.: National Trust for Historic Preservation, 1973), p. 68.

[23] McKee, *Early American Masonry,* p. 68.

[24] McKee, *Early American Masonry,* p. 66.

[25] Edison Coatings, Inc., *History of Rosendale Cement* (www.rosendalecement.net).

[26] Gillespie to Casey, Dec. 3, 1890; Letters Sent; Vol. I, pp. 41-42; Entry 815; RG 77; NARA - Northeast Region (NY).

[27] 1st Lt. Harry Taylor to Captain W. L. Marshall, Feb. 25, 1891; Letters Sent; Vol. I, p. 113; Entry 815; RG 77; NARA - Northeast Region (NY).

used in the exterior and interior for portions of the final pavement or parging.[28] The preference for Portland cement over natural cement in certain applications was not specifically commented on in documents. During that time period, Portland cement was becoming more prevalent in concrete construction due to its greater consistency and strength.[29] This was possibly the reason for using a mix with Portland cement in these vulnerable areas. However, since the cost of Portland cement was more than double that of natural cement, it could not have been substituted for all of the concrete production required for Battery Potter and the Mortar Battery.

The Engineers did perform tests on various brands of Portland cement, and found that the Duryea brand had the greatest tensile strength of those tested, with a medium setting time.[30] The particular test cited by Lt. Col. Gillespie in this document did not include Alsen's Portland cement. However, the F.Y. 1893 Annual Report documents the removal of concrete made with Duryea's Portland cement from the superior slope of the battery. The area was then repaired with an application of concrete made with Alsen's Portland cement (see the subsequent section "Masonry Construction"). This indicated that the Alsen's Portland cement was considered a superior product, but at a cost of about 74 cents more per square yard than the Duryea's, it was more economical to vary the use of both products depending on the application.[31]

The construction of Battery Potter also called for the use of granite block. The defensible entrance on the west elevation was to be constructed with granite block. Other sections of the battery that required additional strength were also planned with granite-block construction. The granite block used at Battery Potter was to be salvaged from the "Fort at Sandy Hook," and was cut, dressed, and placed by a day-labor crew (see the subsequent section "Masonry Construction"). The "Fort" also provided the bluestone pavement that was used at the terreplein level of the battery, and for some of the interior floors.

A large quantity of sand was required for the construction of Battery Potter. The composition of the concrete called for 0.37 cubic yards of sand for every cubic yard of concrete. The final total of sand used in the manufacture of concrete was more than 15,691 cubic feet. In addition, 5,185 cubic yards of sand were used around the exterior of the battery, and sand was also used as fill in the construction of the interior. The vast amount of sand was excavated from nearby sand pits known as "borrow pits" and hauled to the site of the battery.[32] The only expense associated with this part of the operation was the cost of labor for excavating, hauling, and placing the sand.

---

[28] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[29] McKee, p. 69.

[30] Gillespie to Maj. F. A. Mahan, Corps of Engineers, August 14, 1896; Letters Sent; Vol. V, p. 76; Entry 815; RG 77; NARA - Northeast Region (NY).

[31] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB. Note: Cost comparison based on costs included in F.Y. 1893 Annual Report (Appendix B).

[32] Gillespie to Casey, July 8, 1893.

Contracts for Masonry Materials

Lt. Col. Gillespie opened the bids on December 1, 1890, and contracts were awarded to the low bidders. The Lawrence Cement Company was contracted to provide 62,000 barrels of “Hoffman” brand natural cement for $1.02 per barrel, and John A. Bouker was contracted to provide 41,000 cubic yards of broken granite at $1.63 per cubic yard. The materials delivered by the companies were used in the construction of both Battery Potter and the Mortar Battery.[33]

The annual reports from Lt. Col. Gillespie to Chief of Engineers Casey indicate that separate contracts were awarded for the materials slated for Battery Potter and the Mortar Battery. The Lawrence Cement Company was under contract to provide 31,000 barrels of Rosendale cement for Battery Potter and 31,000 barrels of cement for the Mortar Batteries. John A. Bouker was under contract to deliver 21,000 cubic yards of stone for Battery Potter and 20,000 cubic yards of stone for the Mortar Battery. Contracts with both of these companies were to run from December 29, 1890, through January 1, 1892, and were then extended through August 1, 1892, for Lawrence and November 1, 1892, for Bouker.[34]

The Engineers seemed to have periodic troubles with the deliveries from Mr. Bouker. In May 1892, Bouker was unable to deliver the required broken stone for the construction of Battery Potter. Not wanting to halt production, Site Engineer Lt. Warren – with the approval of Lt. Col. Gillespie – allowed Bouker to substitute limestone in limited quantities when granite trap rock was not available.[35]

In July 1892, Lt. Col. Gillespie called for new proposals for cement and broken stone; it appears that he was not completely satisfied with the materials contractors, and was perhaps interested in reducing costs. On July 20, 1892, Lt. Col. Gillespie opened sealed bids for additional masonry materials to be used at Sandy Hook. The lowest bidder in that round was Calvin Tompkins of New York. On July 22, Gillespie contracted with Tompkins to deliver 25,000 barrels of “Old Newark” Rosendale cement at 93.9 cents per barrel, and 20,000 cubic yards of broken stone at $1.28 ¾ per cubic yard. In the case of Mr. Tompkins, the Engineers did allow the use of “Tompkins Cove Broken Bluestone (limestone).”[36] With these materials, the work on the Sandy Hook Batteries could progress, and since the new contracts were cheaper, Lt. Col. Gillespie could reduce the cost of construction.

---

[33] Gillespie to Casey, Dec. 1, 1890; Letters Sent; Vol. I, p. 42; Entry 815; RG 77; NARA - Northeast Region (NY).

[34] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[35] Warren to Bouker, June 1892; Letters Sent; Vol. II, p. 170; Entry 815; RG 77; NARA - Northeast Region (NY).

[36] Gillespie to Calvin Tomkins, July 22, 1892; Letters Sent; Vol. II, p. 251; Entry 815; RG 77; NARA - Northeast Region (NY).

As previously discussed, Portland cement was also used in the construction of Battery Potter. Lt. Col. Gillespie accepted the proposal submitted by Sinclair & Babson of Boston, MA, for the delivery of 900 barrels of Duryea's Brand American Portland Cement at $2.20 per barrel on August 4, 1892.[37]

Also used in the construction of Battery Potter was the large stone required as a component of the massive masonry walls. The low bidder for that contract was John Salterlee, whose proposal to deliver 5,000 tons of large stone at 79 cents per ton was accepted on March 23, 1891.[38]

Masonry Construction

Once he had the requisite approvals and some of the suppliers selected, Lt. Col. Gillespie set out to reconnoiter the site for the gun-lift battery. A survey of the original site determined that a large portion of the area consisted of a low marsh. Gillespie's decision to move the battery approximately 450 feet south of the original site received the approval of both General Casey and the Board of Engineers in December 1890.[39] The new location of the gun-lift battery was about 1,100 feet south of the southeast bastion of the "Fort at Sandy Hook."[40]

Soon after choosing the new location for Battery Potter, Lt. Col. Gillespie had the site cleared and began construction of the railroad tracks. In February 1891, he reported that excavations for the foundation of the battery had begun, and by March the excavation was nearly complete.[41]

Upon the satisfactory completion of the public bidding process, contracts for the masonry materials were awarded to Lawrence and Bouker in January 1891. Lt. Col. Gillespie requested that both companies commence delivery of their products on March 26, 1891.[42] The monthly report for April 1891 reported that 4,000 barrels of cement, 1,200 square yards of broken stone, and 300 tons of large stone were delivered and stored at Sandy Hook. Some 1,300 cubic yards of concrete were mixed during the month of May and placed, along with 260 cubic yards of large stone, for a total of 1,560 cubic yards of masonry in place.[43] Thus the masonry portion of Battery Potter was begun.

---

[37] Gillespie to Sinclair & Babson Co., Aug. 4, 1892; Letters Sent; Vol. III, p. 23; Entry 815; RG 77; NARA - Northeast Region (NY).

[38] Gillespie to John Salterlee, March 23, 1891; Letters Sent; Vol. I, p. 130; Entry 815; RG 77; NARA - Northeast Region (NY).

[39] Gillespie to Casey, Dec. 19, 1890, with approval from Casey, Dec. 20, 1890, and the Board of Engineers, Dec. 22, 1890; Letters Sent; Vol. I, pp. 75-77; Entry 815; RG 77; NARA - Northeast Region (NY).

[40] Warren to Gillespie, June 30, 1892, p. 7, Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894*.

[41] Gillespie to Casey, Feb. & March 1891; Letters Sent; Vol. I; Entry 815; RG 77; NARA - Northeast Region (NY).

[42] Gillespie to Lawrence Cement Co. & John A. Bouker, March 26, 1891; Letters Sent; Vol. I; Entry 815; RG 77; NARA - Northeast Region (NY).

[43] Gillespie to Casey, April 1891; Letters Sent; Vol. I; Entry 815; RG 77; NARA - Northeast Region (NY).

By the end of fiscal year 1891, all of the excavation for the north half of Battery Potter had been completed, and approximately 3,055 cubic yards of masonry had been placed. All excavation and masonry work had been done by day labor, as recommended by Lt. Col. Gillespie. The foundation for the accumulator well, which extended 5 feet below the water table, had been excavated and laid.[44] The construction of the south half of the battery had been approved by Chief of Engineers Casey in April 1891, and the excavation for its foundation was nearly complete by the end of the fiscal year.[45]

The plans submitted by Lt. Col. Gillespie in 1890 underwent some modifications based on suggestions from the Board of Engineers and Lt. Col. Gillespie's consideration of the project, as well as from experience during the construction. Comparison of the preliminary plans and the completion drawings illustrate a number of the changes made during the construction of Battery Potter (figs. 26-27).

One change from the proposed design was made when Gillespie noted that he could substitute sand for part of the interior concrete, thus reducing the cost of the north battery to $154,000. By Lt. Col. Gillespie's estimation, the expenditure of that amount would allow for an adequate test of the hydraulic mechanism.[46]

Lt. Col. Gillespie wrote to Lt. Col. Peter Harris in Washington, D.C., on March 4, 1891, that specifications had been prepared only for the gun-lift mechanism, and that the masonry portion of the battery had been adapted to the gun-lift. He also noted that "almost every day suggests changes." Among the changes communicated in that letter were that the walls had been increased for more stability under shock, and on the second story the loading floor would be extended and the steps to that area replaced by a vertical ladder.[47] However, Lt. Col. Gillespie was not cavalier about changes to the design of the battery, and was always adamant that the modifications to the plans did not affect the safety, efficiency, or operation of the gun-lift battery. The fact that this was the prototype for all hydraulic gun-lift batteries was not lost on Gillespie, and he strove to make this emplacement a model for other Endicott System gun-lift batteries.

F.Y. 1892 witnessed the continued construction of Battery Potter (see Appendix A). Lt. Col. Gillespie pushed the masonry construction, but severe weather from December 1891 through mid-April 1892 required that concrete production be halted during the winter. Monthly reports from the Engineer Office at Sandy Hook document that the progress on the north half of the battery was ahead of the south half. During the fiscal year, the labor force had been able to complete 29,875.5 cubic yards of concrete masonry, and by June 30, 1892, the battery had been constructed up to the 39-foot reference point, and was 76 percent complete. The completion of the masonry to that point allowed for the final installation of the gun-lift

[44] Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.
[45] Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.
[46] Gillespie to Casey, Sept. 8, 1890; Letters Sent; Vol. I, pp. 9-10; Entry 815; RG 77; NARA - Northeast Region (NY).
[47] Gillespie to Lt. Col. Peter C. Harris, March 4, 1891; Letters Sent; Vol. I, pp. 121-122; Entry 815; RG 77; NARA - Northeast Region (NY).

mechanism for the north emplacement in June.[48] By the end of the fiscal year, Battery Potter was prepared to receive its first gun emplacement.

Masonry construction during the year also included a significant amount of granite. The walls and the arch of the loading gallery for the north gun-lift were constructed with granite block, as was the coping above the arch, and the coping at the terreplein level around the gun pit. Granite block was substituted for concrete "in the piers at the level of the shelf plates for the locking bolts" of the gun-lift cage.[49] The use of granite in some areas had been suggested by Chief of Engineers Casey during his September 1891 inspection of the site as a means of increasing the strength of the battery in these critical areas. In January 1892, construction was begun on the defensible entrance, which was also constructed using a significant amount of granite block (see the subsequent section "Defenses for Battery Potter"). The granite used in these applications was salvaged from the "Fort at Sandy Hook," and cut on site by a work force of stone cutters that averaged 18 men.[50]

As the construction continued on the exterior 20-foot wall on the east side of the battery and the interior 10-foot wall, the space between them was filled with sand. The construction of the battery with a core of sand between the exterior and interior masonry walls had been suggested by Lt. Col. Gillespie during the planning stages of the battery. After the sand was added to the core it was settled by pumping water into the core. The exterior and interior walls of the battery were brought up to the 30-foot reference point before the core could be completely filled. Again the sand was compacted with water, and further sand was added as necessary to completely fill the core. Once the core was filled and settled, the concrete covering was started from the 30-foot reference point to the top of the battery.[51]

The completion of the north half of Battery Potter led to some changes in the construction of the south half. One change was communicated by Lt. Col. Gillespie to Chief of Engineers Casey on May 28, 1892.[52] The plans and estimates submitted called for the modification of the loading gallery to allow for additional headroom. This was to be accomplished by using a horizontal iron cover of **I**-beams and plates, rather than the full center arch depicted in the original plan and constructed at the north half of the battery. This alteration was depicted in the completion drawings of the north and south gun lifts (Appendix D). The section drawings clearly show the arched section of the north gun-loading gallery, and the **I**-beam construction used for the south loading gallery. The sectional drawing of the south gun in the loading position further illustrates the need for the additional headroom when the loading lift was in the loading position.

---

[48] Warren to Gillespie, June 30, 1892, p. 9; Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894*.

[49] Warren to Gillespie, October 1891; *Lift Gun Battery*.

[50] Warren to Gillespie, June 30, 1892, p. 9; Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894*. Note: The monthly reports document a range from 3.5 to 26 stone cutters employed at the site of Battery Potter. The Annual Report for Fiscal Year 1892 gives the daily average for the year as 9.25.

[51] Warren to Gillespie, January 1892; *Lift Gun Battery*.

[52] Gillespie to Casey, May 28, 1892; Letters Sent; Vol. II, pp. 163-164; Entry 815; RG 77; NARA - Northeast Region (NY).

During fiscal year 1893, Site Engineer Lt. Warren and Lt. Col. Gillespie, operating from the New York Office, continued to push the progress of Battery Potter. By July 1892, the masonry for the north gun emplacement was all but complete, and the gun-lift mechanism was in place. The carriage for the north gun was attached to the gun-lift and assembled with some difficulty during the month of July 1892. The 12-inch breech-loading rifle was delivered by the Ordnance Department on August 23, 1982, and was raised and mounted by the Engineer Department by August 29, 1892 (see the subsequent section "Battery Potter – Armament" and Appendix B).[53]

Though the fiscal year had started out with these significant accomplishments, the Engineers had to overcome some problems later in the fiscal year. Work at Sandy Hook was hampered not only by the usual winter weather, but also by incidents beyond the control of the Engineers.

In early September 1892, a passenger ship was quarantined in Lower New York Harbor because some of its passengers were suspected of being infected with cholera. The ship was subsequently ordered by harbor officials to dock at the Engineer Wharf at Sandy Hook.[54] The arrival of the cholera patients at Sandy Hook and the establishment of a temporary camp, Camp Low, at Horseshoe Cove caused discontent among the labor force at Sandy Hook. On September 9, 1892, Lt. Col. Gillespie directed Lt. Warren to suspend work "while present excitement prevails."[55] The temporary quarantine area at Camp Low operated from September 17 through October 4, 1892, and a guard detail was in place with strict orders to keep separate the occupants of the camp and the laborers at the northern end of Sandy Hook.[56] In his monthly report, Lt. Warren wrote that the labor force had been depleted by this development, many of them choosing to leave Sandy Hook rather than risk infection. Although he was able to hire more laborers, they were not used to the work, and in Warren's estimation made "poor substitutes for those who left."[57]

Nevertheless, the first tests of the north gun-lift and its recently mounted 12-inch gun were not delayed. The north gun was first fired on September 12, 1892; in attendance was a special Board of the Corps of Engineers convened for that purpose (see the subsequent section "Battery Potter – Armament" and Appendix B).[58]

During the initial tests, Lt. Col. Gillespie observed that the interior crest of the battery (i.e., the top of the east wall of the gun parapet) could be raised 18 inches without limiting the guns' ability to fire over the channel. By raising the crest an additional 18 inches, the gun crew and the loading galleries would be better protected. Thus Lt. Col. Gillespie determined

[53] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[54] Gillespie to Casey, Sept. 9, 1892; Letters Sent; Vol. III, pp. 46-45; Entry 815; RG 77; NARA - Northeast Region (NY).

[55] Gillespie to Casey, Sept. 10, 1892; Letters Sent; Vol. III, p. 53; Entry 815; RG 77; NARA - Northeast Region (NY).

[56] Gillespie to Casey, Sept. 20, 1892; Letters Sent; Vol. III, pp. 66 – 67; Entry 815; RG 77; NARA - Northeast Region (NY).

[57] Warren to Gillespie, September 1892; *Lift Gun Battery*.

[58] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

to make this change by the addition of wedge-shaped pieces that measured 18 inches high at the interior and tapered to nothing at the exterior of the superior slope.[59]

Lt. Warren's report for November 1892 included the following description:

> During the month the surface of the superior slope of the parapet in front of and partly enveloping the gun pits, was brought up to its full reference between the interior crest and the chemin de ronde. The masonry was made with American Portland Cement mixed with sand 1 to 3 by volume; for the lower stratum of 12 inches 7 parts of broken stone were added; for the upper stratum of 4 ½ inches thick was laid without stone. A portion of the exterior slope and of the sloping surface joining the terreplein and the vertical walls on the sides and rear of the battery were also completed, the material being the same as for the upper surface of the superior slope.[60]

When the 12-inch gun was tested in September 1892 and again in November 1892, the Engineers noted degradation of the concrete due to the blasts. In particular, the concrete on the superior slope of the battery was badly damaged. It was only four days old; it had not fully set, and it had been applied during cold weather in November. At that point it was decided to make repairs to the superior slope when warmer weather returned to Sandy Hook.[61] Lt. Col. Gillespie continued with tests of the north gun-lift and gun through December 1, 1892, and resumed tests on March 15, 1893 (see the subsequent section "Battery Potter – Armament").

Construction during the latter part of the 1892 included the initial installation of bluestone pavers at the terreplein level, which had been salvaged from the "Fort at Sandy Hook." The paving of the terreplein ceased in December and was not resumed until March 6, 1893.[62] The paving was completed in 1893, and the joints between the flagstones were pointed with concrete made with Portland cement in May 1893.[63]

In light of the severe winter weather, the concrete plant at Battery Potter was closed from December 1, 1892, until April 1893, and no exterior masonry construction took place. However, the delay in masonry construction did not halt all progress on Battery Potter. During the winter months, Lt. Col. Gillespie contracted with the General Electric Company for the electrical plant for the battery, and the system was installed from December through March 1893 (see the subsequent section "Original Appearance, Battery Potter – Utilities").[64] Lt. Col. Gillespie also took advantage of the winter months to finalize the contract for the south gun-lift mechanism and proceed with its construction (see the subsequent section "Battery Potter – Armament").

---

[59] Gillespie to Casey, July 8, 1893.
[60] Warren to Gillespie, November 1892; *Lift Gun Battery*.
[61] Warren to Gillespie, November 1892; *Lift Gun Battery*.
[62] Warren to Gillespie, Sept. 1892 – March 1893; *Lift Gun Battery*.
[63] Warren to Gillespie, May 1893; *Lift Gun Battery*.
[64] Warren to Gillespie, March 1893; *Lift Gun Battery*.

Interior work completed during the winter of 1892-93 included laying the concrete floors in the north half of the battery, and installing the tracks and turntables for the ammunition-delivery service. The boiler and accumulator rooms were paved with flagstones, which were also set between the railroad tracks in the main gallery.

Though the cold weather precluded any exterior masonry work, progress was made on the filling of the sand slope around the battery. From December 1892 through March 1893, a total of 4,638 cubic yards of sand were excavated and placed around the exterior of the battery. By the close of the fiscal year, 5,185 cubic yards of sand were in place.[65]

Masonry work resumed on the exterior of Battery Potter on April 24, 1893. The damage from the gun tests led the Engineers to improve the composition of the concrete construction on the superior slope. The reconstruction of the superior slope involved the removal of damaged material and the addition of the 18-inch wedges of masonry to raise the interior crest as planned by the Engineers after the initial gun tests. The new masonry slope was brought up to the 50 ½ -foot reference point, and the top layer was constructed with concrete made with Alsen's Portland Cement (Appendix C). While the cement was still fresh, a mix of dry cement and sand was floated on the upper surface. The newly constructed masonry apron was 12 inches thick at the interior crest under the gun, and it tapered down to 2 inches thick at the exterior crest.[66]

The plans of the battery completed by Lt. Warren on June 30, 1893, documented the progress of the masonry construction during the year (fig. 28). By the close of the fiscal year on June 30, 1893, the masonry portion of Battery Potter was practically complete (fig. 29).[67] A small labor force was employed during the month of July to finish the upper surface of the parapet wall, and to complete the placement of sand on the exterior slope.[68]

The treatment of the exterior and interior masonry was also an important part of the construction of Battery Potter. Reports during the construction of the battery note that the exterior and interior slopes were paved with concrete made with Portland cement. As early as November 1891, Lt. Warren was making arrangements for waterproofing the interior and exterior of the battery. The primary concern was to keep the magazines and casemates dry and protect them against frost. The Stone and Brick Waterproofing Company of New York was hired for the job. The reports indicate that it had a system that included the application of a hardening process that was followed with a coating of paraffin.[69] The F.Y. 1893 Annual Report notes that a total of 2,686 square yards of masonry were treated with waterproofing.[70]

---

[65] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[66] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[67] Warren to Gillespie, June 1893; *Lift Gun Battery*.

[68] Warren to Gillespie, July 1893; *Lift Gun Battery*.

[69] Warren to Gillespie, Nov. 1891; *Lift Gun Battery*.

[70] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

The F.Y. 1893 Annual Report documented that a crew of plasterers was employed to finish the interior walls and arches, and that "whitewash" was applied to those same surfaces.[71] Lt. Warren's report from June 1893 also notes the application of "whitewash" to the walls and arches of the accumulator room.[72]

The masonry construction at Battery Potter was completed by 1894. On January 3, 1895, Lt. McGregor forwarded descriptions of the battery and 10 drawings to Lt. Col. Gillespie (Appendix D). However, due to the delay in mounting the south carriage and gun, Battery Potter was not reported as ready for service until June 7, 1895.[73]

Defenses for Battery Potter

Natural Cover

Typical of Endicott System batteries, Battery Potter was designed to blend into the surrounding landscape. Although the upper concrete slopes of the battery were not concealed, as previously mentioned, the plans for the battery did include constructing a sloped embankment from grade to 20 feet up the exterior concrete walls. The construction of the exterior slopes was an important part of the battery's defense, allowing it to blend in better with the surrounding dunes and scrub landscape.

Review of the monthly progress reports shows that the filling of the sand slopes was performed when concrete production was at its lowest. The sand was hauled from nearby "borrow pits" and placed against the exterior concrete walls. The process began in December 1892, when Lt. Warren reported that 1,076 cubic yards of sand had been placed in the rear (west elevation) of the battery. The construction of the sand slopes continued in both January and February 1893, when the monthly reports noted that it was too cold to produce any concrete. The total sand placed during those two months was 2,791.5 cubic yards. In that time, the slope was carried from the rear of the battery, along the south and east elevations, and stopped at the curve of the north side of the battery. The deposit of sand was interrupted in mid-February to allow the Ordnance Department to replace the 12-inch gun on the north emplacement (see the subsequent section "Battery Potter – Armament"). The work of filling the slope on the north side of the battery recommenced in March 1893, and by the end of April, Lt. Warren reported that the placement of sand in the rear of the battery had been completed.[74] An additional 100 cubic yards of sand were deposited in June, at which point the sand slopes were "completed as far as practicable."[75] The F.Y. 1893 Annual Report stated that the embankment of sand surrounding the battery, except for the defensible entrance, had been constructed during the previous year, and that a total of 5,185 cubic yards of sand had been excavated, hauled, and deposited at the battery. The cost of

71 Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

72 Warren to Gillespie, June 1893; *Lift Gun Battery*.

73 Gillespie to Brig. Gen. Wm. Craighill, Chief of Engineers, June 7, 1895; File 9716; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

74 Warren to Gillespie, Dec. 1892 – April 1893; *Lift Gun Battery*.

75 Warren to Gillespie, June 1893; *Lift Gun Battery*.

constructing the sand embankment was determined to be $0.22235 per cubic yard, for a total of $1,152.93.[76]

The sand embankments around Battery Potter were susceptible to the high winds and severe weather at Sandy Hook. To protect the slopes, the Engineers had sod planted on the slopes to the rear (west elevation) of the battery. The sod was preferred in this location because it would give the "machine guns," or Gatling guns, in the flanks of the defensible entrance a clear line of fire along the embankments. A labor force began the placement of sod in October 1893 and completed the task the next month. Planting vegetation on the front (east) east and flanking slopes of the battery was also necessary to protect against erosion. Lt. Warren reported that cedar trees and small shrubs were planted on these slopes during the months of November and December 1893.[77] Though Lt. Warren's reports did not detail the type of sod or small shrubs used at Battery Potter, the slopes of the Mortar Battery were treated in a similar manner, and the journals for that work do document the use of sod from nearby marshes at Sandy Hook and native heath (or heather), which is a small shrub. The vegetation planted on the sand slopes of Battery Potter served to hold the sand in place and further camouflage the battery.

Defensible Entrance

Battery Potter thus blended well with the landscape when approached from the east, but there was still a concern about defending this massive structure from an invading force. In compliance with Lt. Col. Gillespie's instructions, Lt. Warren submitted plans for a "Defensible Entrance to Lift Gun Battery No. 1" on the west elevation on January 16, 1892. Lt. Warren wrote:

> The proposed entrance is in the nature of a caponiere, two stories in height and twelve feet by twenty feet interior dimensions; the walls of the first story are three (3) feet in thickness, those of the second story are two feet in thickness, and the material cut stone (granite) and concrete.
>
> The caponiere is arranged to sweep the slopes in rear of the battery, and the adjacent ground by the fire of machine guns supplemented by musketry fire, and is designed to prevent a small boat party approaching the work from the rear, from reaching the terreplein by a rush, surprising that portion of the gun detachments there posted and disabling the guns and carriages by the use of high explosives, or from gaining the interior of the work where a few determined men could in a few moments render the battery useless.
>
> The wall in rear of the battery as originally planned was covered with sand to the level of the terreplein and would be easily assailable.

[76] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.
[77] Warren to Gillespie, Oct. 1893 – Dec. 1893; *Lift Gun Battery*.

> It is proposed to make this wall an obstacle to assault by removing a portion of the sand cover (this can be done without material danger, as the work will hardly be exposed to the fire of heavy guns from that direction) and to sweep the uncovered part of the wall and the slope by the fire of machine guns from the second floor of the caponiere.
>
> The ground in front of the entrance is also swept by the fire of machine guns supplemented by musketry fire.
>
> It is proposed to provide two sets of double doors, constructed of wood thickly studded with iron, the outer ones loop-holed for musketry, and the inner ones on the inner face of the twenty-foot wall thirty-five feet in rear of the outer set, for a machine gun; all of these loop holes are to be furnished with bullet proof shutters.
>
> The face of the caponiere as proposed is of cut stone masonry the material for which can be obtained from old fort.
>
> The use of cut stone will not unduly increase the cost and will give a dignified and substantial appearance to the entrance which will properly accord with the importance of the work itself. Access to the second floor of the caponiere will be had from the interior of the work by a four-foot gallery communicating with the ten-foot gallery of the second tier of casemates and directly over the main entrance.[78]

Lt. Col. Gillespie accepted Lt. Warren's design and forwarded the plans to Chief of Engineers General Casey for approval (figs. 30-31). The Chief of Engineers approved the defensible entrance in February 1892, but requested that Lt. Col. Gillespie and his staff further review the flanking defense of the battery.

Construction of the defensible entrance began in April 1892 with the employment of a small force of stone cutters preparing granite salvaged from the "Fort at Sandy Hook," and a day-labor force laying the courses of masonry. Work on the caponiere continued in May with a larger force of stone cutters (approximately 15 men) able to provide enough stone to complete the lower 10 courses. Progress on the entrance was periodically delayed while the stone cutters were engaged in cutting stone for portions of the south gun-lift. In November, Lt. Warren reported that the stone cutting for the defensible entrance and its wing walls was completed, and that the masonry of the front and wing walls had been carried to reference (22.0). By the end of December 1892, the granite masonry had been completed, and "the forms for the side walls and arch of the second story were set up and the concrete masonry carried from ref. (25.0) to ref. (36.0) or two feet over the crown of the arch."[79] The F.Y. 1893 Annual Report included photographic documentation of this phase of the entrance construction. The exterior bullet-proof doors of the defensible entrance were hung in September 1893, which essentially completed the construction of the battery.[80]

[78] Warren to Gillespie, Jan. 16, 1892; *Miscellaneous Reports, 1892 - 1894*.
[79] Warren to Gillespie, Dec. 1892; *Lift Gun Battery*.
[80] Warren to Gillespie, Sept. 1893; *Lift Gun Battery*.

The defenses of Battery Potter were an integral part of the success of the hydraulic gun-lift battery. The defensible entrance of the battery in particular continues to define the structure as a formidable defense.

Flanking Defense

Upon the request of Chief of Engineers Casey, Lt. Col. Gillespie and Lt. Warren further explored ways to provide a better flanking defense for Battery Potter. Lt. Col. Gillespie's 1892 Annual Report included thoughts on defending the other sides of the battery:

> The trace of the battery does not lend itself to a flank defense of a simple character but it would seem that all conditions requisite to the defense of the work by its garrison will be sufficiently fulfilled by placing a chemin de ronde at the foot of the superior slope on the curved face of the battery, supplemented by wire entanglements surrounding the work and placed at the foot of the sand slope.[81]

A *chemin de ronde* is a sentry path around the outer retaining wall of a rampart or emplacement that is protected by a parapet. In the case of Battery Potter, the *chemin de ronde* extended along the eastern curved face of the battery, and provided a protected area from which the garrison could direct rifle fire on forces approaching from the east. To further improve the flanking defense of the battery, the parapet extended from the front/east side of the battery around the sides and terminated at the rear of the structure. This provided cover for the garrison at the terreplein level of the battery. This solution appears to have satisfied the Chief of Engineers' concern for providing flank defense for the entire battery.

Construction of the *chemin de ronde* and parapet wall kept apace with other masonry work, and by August 1892 the parapet wall had been completed to the 45.6-foot reference point, with a gap left in front of the north gun-lift for mounting the 12-inch breech-loading rifle. By the end of September 1892, the parapet had been completed except for the Portland cement pavement. As previously cited, concrete made with Portland cement was applied to the masonry surfaces, including the parapet walls, in November 1892. Lt. Warren reported in the 1893 Annual Report that the parapet wall had been weakened and partially destroyed by the blasts from the north gun (Appendix B). Repairs to the structure in the spring of 1893 included reconstruction of portions of the parapet to the same specifications as the superior slope previously discussed.

Though not part of the original plan for Battery Potter, the addition of the *chemin de ronde* and parapet wall became important parts of the battery, and they remain character-defining features of the structure.

[81] Gillespie to Casey, Annual Report and Summary 1892; Letters Sent; Vol. II, p. 219; Entry 815; RG 77; NARA - Northeast Region (NY).

Battery Potter – Armament

North Gun-Lift Mechanism

Lt. Col. Gillespie's planning for Battery Potter included an inquiry to Warren E. Hill of Continental Iron Works, Brooklyn, NY, in May 1890 about the cost of a gun-lift mechanism.[82] Lt. Col. Gillespie submitted plans and estimates for the gun-lift battery to the Chief of Engineers on May 27, 1890. The letter discussed the design of the battery and included details of the estimated cost, including the estimates for the gun-lifts furnished by Continental Iron Works. Lt. Col. Gillespie cited Continental's participation in the construction of the ironclad "Monitor" as foremost among the reasons for using that company:[83]

> The Department will remember that this company was the builder of the original "Monitor" and I believe that its terms will be reasonable and the work will be executed in the very best manner.[84]

Preliminary plans for the battery were focused on the gun-lift aspect of the emplacement. Since it was the first of its type, Lt. Col. Gillespie's plan was really a work in progress, and – as previously discussed – several changes were made to the original plan in the course of construction. Once the plans for the battery had been reviewed, revised, and ultimately approved by the Board of Engineers and Chief of Engineers General Casey, a public advertisement for sealed bids for the manufacture of the gun-lift mechanism was submitted to the newspapers on December 5, 1890:

> U.S. ENGINEER OFFICE. Army Building, New York, December 5, 1890. – Sealed proposals, in triplicate, will be received at this office until 12 o'clock noon, Tuesday, January 20, 1891, at which place and time they will be publicly opened in the presence of bidders, for the manufacture of the mechanism of a gun lift for a twelve-inch high-power gun, and for its satisfactory erection at Sandy Hook, N. J., in accordance with specifications and drawings which may be seen on application at this office. The attention of bidders is invited to Acts of Congress approved February 26, 1885, and February 23, 1887, vol. 23, page 332 and vol. 24 page 414, Statues at Large. For full information apply to G. L. GILLESPIE, Lt. Col. of Engineers.[85]

---

[82] Gillespie to Warren E. Hill, Continental Iron Works, May 8, 1890; Letters Sent; Volume I, 5/8/1890 – 9/30/1891 (Vol. I), p. 1; Entry 815; Office of the Chief of Engineers; RG 77; NARA - Northeast Region (NY).

[83] Gillespie to Casey, May 27, 1890; Letters Sent; Vol. I, pp. 2-4; Entry 815; RG 77; NARA - Northeast Region (NY). Note: The *USS Monitor* was constructed by eight iron foundries, including Continental Iron Works, and final assembly was completed at Continental's Greenpoint foundry in Brooklyn, NY.

[84] Gillespie to Casey, May 27, 1890, p. 4.

[85] *New York Tribune*, December 12, 1890, p. 8, col. 2; Boston Public Library, Microtext AN2 – N7N525, Reel 162, November – December 1890.

Apparently Lt. Col. Gillespie already had a high opinion of Continental Iron Works, and he had perhaps given them an edge in estimating the cost of the gun-lift mechanism. Be that as it may, when the bids were opened on January 20, 1891, Continental was the low bidder at $93,750. The proposal was approved by the Chief of Engineers and accepted by Lt. Col. Gillespie on January 24, 1891.[86]

As Continental Iron Works moved forward with the manufacture of the gun-lifts, they found it was necessary to make some modifications to the design. A supplementary contract was thus signed on August 19, 1891, for a total of $9,350, bringing the price of the north gun-lift mechanism to $103,100, which was still under the allotted $112,500.[87] Later in fiscal year 1892, Continental was also contracted to manufacture tanks for the accumulator pit, to provide a water supply for the hydraulic system, and to supply parts for the south gun-lift that were to be built into the masonry.[88]

Manufacture of the gun-lift cage, boilers, accumulator, and associated parts continued at Continental's Greenpoint foundry throughout 1891 and into the first half of 1892 (figs. 32-33). In November 1891, the components that were to be built into the masonry were installed at the battery by employees of the iron works.[89] These included the locking bolt plates, guide rails, and their attachments. During the winter of 1891-92, the gun-lift cage and platform were assembled at the foundry, and were successfully tested in the presence of the U.S. Army Engineers on March 10, 1892.[90] The inspection of the mechanism and approval by the Engineers made for a busy April at Battery Potter, as reported by Lt. Warren:

> Gun Lift Mechanism: During the month the Continental Iron Works had employed at Sandy Hook an average daily force of 26 men.
>
> The ram and cylinder of the main lift were set up in place, the lower half of the cage was assembled, riveted up, the locking bolts and their mechanism attached and on April 27th was lowered to the firing position and the locking bolts shot home in their seats.
>
> The accumulators were completely set up and the pressure pipes connecting them with the pumps were fitted.
>
> The boilers and pumps were delivered at the work and set in place.
>
> The ammunition lift and hydraulic rammer are in process of construction at the Continental Iron Works.[91]

---

[86] Gillespie to Casey, Jan. 24, 1891, with approval from Casey and the Board of Engineers; Letters Sent; Vol. I, pp. 91-95; Entry 815; RG 77; NARA - Northeast Region (NY).

[87] Warren to Gillespie, June 30, 1892; Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894*.

[88] Warren to Gillespie, June 30, 1892.

[89] Warren to Gillespie, Nov. 1892; *Lift Gun Battery*.

[90] Warren to Gillespie, June 30, 1892, Fiscal Year 1892 Annual Report; *Miscellaneous Reports, 1892 - 1894*.

[91] Warren to Gillespie, April 1892; *Lift Gun Battery*.

Over the next two months the gun-lift mechanism was tuned and adjusted, and the gun-lift was ready for trial on July 7. On that day the cage and platform were successfully raised and lowered, and after further adjustments, the gun-lift was ready to receive the gun carriage and 12-inch breech-loading rifle.

North Gun Carriage and Gun

The carriage for the north gun of Battery Potter was manufactured by Henry Schneider & Co., Creusot, France.[92] Schneider & Co. completed the gun carriage in December 1891, and it was at Sandy Hook ready for installation on the gun-lift mechanism by April 2, 1892.[93]

The letters and reports from the Engineer Department document the process and some of the difficulties encountered during the mounting of the gun carriage and the 12-inch breech-loading rifle at Battery Potter. As early as July 1891, Continental Iron Works requested additional drawings of the bed-plate of the carriage in order to better guide their manufacture of the deck of the gun-lift cage.[94] Lt. Col. Gillespie had forwarded this request to the Chief of Engineers, but Gillespie's reply to Mr. Hill of Continental suggested that the contractor should plan for the ultimate fitting on site once the carriage had arrived.[95] As it turned out, Mr. Hill's request for more detailed drawings might have spared some effort in attaching the bed-plate to the lift deck.

Perhaps Lt. Col. Gillespie shared Mr. Hill's apprehension regarding the assembly of the gun carriage, for in a letter to his superior, the colonel suggested that the Ordnance Department should mount the carriage and gun, in part due to their experience in such operations.[96] However, once the gun carriage's components had been moved to the terreplein of the battery, Chief of Engineers Casey decided that the Engineers would mount the 12-inch gun and carriage, with the Ordnance Department superintending the assembly of the carriage and gun and furnishing workmen to assist in the efforts.[97] The Engineers and Ordnance Department had some difficulty connecting the carriage to the gun-lift. According to Lt. Col. Gillespie's Annual Report (Appendix B), it took two weeks of chipping at the upper surface of the platform in order to get the bed-plate properly attached. This process was completed by July 30, and the rest of the carriage could be assembled (figs. 34-35).

[92] Warren to Gillespie, July 1892; *Lift Gun Battery*.

[93] Gillespie to Casey, April 2, 1892; Letters Sent; Vol. II, p. 106; Entry 815; RG 77; NARA - Northeast Region (NY).

[94] Gillespie to Casey, July 2, 1891; Letters Sent; Vol. I, p. 169; Entry 815; RG 77; NARA - Northeast Region (NY).

[95] Gillespie to Hill, July 10, 1891; Letters Sent; Vol. I, p. 189; Entry 815; RG 77; NARA - Northeast Region (NY).

[96] Casey to Gillespie, April 8, 1892; Letters Sent; Vol. II, p. 109; Entry 815; RG 77; NARA - Northeast Region (NY).

[97] Casey to Gillespie, April 30, 1892; Letters Sent; Vol. II, p. 136; Entry 815; RG 77; NARA - Northeast Region (NY).

The Engineers filed a requisition for a 12-inch breech-loading rifle with Ordnance Department on July 11, 1892.[98] Ordnance Department Capt. Frank Heath, Commander of the Proving Ground at Sandy Hook, N. J., delivered a breech-loading rifle to Battery Potter on August 23, 1892. The gun was raised by the Engineer Department on August 25 and 26 via an elaborate system of timber framing, pulleys, block and tackle, and hoisting engines (figs. 36-37). The gun was finally mounted on its carriage on the evening of August 29, 1892 (fig. 38).[99] On that date, Battery Potter became the first and only hydraulic gun-lift to be emplaced under the Endicott System.

The gun that was initially mounted on the north emplacement had not been fully tested by the Ordnance Department, and was apparently put in place only for the purpose of testing the lift mechanism. The Chief of Ordnance notified the Chief of Engineers that this gun would be removed and replaced by a new, fully tested 12-inch gun after completion of the initial gun-lift tests.[100] In January 1893, the "stand-in" gun was removed by the Ordnance Department, which emplaced a fully tested 12-inch gun in February and March 1893. Testing of the mechanism and new gun resumed in March 1893. The Fort Record Book, Fort Hancock, N.J., documents that the north emplacement of Battery Potter (no. 2) was equipped with 12-inch breech-loading rifle, Model 1888, No. 11, manufactured at the Watervliet Arsenal.[101] Apparently this was the second gun emplaced by the Ordnance Department.

Testing the North Gun-Lift

The first test of the north gun was scheduled for September 12, 1892, and despite the establishment of the cholera camp, the tests were executed as planned. Records document that two shoots were fired from the gun on that date. The testing that day was recorded by photographs (fig. 39). The F.Y. 1893 Annual Report documents that the first shoot used 200 pounds of V.P. XIV powder and a 1,000 pound solid shot. [102] The tests were suspended after two shots due to problems with the gun carriage.

After the initial tests, the north gun was not fired again until November 22, 1892. The north gun was fired 12 times over a two-week period with satisfactory results. It was during these trials that the damage to the parapet wall was discovered, and plans to improve the masonry were developed.

Tests at Battery Potter resumed upon the installation of the fully tested 12-inch gun by the Ordnance Department in February and March 1893. As the F.Y. 1893 Annual Report

[98] Gillespie to Capt. Frank Heath, July 11, 1892; Letters Sent; Vol. II, p. 233; Entry 815; RG 77; NARA - Northeast Region (NY).

[99] Warren to Gillespie, August 1892; *Lift Gun Battery*. See F.Y. 1893 Annual Report, Appendix B.

[100] Chief of Ordnance, Brig. Gen. Daniel Flagler, to Casey, Dec. 12, 1892; Letters Sent; Vol. III, p. 143; Entry 815; RG 77; NARA - Northeast Region (NY).

[101] Fort Record Book, Fort Hancock, New Jersey, p. 30, Entry 224; RG 392; NARA – Northeast (NY).

[102] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

indicates, the gun was fired numerous times during the remainder of the fiscal year (Appendix B).
It is of interest to note that the gunpowder used, designated "V.P.", was apparently brown prismatic powder. A publication by the Watervliet Arsenal specified the use of brown prismatic gunpowder for the Model 1888 12-inch breech-loading rifle,[103] and the monthly and annual reports for Battery Potter also mention the use of this type of powder. The "V.P." appears to have been a standard abbreviation for brown prismatic gunpowder, which was followed by a Roman numeral indicating the lot number. The table from the F.Y. 1893 Annual Report demonstrates that the gun was tested with several different lots of gunpowder and with varying weights of charge. At least some of these tests were done for the benefit of the Ordnance Department to prove a sample of powder, as noted in Lt. Warren's monthly report for April 1893. Of further interest is the entry in that table for December 14, 1892, indicating the use of "B.N. Smokeless" powder. During this period, the DuPont Company was developing a smokeless powder,[104] and was no doubt testing it at Sandy Hook. Smokeless powder, noted as "French Smokeless," was used on July 25, 1893, and again on August 8, 1893. After the July 25 test, Lt. Warren noted:

> The last round was most interesting, as showing the really smokeless character of the powder used, when firing over a clean, hard surface. The smoke was almost imperceptible and was instantly dissipated by the light breeze then blowing.[105]

The tests of the north gun-lift allowed the Engineers to make the necessary adjustments to the mechanism, the gun carriage, and the gun. By all accounts the tests went smoothly, with no damage to the lift mechanism. The monthly reports did note that the pressure during a test on April 24 was so great that it damaged the breech block of the gun. The pressure was estimated at between 73,600 and 75,000 per square inch, which was almost double the normal pressure.[106] The rifle was repaired, and subsequent tests under normal conditions were successfully completed.

South Gun-Lift Mechanism

The supplementary contract for the north gun-lift, approved June 29, 1892, also provided some parts for the south gun-lift, which were installed in the masonry in November 1892. However, the proposals for the south lift were not received until January 24, 1893. Continental Iron Works was the only bidder on this project, and their bid for $63,000 was accepted by the Chief of Engineers on January 27, 1893.

As with the north lift, the preliminary assembly and testing of the south lift cage and mechanism was carried out at Continental's Greenpoint site. During the months of June and

---

[103] Documents relating to the Gun Lift Battery, Sandy Hook, N.J.; Entry 224; RG 392; NARA - Northeast Region (NY).
[104] "The History of DuPont" (http://www2.dupont.com/Government/en_US/gsa_contracts/Government_Projects.html).
[105] Warren to Gillespie, July 1893; *Lift Gun Battery*.
[106] Warren to Gillespie, April 1893; *Lift Gun Battery*.

July 1893, Lt. Warren reported that good progress had been made at the iron works, and he expected that work would begin at Sandy Hook in August 1893. On-site work at Sandy Hook did not actually start until late September of that year, when the contractor began the assembly of the ammunition hoist. By the close of November, most of the parts for the mechanism were on site, and the assembly of the south gun-lift progressed at a good pace. By January 1894, the cage was completed and the mechanism was operational. Lt. Warren reported that Continental Iron Works completed connections and "cleaning up" for the south lift mechanism on February 8, 1894, and then left Sandy Hook.

South Gun Carriage and Gun

The Watertown Arsenal in Watertown, Massachusetts, was manufacturing the gun carriage for the south gun-lift. The Ordnance Department first notified the Engineers of delays in the construction of the carriage in August 1893.[107] However the Site Engineers did not let this delay deter construction on the battery. On January 11, 1894, Lt. Col. Gillespie requested that Major Frank Heath of the Ordnance Department transfer the north gun and carriage to the south lift for testing (see the subsequent section "Testing the South Gun-Lift").[108] As it turned out, the south carriage was shipped from Watertown to Sandy Hook more than a year after the initial tests. The gun carriage, Model 1891, was received by the Engineers on May 20, 1895,[109] and was apparently mounted without the difficulties experienced at the north gun-lift.

Battery Potter was designed and constructed to emplace two 12-inch breech-loading rifles. Like the north gun, the gun for the south emplacement (no. 1) was manufactured at the Army Gun Factory, Watervliet Arsenal. The 12-inch gun, Model 1888, No. 2,[110] was delivered to the site by the Ordnance Department and mounted on the gun carriage on June 5. Two days later, Lt. Col. Gillespie wrote Chief of Engineers General Craighill, notifying him that the battery was complete:

> General:
> I have the honor to report that the two 12-inch high-power guns constituting the projected armament of Gun Lift Battery No. 1, Sandy Hook, New Jersey, have been satisfactorily mounted upon their lifts and that that battery is now ready for service.[111]

[107] Acting Chief of Ordnance, Gen. Charles Shuler, to Casey, Aug. 23, 1893; Letters Sent; Vol. IV, p. 23; Entry 815; RG 77; NARA - Northeast Region (NY).
[108] Gillespie to Heath, Jan. 11, 1894; File 1011, inclo. 3; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.
[109] Fort Record Book, p. 31.
[110] Fort Record Book, p. 106.
[111] Gillespie to Craighill, June 7, 1895.

Testing the South Gun-Lift

In the meantime, fulfillment of the contract with Continental Iron Works required the successful test of the south gun. As previously described, delays in the construction of the gun carriage at the Watertown Arsenal prompted Lt. Col. Gillespie to request that the Ordnance Department transfer the north gun and carriage to the south lift for testing. The gun and carriage were transferred by February 23, 1894, and the gun was ready for firing.[112] On March 7, 1894, five rounds were test-fired from the south gun (fig. 40). Once again the guns were tested with a charge of brown prismatic powder, manufactured by DuPont. The report by Lt. Robert McGregor stated that the lift mechanism performed to his satisfaction. The only problem with the operation was the failure of the hydraulic rammer.[113] At that point, it was determined that Continental had fulfilled its contract, and that upon delivery of the gun and carriage for the south lift, Battery Potter would be fully operational.

Rapidity Test

Once the south carriage and gun lift had been mounted and the battery was declared ready for service, the Board of Ordnance and Fortification recommended that the battery to subjected to a rapidity test.[114] Rapidity tests for Battery Potter were conducted on August 7, 1895. Lt. Col. Gillespie's account of the procedure in a report to Chief of Engineers William P. Craighill stated that 10 shots were fired, five from each gun. The test started with one gun up and one gun down, and the shots were fired alternately from each gun. The total time consumed during the test was 33 minutes and 57 seconds, which averaged out to 3 minutes 23.7 seconds per shot.[115] The successful completion of the rapidity tests meant that Battery Potter was finally ready for full service in the defense of New York Harbor.

Ammunition Service

Another component vital to the successful operation of Battery Potter was the ammunition service for the emplacement. The preliminary plans for Battery Potter had not included a system for transporting and storing the gunpowder and shot to be used at the battery. Thus Lt. Warren submitted plans for the ammunition service to Lt. Col. Gillespie on September 27, 1892 (fig. 41). The plans called for a system of railroad tracks and turntables for the delivery of munitions. The plans were slightly modified by the Board of Engineers before being

---

[112] Gillespie to Casey, Feb. 23, 1894; File 1011, inclo. 4; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[113] 2nd Lt. Robert McGregor to Gillespie, March 14, 1894; File 1011, inclo. 8; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[114] Board of Ordnance & Fortification to Chief of Ordnance, June 20, 1895; endorsed by Craighill, June 27, 1895; File 9716; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[115] Gillespie to Craighill, Aug. 23, 1895; File 9716; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

implemented by the Engineers on site. The alterations included the omission of turntables from the main transverse gallery to the north and south magazine galleries (the attached plan was marked up with those two turntable crossed out), and the change of materials for the magazine gallery rails from cast iron to gun metal.

The system as built is fully described in the F.Y. 1893 Annual Report (Appendix B). In brief, the tracks to Battery Potter utilized the existing narrow-gauge standard track that led to the main gallery of the battery and continued into the interior of the battery and the boiler room area, presumably for delivery of coal for the boilers. This track was furnished with a turntable at the transverse gallery, which led to the entrance of the north and south magazine galleries. Each magazine gallery had a set of gun-metal rails on which the ammunition car ran for delivering the munitions to the storage magazines and the ammunition lift (fig. 42). Additional turntables were installed in the magazine galleries at the entrances of the magazine storage rooms. Each gun emplacement had two magazines, one for gunpowder and one for solid-shot projectiles. In both cases, the powder magazines were located on the exterior rooms of the battery, and the shot magazines were located in the interior rooms (see the subsequent section "Original Appearance"). The shot magazines were equipped with an overhead trolley system that enabled the crew to handle loads of up to 2,000 pounds.[116] Thus, the ammunition for the battery could be efficiently delivered from the Engineer Wharf to Battery Potter.

Battery Potter – Personnel

Upon completion of Battery Potter in January 1895, Lt. Col. Gillespie requested that Lt. McGregor submit a report detailing the work force required to operate the battery, as well as procedures for operating the lifts by the crew.

Lt. McGregor's reply estimated that the operation of the machinery would require a force of five men: one engineer in charge of the mechanism, one assistant engineer, and three firemen to tend the furnaces and boilers (one on duty at any given time). For these positions, McGregor noted that the men should be skilled in their trades; competent men might be found among the enlisted force, but "the chief engineer would doubtless be a civilian, as no enlisted man could be found of the requisite skilled capacity." He also noted that it would be important to have alternates for these positions in case of injury.

Lt. McGregor estimated the numbers for the Artillery force as follows:

> For each gun there will be required:
> <u>One sergeant and four privates</u> on the gun platform to serve the gun under the supervision of an officer. This detachment will remain with the gun when it descends, and will operate the loading mechanism in the loading gallery.
> <u>One valve operator</u> at the elevated operating stand to serve the cluster-valves controlling the motions of the gun lift, in obedience to signals

[116] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

> from the gun platform. The operation of the levers controlling the valves is simple, and may safely be intrusted to a private.
> One sergeant in the first-floor magazines, in charge of the ammunition supply for the gun, and to superintend the operation of the ammunition-hoist from below.
> Two privates, to operate the ammunition service car; they are under the personal supervision of the sergeant in charge of the supply.
> One corporal and four privates, in the powder magazine, to prepare the charge.
> One corporal and four privates, I the shot magazine to prepare and handle projectiles.
> There should also be an officer on the first floor, to superintend the ammunition supply for both guns.
> This estimate would therefore require for the entire battery a military force consisting of:
> 4 officers (including the commanding officer).
> 4 sergeants.
> 4 corporals.
> 30 privates.[117]

Lt. McGregor's description provides both the number of personnel required to operate Battery Potter, as well as the general duties of the work force, both civilian and enlisted. As previously discussed, records indicate that a civilian engineer was employed to operate the gun-lift mechanism, but that the other positions were filled by enlisted men, to reduce the expense of operating the battery.

Lt. McGregor felt that the mechanical operation of the gun lift was straightforward. Two hours' advance notice was required to get the boilers going and the steam up to pressure. This would require the battery to be running 24 hours a day during any hostilities to maintain readiness. The chief engineer was in charge of the machinery and the operators, while the commanding officer was in charge of the guns. The valve-operator was responsible for maneuvering the gun platform and lift cage. A series of bell rings was used to signal the operator: one bell sent the cage up, one bell to stop it, and two bells to send the cage down. Lt. McGregor reported that this system had worked well during tests.[118]

[117] McGregor to Gillespie, May 27, 1897; File 9716; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.
[118] McGregor to Gillespie, May 27, 1897.

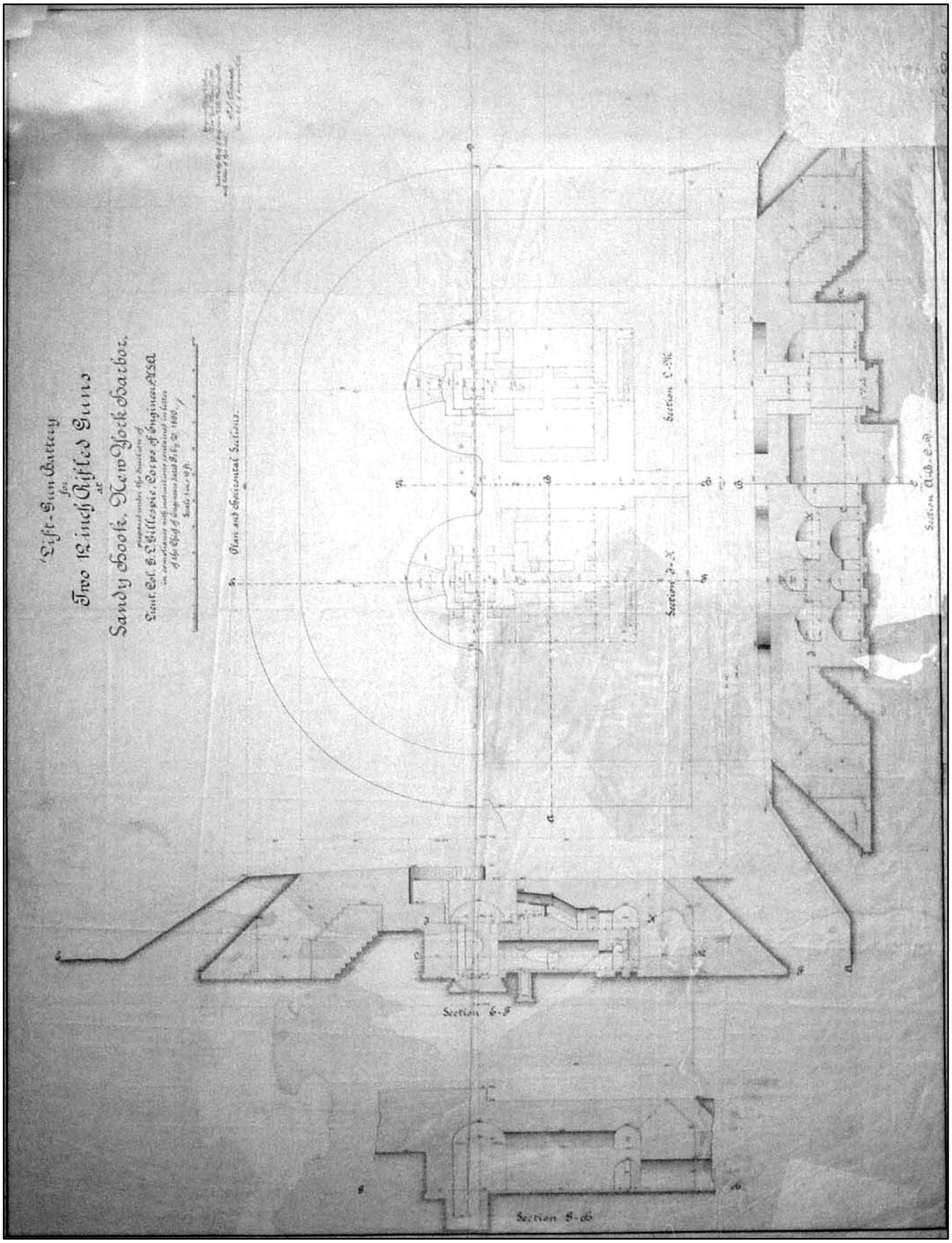


Figure 19. "Lift-Gun Battery for Two 12 inch Rifled Guns, at Sandy Hook, New York Harbor." Original plans for Battery Potter. Prepared under the direction of Lt. Col. G.L. Gillespie, February 20, 1890.

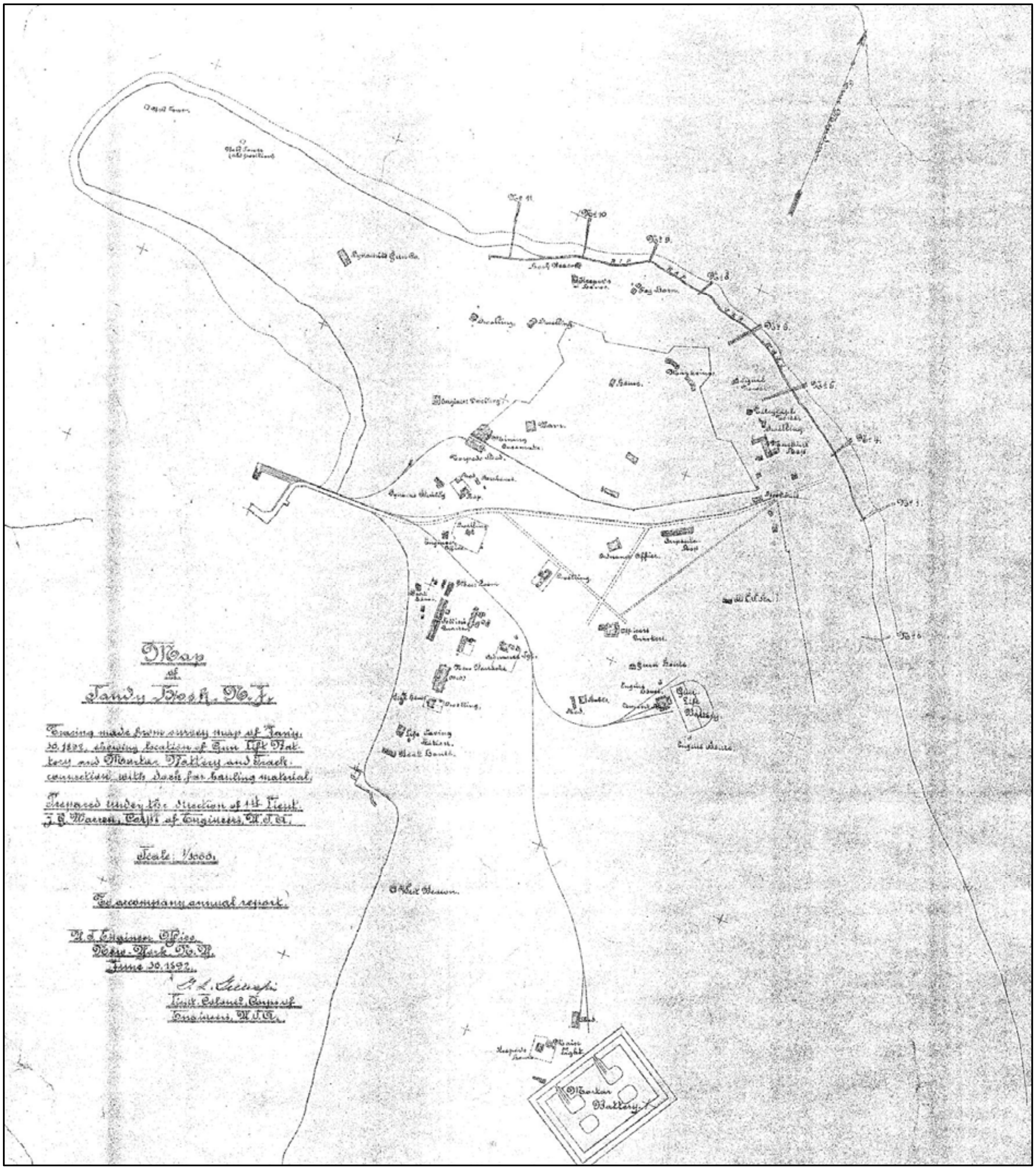


Figure 20. "Map of Sandy Hook, N. J., Tracing made from survey map of Jan. 30, 1892, showing location of Gun Lift Battery and Mortar Battery and Track connection with Dock for hauling material." Prepared under the direction of 1st Lt. J.G. Warren, Corps of Engineers, June 30, 1892.

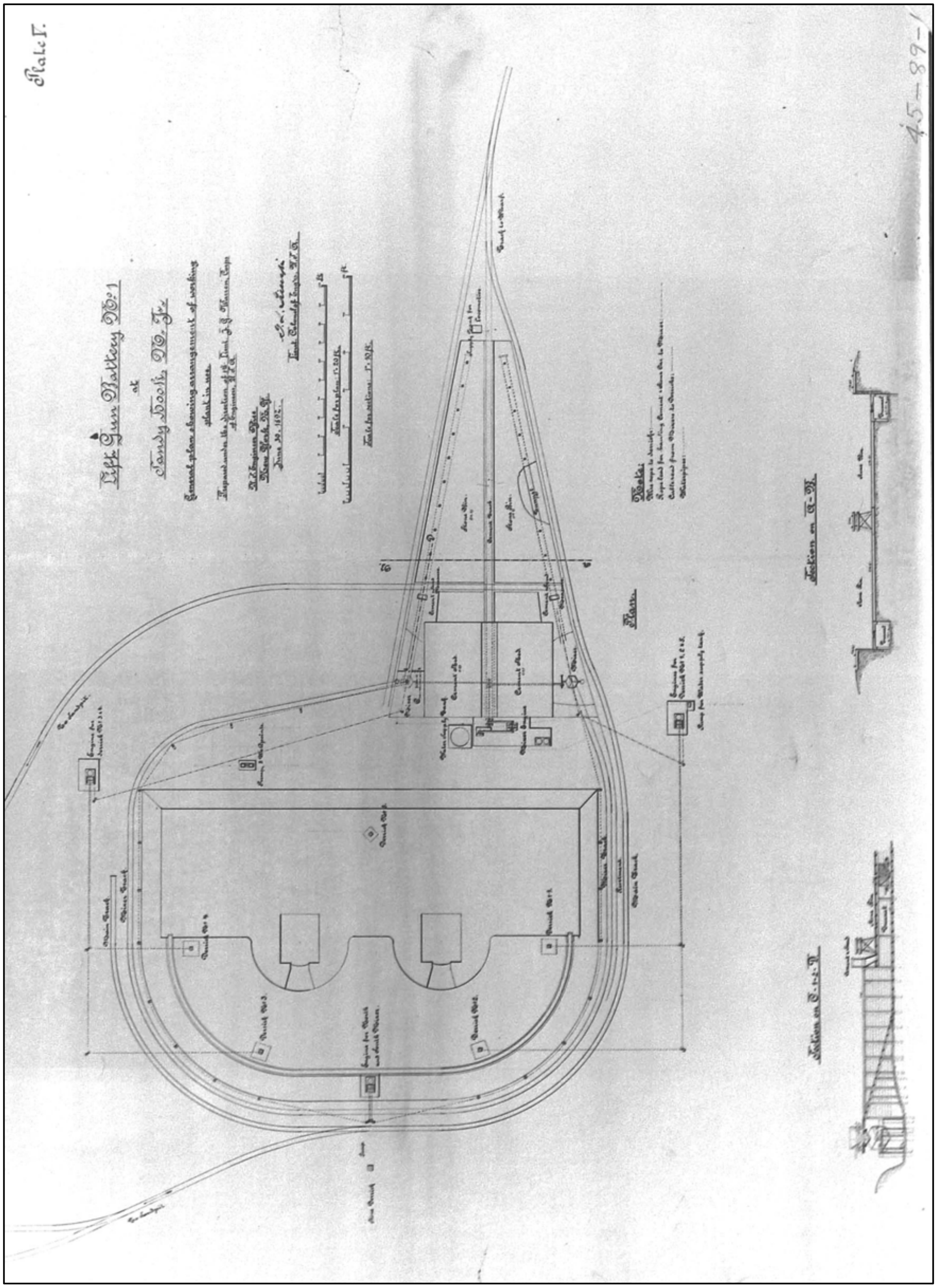


Figure 21. "Gun Lift Battery No. 1, at Sandy Hook, N.J." Plan of Battery Potter showing general layout of battery and concrete plant. Prepared under the direction of 1st Lt. J.G. Warren, June 30, 1892.

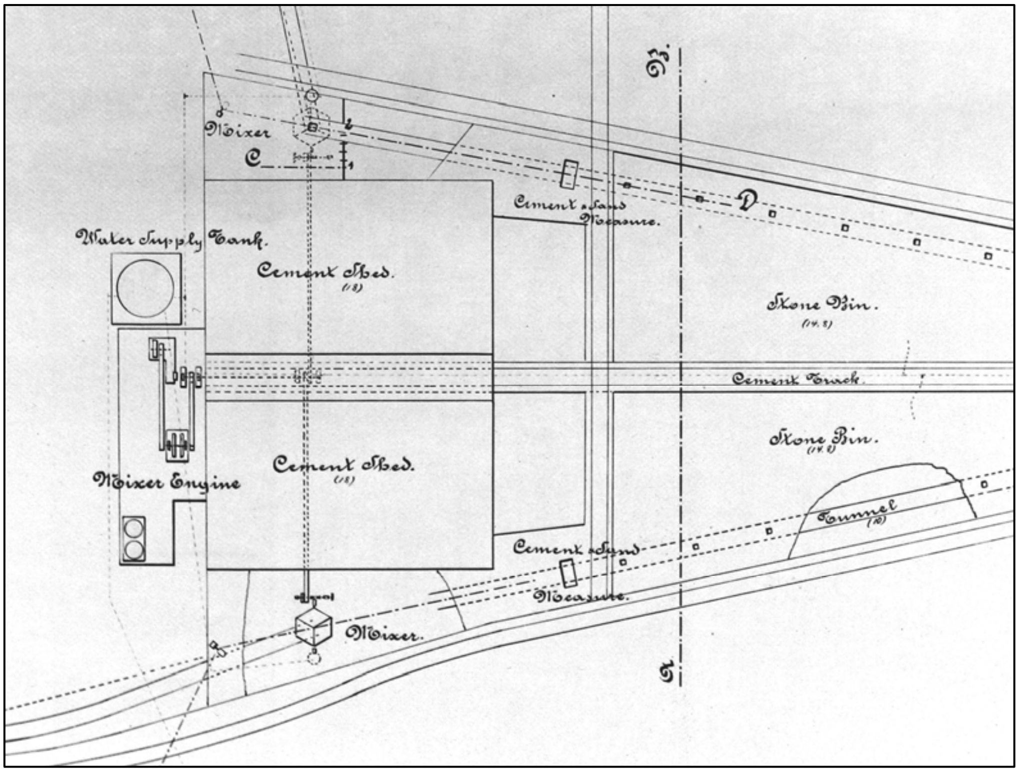


Figure 22. "Gun Lift Battery No. 1, at Sandy Hook, N. J." Detail of concrete plant plan. Prepared under the direction of 1st Lt. J.G. Warren, June 30, 1892.

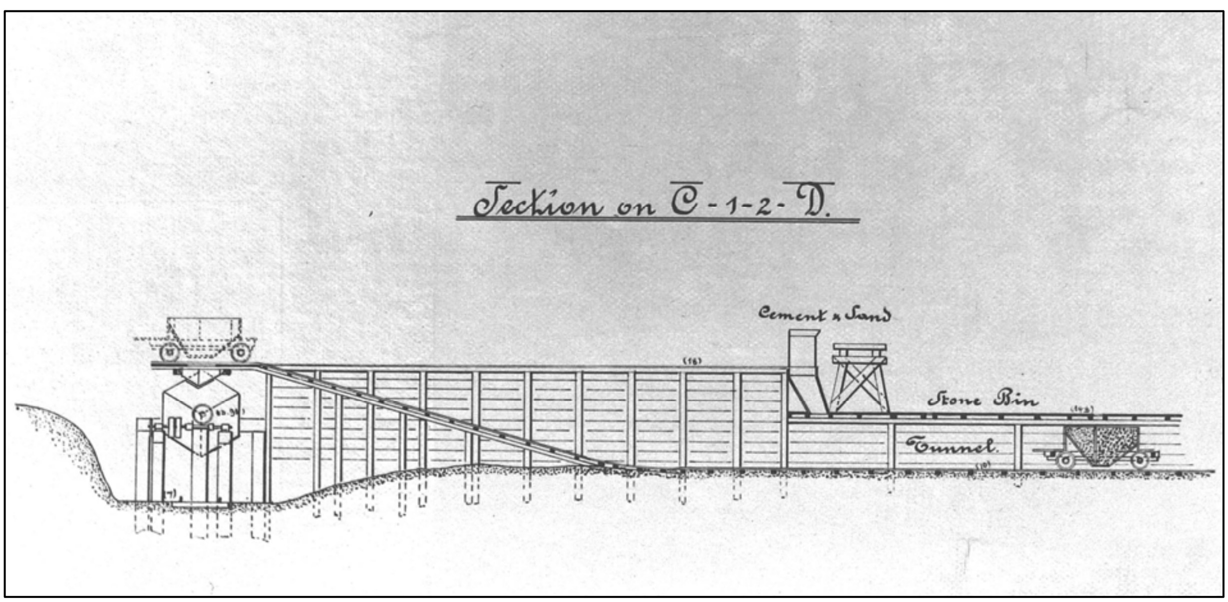


Figure 23. "Gun Lift Battery No. 1, at Sandy Hook, N. J." Detail of concrete plant section. Prepared under the direction of 1st Lt. J.G. Warren, June 30, 1892.

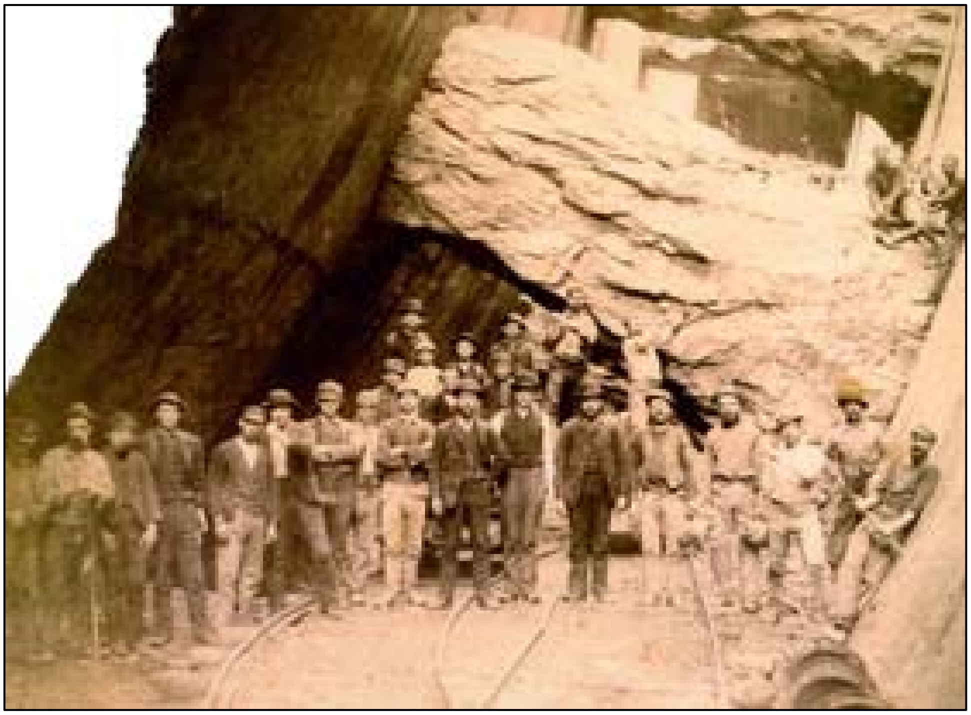


Figure 24. Miners at natural hydraulic cement mine, New York State.

Figure 25. Seal for Rosendale Cement Company with trademarked "Brooklyn Bridge" Brand.

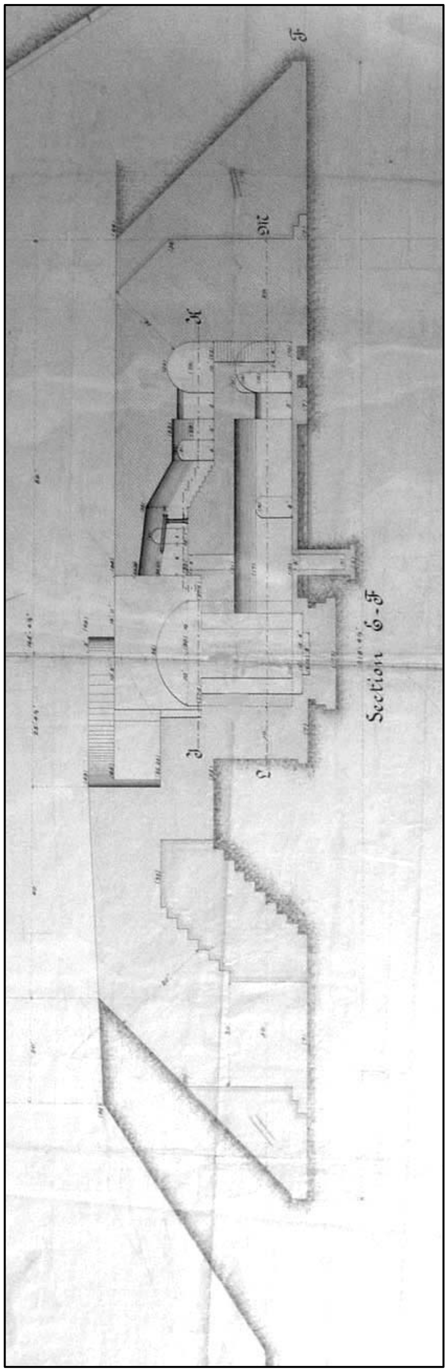


Figure 26. Section E-F through North Gun Lift; detail from "Lift-Gun Battery for Two 12 inch Rifled Guns, at Sandy Hook, New York Harbor." February 20, 1890.

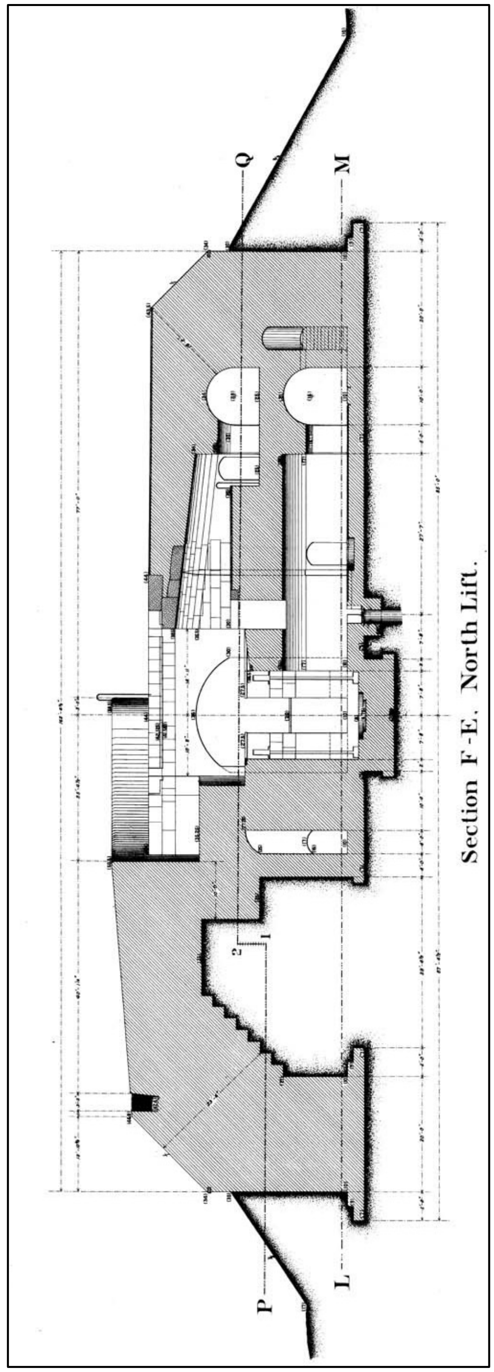


Figure 27. Section F-E through North Gun Lift, from "Gun Lift Battery No. 1, Sandy Hook, N.J." Sheet No. 4, Sections through Lifts and Boiler Room, 1894.

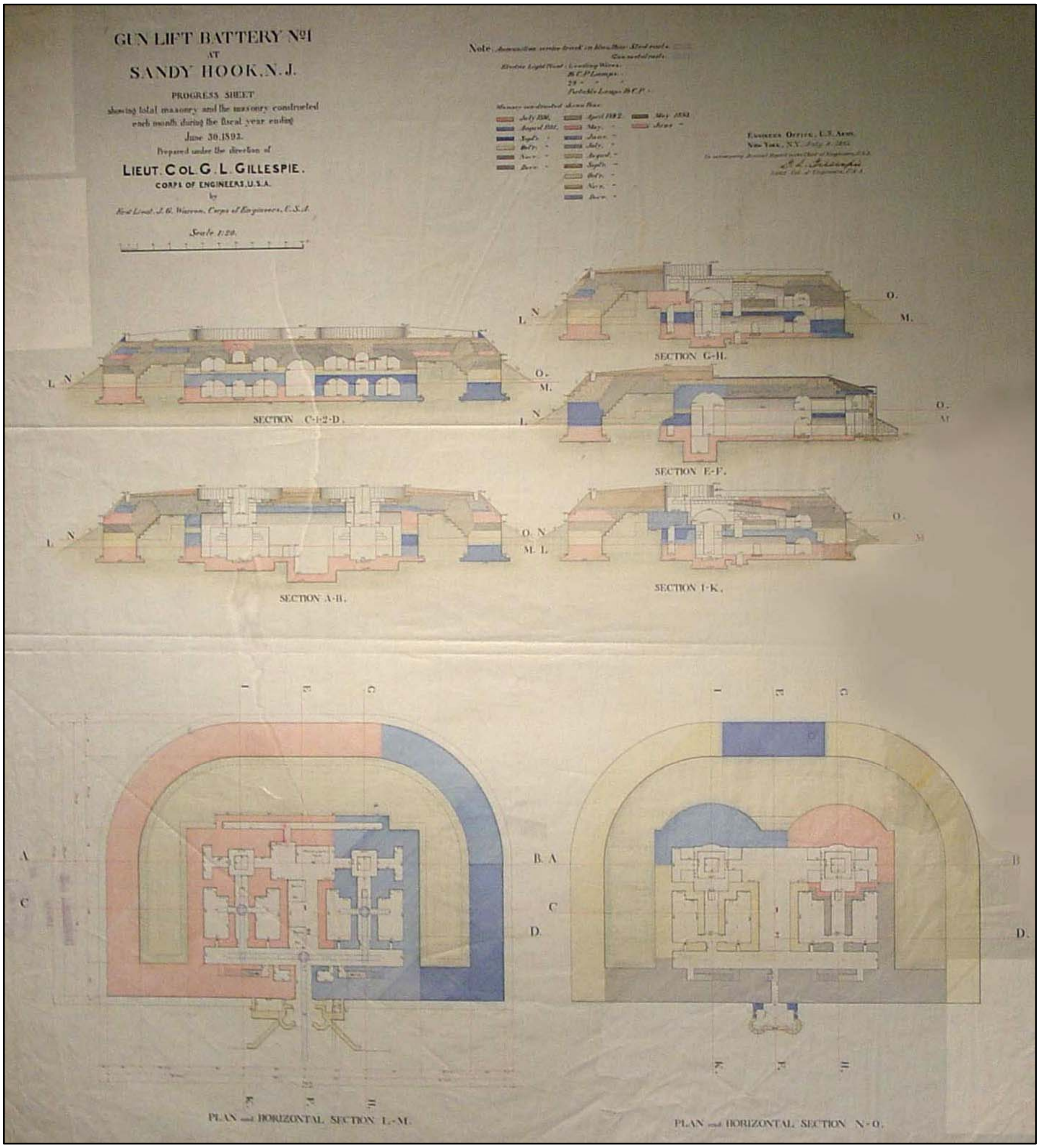


Figure 28. "Gun Lift Battery No. 1, at Sandy Hook, N.J." Color-coded progress sheet, June 30, 1893.

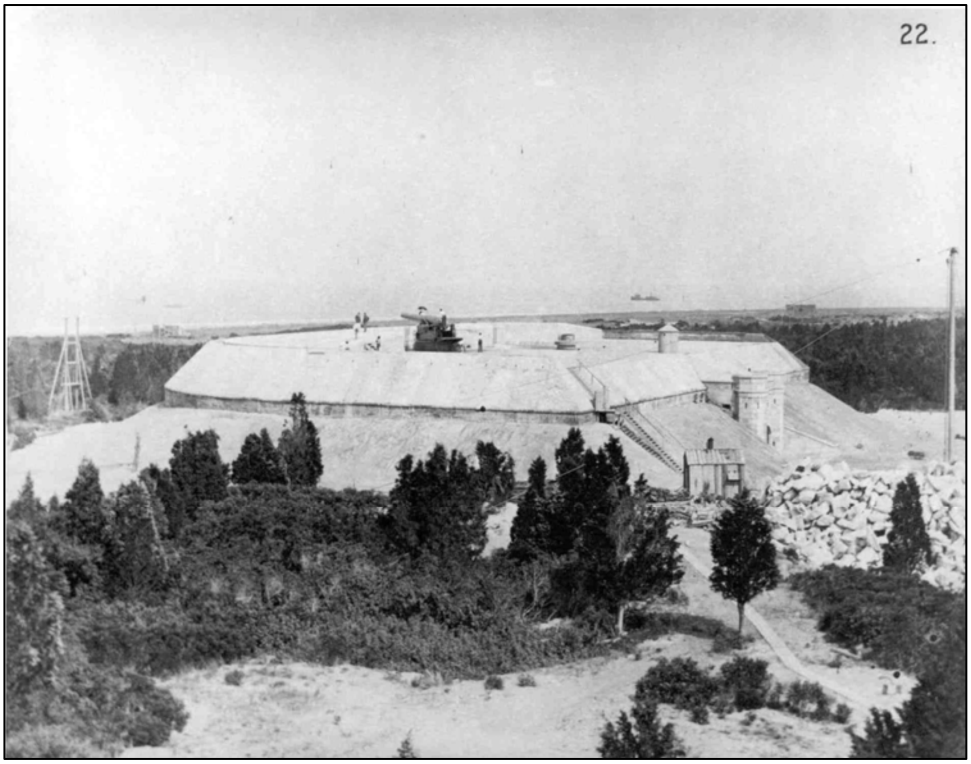


Figure 29. Battery Potter, looking southeast: "View of Gun Lift Battery, July, 1893." Photograph No. 22 of 39 with F.Y. 1893 Annual Report.

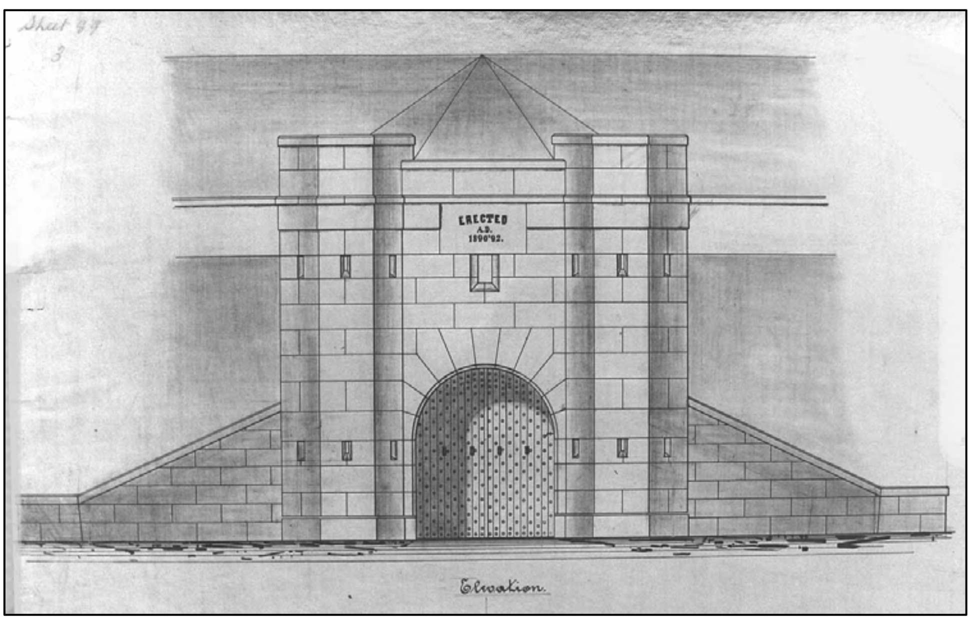


Figure 30. "Proposed Main Entrance to the Lift Gun Battery at Sandy Hook, N.J." Detail from plans of defensible entrance for Battery Potter, prepared by 1st Lt. J.G. Warren, Jan. 14, 1892.

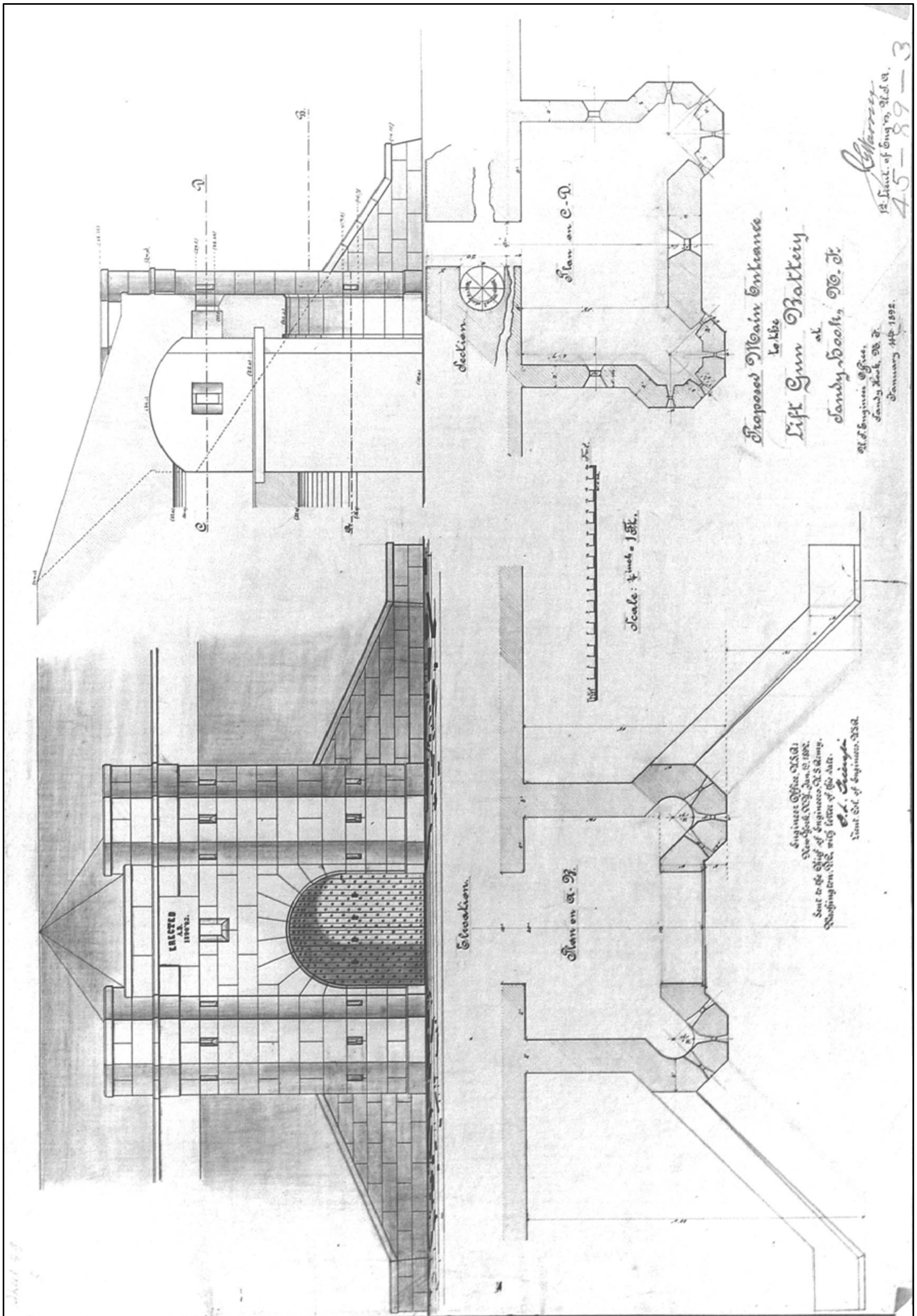


Figure 31. "Proposed Main Entrance to the Lift Gun Battery at Sandy Hook, N.J." Plans, elevation, and section of defensible entrance for Battery Potter, prepared by 1st Lt. J.G. Warren, Jan. 14, 1892.

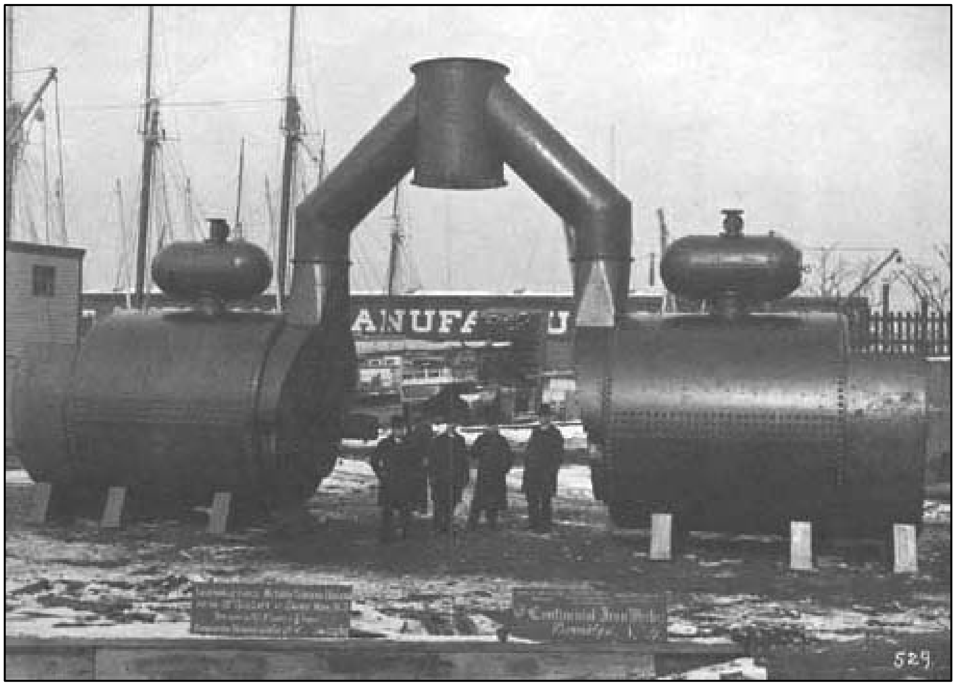


Figure 32. "Internally Fired Return Tubular Boilers for the 12" Gun Lift at Sandy Hook, N.J., 9 ft. diam. x 12'-2" long x $^{5}/_{8}$ thick, Corrugated furnaces, 36" I.D. x 9'-4", Jan. 22, 1982" Boilers at the Continental Iron Works, Brooklyn, N.Y.

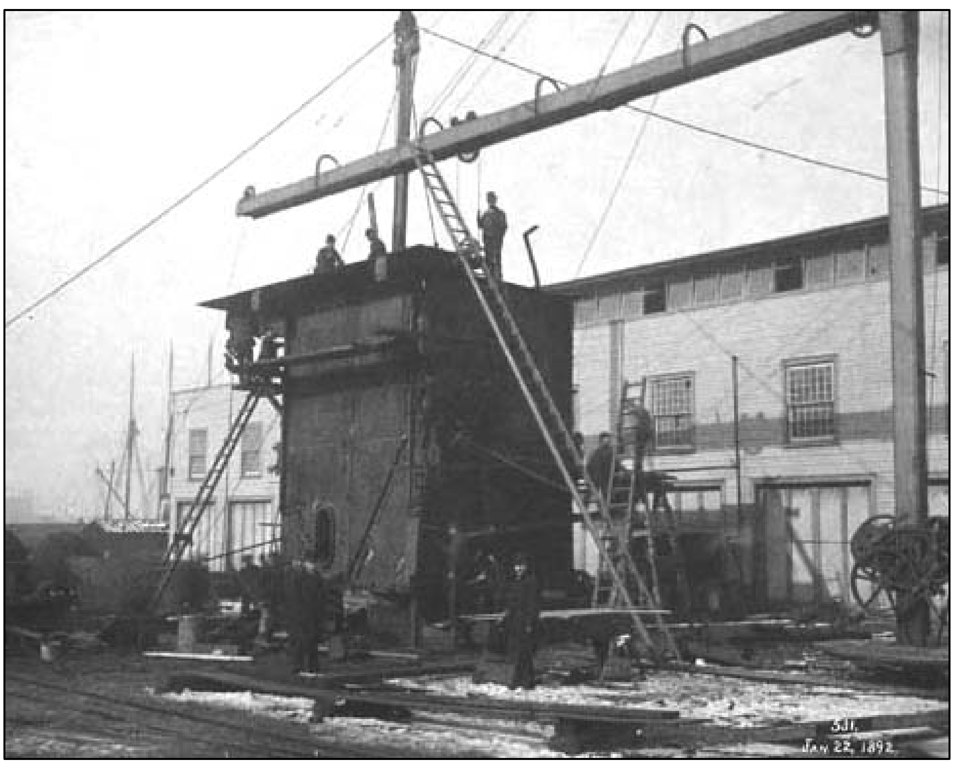


Figure 33. Gun-lift cage for Battery Potter at the Continental Iron Works, Brooklyn, N.Y. Jan. 22, 1892.

Figure 34. Battery Potter, Schneider & Co. gun carriage, pintle plate, and traversing circle. Photograph no. 1 of 39 with F.Y. 1893 Annual Report.

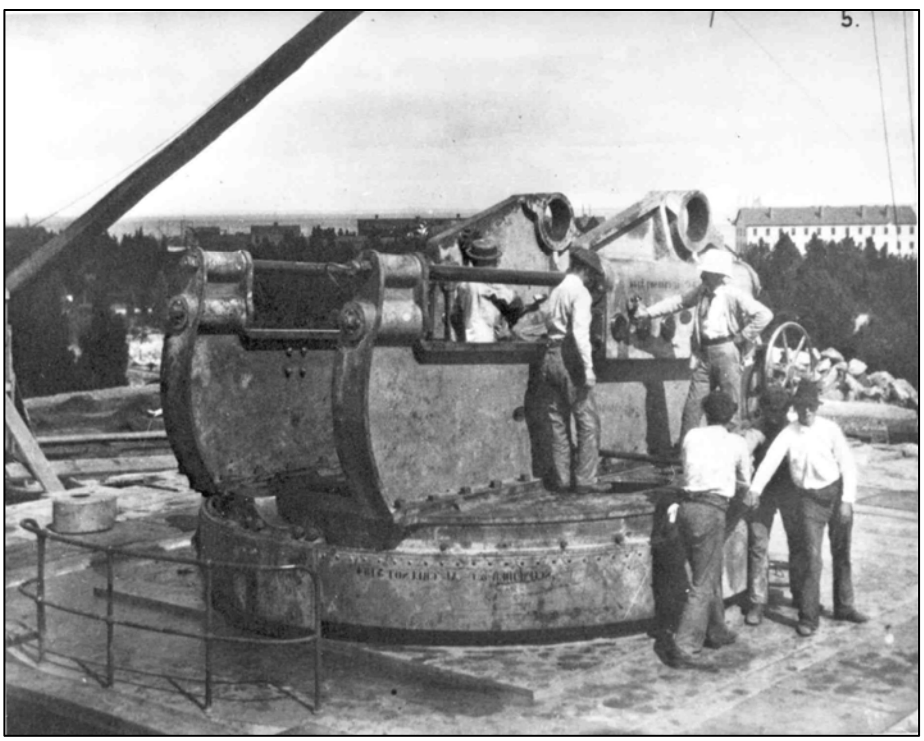


Figure 35. Battery Potter, Schneider & Co. gun carriage complete, rear view. Photograph no. 5 of 39 with F.Y. 1893 Annual Report.

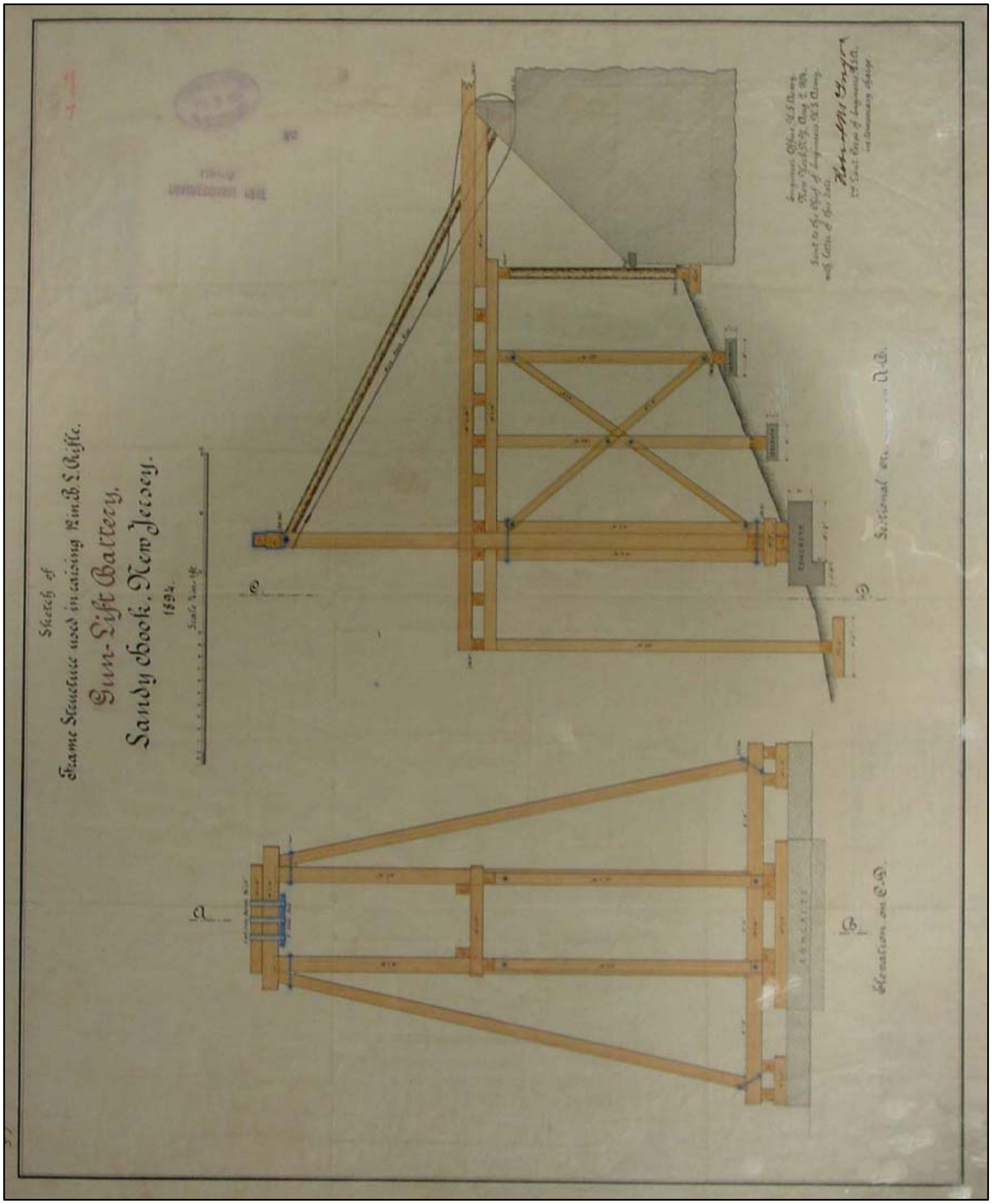


Figure 36. "Frame Structure used in raising 12 in. B.L. Rifle. Gun Lift Battery. Sandy Hook, New Jersey, 1894."

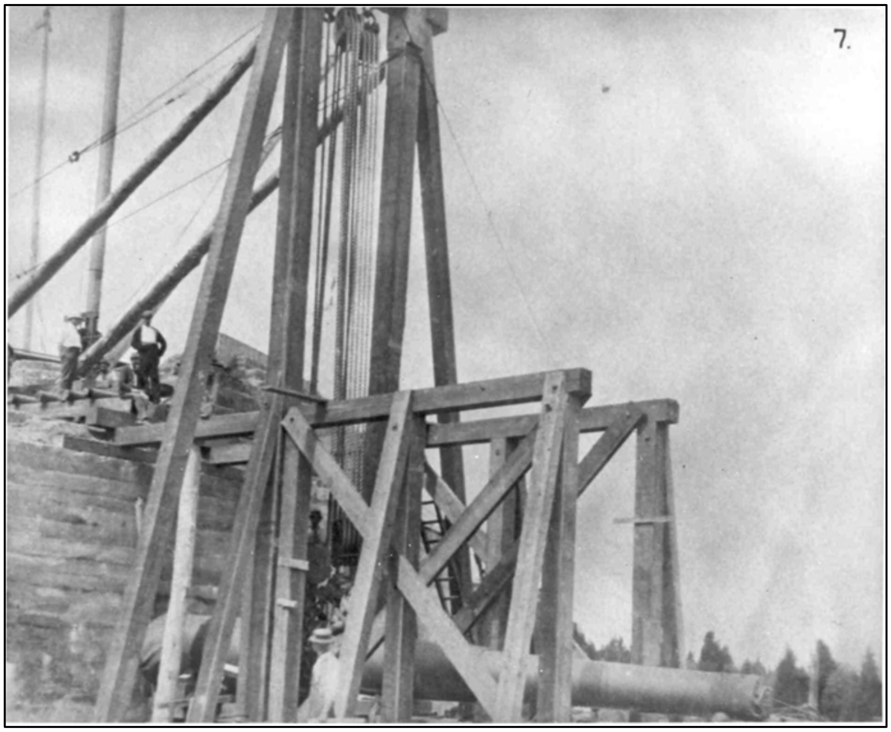


Figure 37. Battery Potter, raising 12-inch B.L. rifle. Photograph no. 7 of 39 with F.Y. 1893 Annual Report.

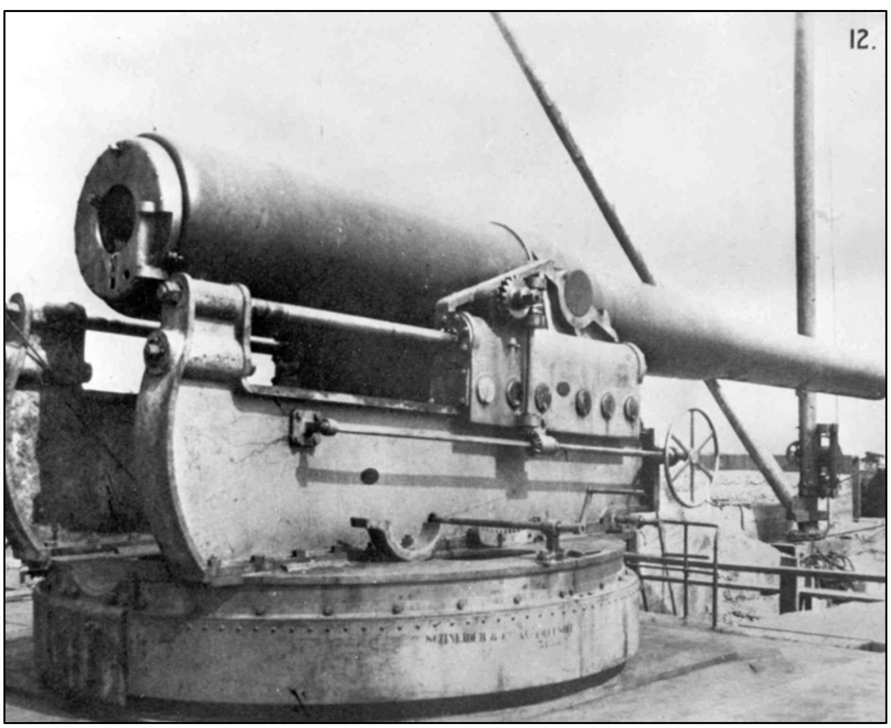


Figure 38. Battery Potter, 12-inch B.L. rifle mounted on carriage, Aug. 27, 1892. Photograph no. 12 of 39 with F.Y. 1893 Annual Report.

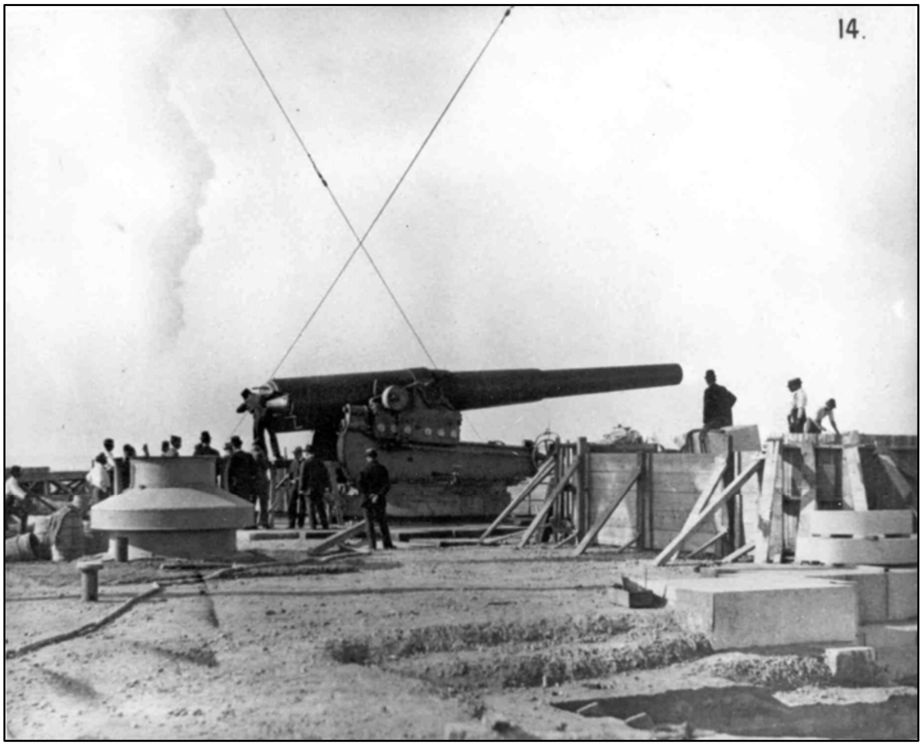


Figure 39. Battery Potter, north emplacement; preparing for second shot, Sept. 12, 1892. Photograph no. 14 of 39 with F.Y. 1893 Annual Report.

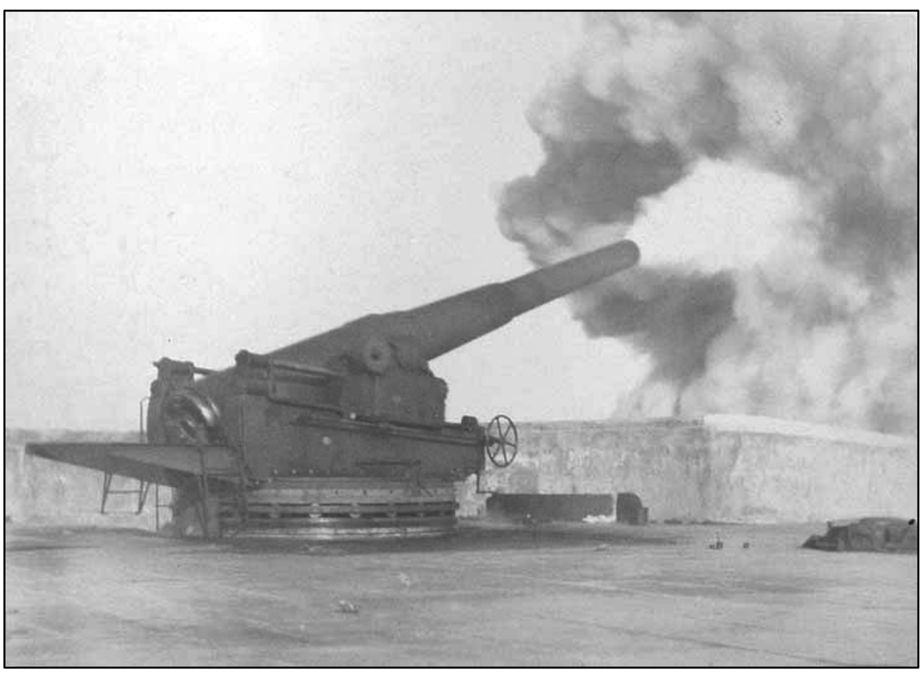


Figure 40. Battery Potter, proof-testing the mechanism at the south emplacement, test number 5, March 7, 1894.

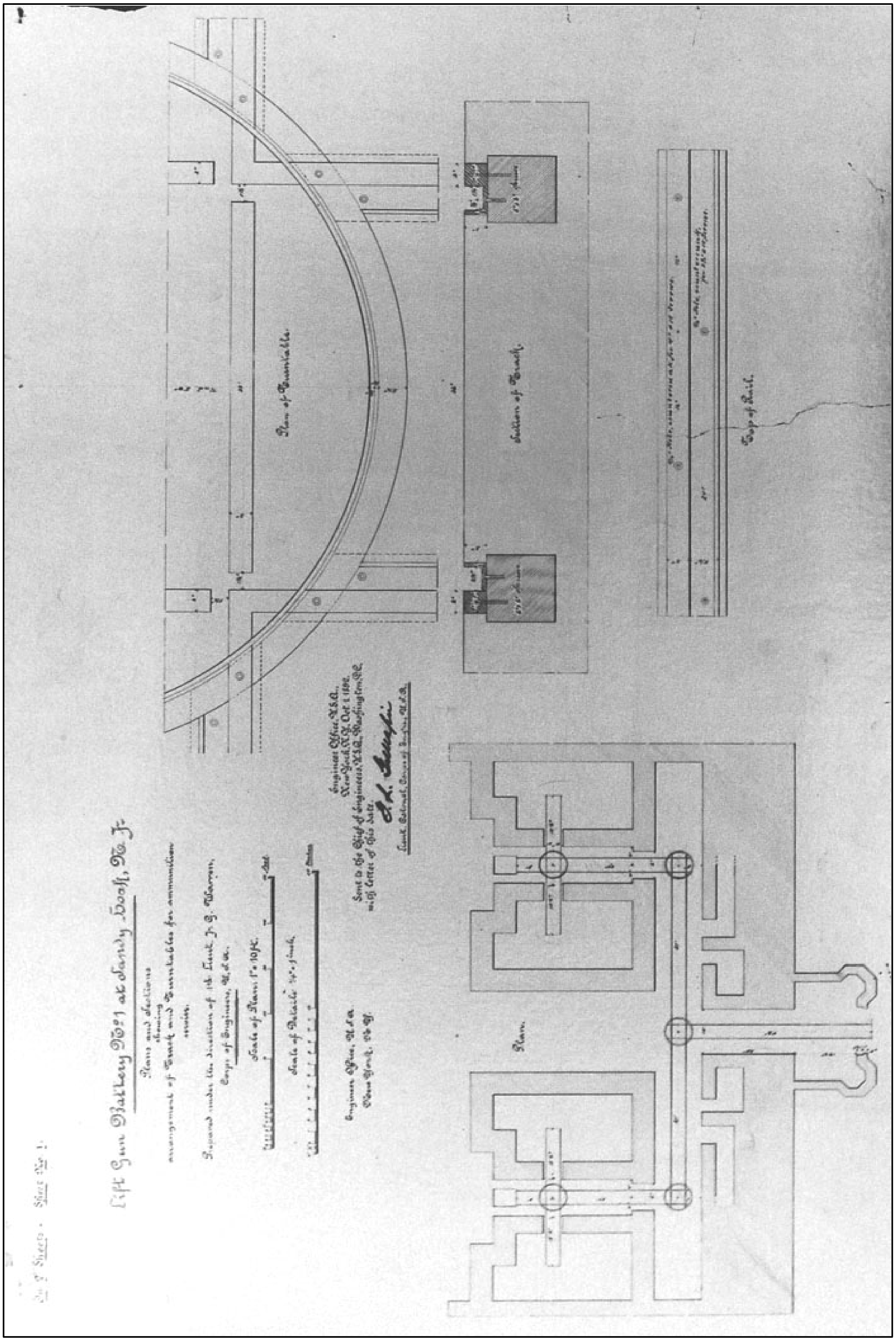


Figure 41. "Lift Gun Battery No. 1 at Sandy Hook, N.J. Plans and sections showing arrangement of track and turntables for ammunition service." Prepared under the direction of 1st Lt. J.G. Warren, Corps of Engineers, Oct. 1, 1892.

Figure 42. Battery Potter, carriage for ammunition hoist, Feb. 1893. Photograph no. 18 of 39 with F.Y. 1893 Annual Report.

ORIGINAL APPEARANCE

Introduction

The sections here discuss the appearance of Battery Potter upon completion. The "General Description of Gun-Lift Battery No. 1, Sandy Hook, N.J."[1] (Appendix D) and a set of 10 drawings completed in 1894 provide extremely useful information about the original appearance and use of the battery. An additional set of floor plans with room numbers are included with this report to illustrate the general layout (figs. 43-45); the room numbers were established for a prior report, and were kept by this report in an effort to standardize the information. The description of the original appearance is meant to augment the information discussed in the previous section on construction.

Battery Potter – Exterior Elements

Battery Potter was D-shaped in plan, with its curved walls facing east toward the natural channel to New York Harbor. Endicott System emplacements were typically designed to blend into the surrounding landscape as much as possible. At Battery Potter, sand embankments were built up around the exterior concrete walls of the battery so that the battery would blend in with the dunes of Sandy Hook. However, the upper slopes of the concrete walls remained visible above the embankments.

The west elevation of Battery Potter contained the only ground-level entrance to the battery. The sand embankment on either side of the entrance was brought up to the 30-foot reference mark, 20 feet above grade, exposing only the top 4 feet of the concrete wall. The embankment sloped at a 45-degree angle away from the structure. A granite cornice ran the length of the concrete wall, and was interrupted only by the entrance to the battery. Above the cornice, the concrete structure sloped up toward the terreplein. Since this elevation served as the main entrance to the battery and had no parapet at the terreplein level, it was important that the entryway be well constructed.

The primary feature of the west elevation was the fortress-like main entrance to the battery (fig. 46). This "defensible entrance" was a castellated sally port or caponiere constructed of granite block salvaged from the "Fort at Sandy Hook." The rectilinear granite blocks were dressed with chiseled edges or margins, and bush-hammered centers creating a pitted appearance. The joints between the granite blocks were pointed with Portland cement

[1] 2nd Lt. Robert McGregor to Lt. Col. George L. Gillespie, Dec. 24, 1894; File 9716, enclosure 2; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

mortar and tooled flush with the edge of the blocks. The defensible entrance to Battery Potter was replete with iron-clad doors, gun loops, and gun ports, to appear impenetrable.

The primary façade of the sally port rose 26 feet 2 inches above grade, and was flanked by towers that were 28 feet 2 inches high. A belt course above the second story unified the façade elements. Just below the belt course was a granite block with the construction dates of the battery carved into it, which read “ERECTED 1890 -92.” Below that was a gun port that was fitted with a vertically sliding iron door, behind which was a Gatling gun.

The main entrance to Battery Potter was through an arched opening 24 feet 9 inches high. The arch above the doorway was segmental and was constructed with stepped granite blocks. The size of the opening allowed for the transport of ammunition, powder, coal, and other materials via the railway running from the wharf to the battery. The rails continued into the battery to facilitate the delivery of supplies.

The doorway was equipped with iron-clad double doors hung on iron strap hinges 4 inches wide by 4 feet long. The hinges, three per door, were hung on pintles set in to the masonry of the doorway. Each door was 3 inches thick, constructed with three layers of tongue-and-groove boards, and covered by a quarter-inch plate of iron that was bolted to the door. Each door was built with two gun ports with sliding iron doors for protection. The south door had a smaller door cut into it that was 1 foot above the bottom of the larger door, and which measured 2 feet 1 inch wide by 5 feet high. The hinges for the small door extended from the larger hinges, which created a somewhat unique hinge arrangement. The entry doors were secured with L-shaped locking pins at the top of the arch and the base of each door.

The flanking towers of the sally port rose 2 feet higher than the main wall. The towers were constructed with the same granite block as the rest of the sally port, and were integral to the masonry construction. The towers were capped with granite coping and octagonal hipped roofs of concrete. Each tower was pierced with three gun loops on the first story and four gun loops on the second story. The embrasure of the gun loops measured 6 inches wide by 18 ¾ inches high on the exterior, and narrowed to 3 inches wide by 16 inches high in the middle of the wall before opening up to the interior. The gun loops were positioned to provide flanking fire for the entrance during an attack. The splayed configuration of the gun loops provided the maximum cover for the garrison defending the battery. The towers of the sally port provided an important defense for the battery, and established the fortress-like appearance of the west elevation.

The north and south side walls of the sally port, which extended from the granite façade to the main structure of the battery, were constructed with concrete. Only the second-story exterior walls of the side walls were exposed. Each wall had a gun port 12 inches square, equipped with vertical sliding iron shutters, at the second-story level. These gun ports were also equipped with Gatling guns.

Granite-block retaining (or wing) walls were constructed on either side of the sally port. They extended 19 ½ feet to either side of the sally port, and held back a portion of the sand embankment. The walls were 11 feet 6 inches high where they joined the towers of the entrance, tapering down to 3 feet 6 inches at their outer ends. Each retaining wall was terminated with a return parallel to the battery, and was capped with a beveled granite coping.

The junction of the west and north elevations formed a right angle, and the upper slope at the northwest corner formed a hip. The sloped portion of the structure on the north side included a parapet that extended above the terreplein level and served to protect that area. The sand embankment sloped at 45-degree angle away from the structure and rose 20 feet above grade. The junction of the north and east elevations was formed by a curve in the masonry wall.

The east elevation, as viewed from the Proof Battery of the Sandy Hook Proving Ground situated east of Battery Potter, resembled a massive dune. As with the other elevations, the sand embankment was brought up to the 30-foot reference mark (20 feet above grade), and the masonry wall extended 4 feet above that. The sloped portion of the structure rose another 10 feet above that, and included a 4-foot parapet at the top. The parapet protected the *chemin de ronde* designed by Lt. Col. Gillespie and Lt. Warren. The superior slope of the battery roof extended west from the *chemin de ronde* toward the gun emplacements.

The southeast corner of the Battery Potter was also curved in transition to the south elevation. The south elevation of the battery closely resembled the north elevation. The sand embankment rose at a 45-degree angle to a point on the concrete wall 20 feet above grade. Above the sand, the wall rose 4 feet to a granite belt course; from there it sloped upward to form the parapet.

The roof level of Battery Potter was constructed in two sections. The lower section was a terraced area commonly known as the terreplein. The upper section was sloped and comprised the superior slope of the battery, facing east.

The 12-inch guns were raised to their firing position at the terreplein level of Battery Potter. The curved concrete walls of the gun parapets formed the east wall of the terreplein. The exterior concrete slope of the battery formed the parapet that protected the north and south sides of the terreplein. The parapet wall was an extension of the front wall of the *chemin de ronde*, and served as the flank defense for Battery Potter. The west side of the terreplein was open. The terreplein was paved with flagstone taken from the "Fort at Sandy Hook."[2] The coping at the top of each gun lift was constructed with granite block.

A spiral staircase from the second story of the battery opened on to the terreplein and was protected by a round wooden tower with a conical roof. The completion drawings depict an iron ladder installed between the gun parapets leading from the terreplein level to the sloped roof of the battery.

The east roof of Battery Potter sloped away from the gun emplacements toward the curved east face. This section of the roof had several angles to accommodate the D-shape of the battery. The roof was constructed with concrete sections arranged in a pattern of wedges conforming to the slope and curve of the roof. The superior slope of the battery was constructed with a concrete "granolithic" pavement composed of Portland cement, as described by Lt. Warren in 1893 (Appendix C). The superior slope of the roof ended at the *chemin de ronde*.

---

[2] Lt. J.G. Warren to Gillespie, September 1892; *Lift Gun Battery, Sandy Hook, New Jersey* (New York: United States Engineer Bureau). [Note: This is a bound volume of monthly reports from Sept. 1891 through March 1894, sent from Sandy Hook to Lt. Col. Gillespie at the N.Y. Engineer Office.]

Battery Potter – Interior Elements

First Story

The iron-plated double doors of the defensible entrance led to an open room or foyer (room 101) on the first level of Battery Potter (fig. 43). Room 101 provided the only access to the interior of the battery from the ground level. The interiors of the flanking towers were open to the foyer. Each of those spaces was reached by one step up. The interior of each tower at the first story was equipped with three gun loops, each with an interior opening of 10 inches wide by 16 inches high, which narrowed to 3 inches wide at the center of the wall. This design protected the riflemen, while allowing for some range of motion for the rifles.

Past the towers, a doorway in each side wall of the foyer led to a room that was also part of the defensible entrance. Both rooms were covered by the sand embankment and were constructed as bombproof rooms. The room to the north (room 102) was used as a bathroom for the battery. The F.Y. 1893 Annual Report (Appendix B) noted that the room was constructed "to provide space for a suitable and sanitary water closet for the garrison when the work is occupied."[3] The room directly opposite room 102, to the south (room 103), was originally used as a pump room. The annual report stated that the pump could provide 1,000 gallons of water per hour. A water supply of that capacity was required for the boilers, hydraulic system, and the sanitary systems of Battery Potter.[4]

Entry to the main interior of the battery was via an arched hallway or entry gallery (room 104) leading east from the defensible entrance through the concrete mass that comprised the exterior wall of the battery. The entry gallery was 10 feet wide by 20 feet long, with an 11-foot-high arched ceiling. Its inner end opened to a transverse (north-south) gallery, and to a main center gallery (room 111) that contained the boilers.

The north section of the transverse gallery (room 109) was an arched corridor leading to the magazines and lift for the north gun. The floor of the north transverse gallery was concrete, with narrow-gauge railroad tracks running along the center of the passage. The north transverse gallery had two doorways in the west wall and one doorway in the east wall. The east wall was also equipped with two openings approximately 5 feet off the ground and arranged equidistant from the doorway on the east wall. These arched openings extended to the interior storage rooms of the battery, as part of the original lantern lighting system. This lantern lighting system was designed to keep the open flame of the lanterns out of the ammunition storage magazines. The lanterns were placed in the gallery niches, and their light shone through openings into the magazines. The interior walls of the magazines were equipped with round openings that held a small glass window that allowed the light to shine into the room. When Battery Potter was finished, the lantern lighting system was used as a backup system for the electric lighting system.

---

[3] Gillespie to Brig. Gen. Thomas L. Casey, Chief of Engineers, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[4] Gillespie to Casey, July 8, 1893.

In the north end of the north transverse gallery, the first room on the west side of the gallery (room 106) was labeled "Dynamo" on the 1894 floor plan, which indicated that it was used for the electric plant for Battery Potter. Room 106 was a rectangular space measuring 6 feet wide by 10 feet long; it was equipped with a cement pad for the electrical plant, and an additional interior wall to protect the electrical equipment (see the subsequent section "Battery Potter – Utilities").

Proceeding north in the north transverse gallery, the next doorway to the west led to the north stairway. Just beyond the stairway on the east side of the gallery was an arched double doorway with doors leading to the north magazine gallery (room 113).

Room 113 led to the two magazines and the gun-lift mechanism. The floor of the magazine gallery was concrete, and was equipped with narrow-gauge railroad tracks and a gun-metal turntable for the ammunition storage system, as previously described. The walls of Room 113 were concrete, and they extended up to an arched ceiling. At the east end of Room 113 was the lift for the ammunition, which traveled up though a rectangular shaft in the ceiling to the loading gallery for the gun. The east end of the magazine gallery terminates at the room for the gun-lift mechanism (room 119).

The magazines were arranged on either side of the gallery, with their doorways directly opposite each other. The doorway to the powder magazine (room 112) was located on the north side of the gallery. This arched doorway was fitted with a wooden door that led into a cavernous storage room. The rails from the turntable in the magazine gallery (room 113) extended partway into the powder magazine. Room 112 had a concrete floor that was slightly pitched toward a drain. The room measured 15 feet wide by 30 feet long at its longest point. (There was a rectangular protrusion, or jog, in the southeast corner.) The ceiling consisted of an 11-foot-high segmental arch. The west wall of the room was pierced with a small, round "bulls-eye" window[5] that admitted light from a lantern set in a larger niche in the wall of the adjacent transverse gallery, as previously described. In the south wall next to the jog was a deep niche that provided access to the large nuts securing the long bolts that helped to hold the vertical guide rails for the gun-lift cage in room 119.

The shell magazine (room 114) mirrored the powder magazine. The rails from the magazine gallery (room 113) were laid in the concrete floor of the room, and extended 8 feet into the magazine. The concrete walls of the room extended up to an arched ceiling. As in Room 112, Room 114 had a jog in its northeast corner, a "bulls-eye" window in its west wall for the lantern lighting system, and a deep niche in its north wall for access to the large nuts securing the long bolts that helped to hold the vertical guide rails for the gun-lift cage. Room 114 was also equipped with an overhead hoisting apparatus for loading and unloading shells, as previously described.

[5] McGregor to Gillespie, Dec. 24, 1894.

The gun-lift room (room 119) at the east end of the magazine gallery was open to the terreplein of the battery. The floor level of Room 119 was 2 feet lower than the gallery, and the space was occupied by the lift mechanism and cage (depending on the position of the gun). At the first story, this space was defined by four large piers, which extended up to the second-story level; they were constructed as solid concrete masses. As previously discussed, granite blocks were used in the sections of the piers where the shelf plates for the locking bolts of the gun-lift cage were attached. The tops of the piers were edged with a bluestone coping to protect the exposed edge of the concrete.[6] Vertical guide rails for the gun-lift cage were attached to all four walls of the room, by means of very long bolts that ran through the concrete into adjacent rooms, where they were secured with large nuts. In the case of room 119, the bolts extended westward into the powder magazine (room 112) and the shell magazine (room 114); northward and southward into room 118 and the accumulator room (room 120), respectively; and eastward into the east transverse gallery (room 123).

The south half of Battery Potter was a mirror image of the north half. The south section of transverse gallery (room 110) led to a small storage room (room 107) and then to the south magazine gallery (room 116), from which the south magazines could be reached. In the case of the south half of the battery, the shell magazine (room 115) was located north of the corridor, and the powder magazine (room 117) was located south of the corridor. These rooms, as well as the magazine gallery (room 116) and the gun-lift room (room 121), were arranged similarly to the north half of the battery, described previously.

At the center of the battery on the first story was the main gallery (room 111), which contained the battery's two boilers. The room's east end was open to the accumulator room behind it (room 120); together they formed one contiguous space that housed all of the mechanical systems for the operation of the gun lifts. The main gallery/boiler room was 18 feet wide by 50 feet long, and was constructed with a barrel-vaulted ceiling that was open to a height of 22 feet above the first level of the battery. The two large boilers that dominated the room were situated on the north side of the space (fig. 47). The floor of the main gallery was constructed with two areas that were 1 foot below the floor level. The depressions measured 10 feet 6 inches wide by 13 feet long, and were built to accommodate the two large boilers. The floors in these areas were concrete, and the rest of the floor of Room 111 was set with rectangular bluestone pavers salvaged from the Fort at Sandy Hook.

East of the main gallery/boiler room was the accumulator room (room 120), which measured 22 feet wide by 38 feet 8 inches long. Room 120 was also open to the second story, and constructed with a barrel-vaulted ceiling 26 feet above the floor level. Room 120 was wholly devoted to the machinery that powered the gun lifts (figs. 48-49). The accumulator well was sunk into the southeast corner of the space, and pumps, water tanks, and piping took up the remainder of the area, as documented by photographs and drawings. The accumulator machinery was operated from a platform at the north end of Room 120, situated between the two southern piers of the north gun lift (fig. 48). The platform was accessed from the first story via a metal ladder. The boiler and accumulator rooms were vital to the operation of Battery Potter, and were well-documented in photographs and plans from the period of construction.

---

[6] Warren to Gillespie, October 1892; *Lift Gun Battery*.

An arched passage way in the east wall of Room 120 led to a narrower transverse gallery along the east side of the battery (rooms 123-125). The sections at either end of this east transverse gallery (rooms 123 and 125) were open to the second story, in order to provide access to bolts helping to hold the two-story vertical guide rails for the gun-lift cages in rooms 119 and 121. The gallery was a long corridor measuring 4 feet wide and 96 feet long, with an arched ceiling. The bolts for the guide rails emerged from the west wall of the gallery, where they were secured by large nuts.

There were two stairways from the first to the second levels (rooms 105 and 108), located at either end of the transverse gallery. As elsewhere on the first story, the stairways were mirror images of each other. In May 1892, James Cosby of Brooklyn, N.Y., was the low bidder for the construction of two straight iron stairways and one spiral stairway.[7] The report for that month confirms that the stairways were ordered, but no further documentation was uncovered regarding their manufacture. The iron stairways were installed in arched passageways that were 4 feet wide and 31 feet long. Each straight stairway was 23 feet long and constructed with 11 ½-inch treads and 7 ½-inch risers. The stairways were installed in September and October 1892.[8]

Second Story

The second story of the defensible entrance (room 201) was an irregularly shaped space measuring 22 feet wide by 13 feet 6 inches long overall (fig. 44). Occupying the northwest and northeast corners of Room 201 were the interiors of the towers. As at the first story, the towers were constructed with gun loops for defense of the battery. Each tower had four gun loops that measured 12 inches wide by 18 inches high at the widest part of the embrasure, and narrowed to 3 inches wide at the mid-section of the wall. The center of the west wall had a larger recess measuring 20 inches wide by 34 inches high at the interior, with a gun port. Similar recesses and openings were cut into the north and south walls of Room 201. These openings were provided for Gatling guns that could sweep the embankment of the battery during an attack. The openings for the Gatling guns were equipped with vertical sliding iron shutters for the protection of the gunners. Room 201 was connected to the second story of the battery via a gallery (room 202).

The connecting gallery (room 202) at the second story was located directly above the main gallery. Room 202 was 4 feet wide, with an arched ceiling. It was the only communication between the second story of the defensible entrance and the interior of the battery. Near the interior of the main structure, an arched opening in the north wall of Room 202 provided access to a spiral staircase that led up to the terreplein level. The spiral staircase was manufactured by James Cosby and was installed in September 1892.[9] Room 202 connected the defensible entrance to the 10-foot-wide transverse gallery of the second story (rooms 203-205).

---

[7] Gillespie to James Cosby, May 19, 1892; Letters Sent; Vol. II, p. 156; Entry 815; RG 77; NARA - Northeast Region (NY).

[8] Warren to Gillespie, September and October 1892; *Lift Gun Battery.*

[9] Warren to Gillespie, September and October 1892; *Lift Gun Battery.*

The north transverse gallery (room 203) and the south transverse gallery (room 205) were connected by a wooden bridge (room 204) that spanned the main gallery/boiler room (room 111). As depicted in the 1894 completion drawings, the bridge was constructed with pine planks 10 feet long, 1 ½ inches thick, and 6 inches wide. The planks were secured to six **I**-beams that spanned the space.[10] The east side of the bridge, which overlooked the main gallery, was equipped with a railing. The wooden bridge served as the only access for Room 202 and the defensible entrance.

The second story of the northern half of Battery Potter was accessible from the staircase in Room 105. The stairway led to the north transverse gallery (room 203), with access to the gallery through a doorway in the west wall of the gallery. On the east wall of Room 203, two niches for lighting were cut into the wall in a similar fashion to those on the first story. A doorway to the loading gallery and storage room was located in the middle of the east wall.

A small hallway (room 207) was located directly off Room 203; it provided access to two casemate rooms (rooms 206 and 208) on either side of the hallway and loading gallery. Rooms 206 and 208 were mirror images of each other. Both rooms were **L**-shaped and had barrel-vaulted ceilings. Little information was discovered regarding the use of these rooms. The 1894 completion plans lists them as “casemate” rooms, which suggests that they were used for the storage of munitions.

The loading gallery for the north gun (room 209) was accessed via an iron ladder leading from the hallway (room 207) up 5 feet to the platform of the gallery. The gallery was 8 feet wide and 24 feet 7 inches long. The floor of the gallery was flagstone, and toward the east end of the gallery, a rectangular opening in the floor allowed the ammunition lift to rise to the loading level. The floor was trenched for the pipes for the hydraulics of the ammunition lift. The ammunition lift was operated by levers at this level. The walls and ceiling of the east end of the loading gallery were constructed with granite block, including the arch of the loading gallery where it opened to the gun-lift area (fig. 50). From the east end of room 209, the granite-block construction extended approximately 14 feet into the gallery. The south wall of the granite block was notched with a chase measuring 6 by 12 inches for the pipes that carried the hydraulics for the ammunition lift. The ceiling of room 209 was an inclined arch that angled down from east to west to accommodate the loading mechanisms for the north gun. The hydraulic rammer for loading the 12-inch breech-loading rifle was mounted to the ceiling of the loading gallery.

The gun-lift area (room 217) east of the loading gallery (room 209) was open to the lift mechanism when the gun was raised. When the gun was lowered, the platform of the lift-cage was even with the loading gallery (fig. 50). The east wall beyond the gun-lift mechanism was notched out (room 214) to accommodate the barrel of the gun during loading.

The south half of Battery Potter was a mirror image of the north half, except for the loading gallery (room 213). As previously discussed, the Engineers decided to modify the ceiling of the south gun’s loading gallery, to provide additional head room and more efficient operation of the ammunition lift and gun loading. This was the only discernable difference between the two emplacements. One of the 1894 completion drawings of Battery Potter depicts in cross-section the north and south ends of the battery, as well as the main gallery/boiler room

[10] McGregor to Gillespie, Dec. 24, 1894.

(Appendix D, no. 4 of 10). Another illustrates the gun-lift mechanism in the loading position and in the firing position (Appendix D, no. 10 of 10).

Battery Potter – Utilities

The operation of Battery Potter relied on the machinery specified by Lt. Col. Gillespie and his assistants. In addition to the machinery to operate the gun lifts, Battery Potter required lighting and a water supply for general operations.

The specifications for the gun-lift mechanism submitted by Lt. Col. Gillespie on December 5, 1890, included detailed descriptions of the accumulators and pumps that would power the hydraulic mechanism, as well as the two boilers for the system. Continental Iron Works, which had been the successful bidder on the project, installed the accumulators in February 1892, and the boilers and pumps were set up in April 1892.[11] As previously described, the accumulator and pumps were situated in room 120, and the boilers were installed along the north wall of room 111.

The original plans for Battery Potter included a lighting system that used oil lamps set in niches along the galleries to provide the necessary light for the garrison. From the back of the niches, as previously described, smaller openings extended through the walls to the magazines and casemates. Here, each opening was fitted with a circular glass window or "bulls-eye"; this allowed some light to reach the rooms without the danger posed by an open oil-lamp flame. During the construction of Battery Potter, it was decided that this system of lighting was not adequate, but it was kept as an auxiliary system. As described by Lt. Col. Gillespie in the F.Y. 1893 Annual Report, the magnitude of the battery made it apparent that the oil-lamp system would not suffice, and that an electric light plant was required.[12]

Proposals for the electric plant were opened on September 19, 1892, and General Electric was awarded the contract for the project on October 7, 1892, at a cost of $3,788.[13] Installation of the electric light plant began in December of that year and was completed on March 9, 1893. The plant was described by Lt. Col. Gillespie as follows:

> The plant is of the same general type as that in use by the Navy Department on vessels of war.
>
> It consists of a direct coupled Thompson-Houston engine and dynamo having a capacity, with 80 pounds of steam and running at 550 revolutions per minute, of 100 volts and 40 amperes, equivalent to about 80 16-candle power lamps. Connected with this there are four 24-candle power lamps, one in each magazine and fifty-four 16-candle power lamps.[14]

[11] Warren to Gillespie, February and April 1892; *Lift Gun Battery*.
[12] Gillespie to Casey, July 8, 1893.
[13] Warren to Gillespie, September and October 1892; *Lift Gun Battery*.
[14] Gillespie to Casey, July 8, 1893.

The steam for the electric plant was provided by the boilers. The conductors for the electric lights were covered with lead and run in moldings attached with brass expansion bolts to the walls and arches of the battery. For the safety of the battery, the lamps of the lighting system were covered with globes that were steam- and vapor-proof.[15] The dynamo for the electric light system was set on a concrete pad in Room 106.

The water supply for Battery Potter was pumped from four well points that were located about 175 feet west of the battery. The pump was located in Room 103, and was a "Rider Hot Air Pumping Engine" with a capacity of 1,000 gallons per hour. It was capable of supplying the boilers, which evaporated 500 gallons of water per hour, and the 1,500-gallon tank for the hydraulic system, which occasionally required filling.[16]

The 1894 plans of Battery Potter depict a series of vents and piping that facilitated the function of the utilities and the battery in general (Appendix D). Upon the completion of Battery Potter, all of the utilities were installed and operational.

[15] Gillespie to Casey, July 8, 1893.
[16] Gillespie to Casey, July 8, 1893.

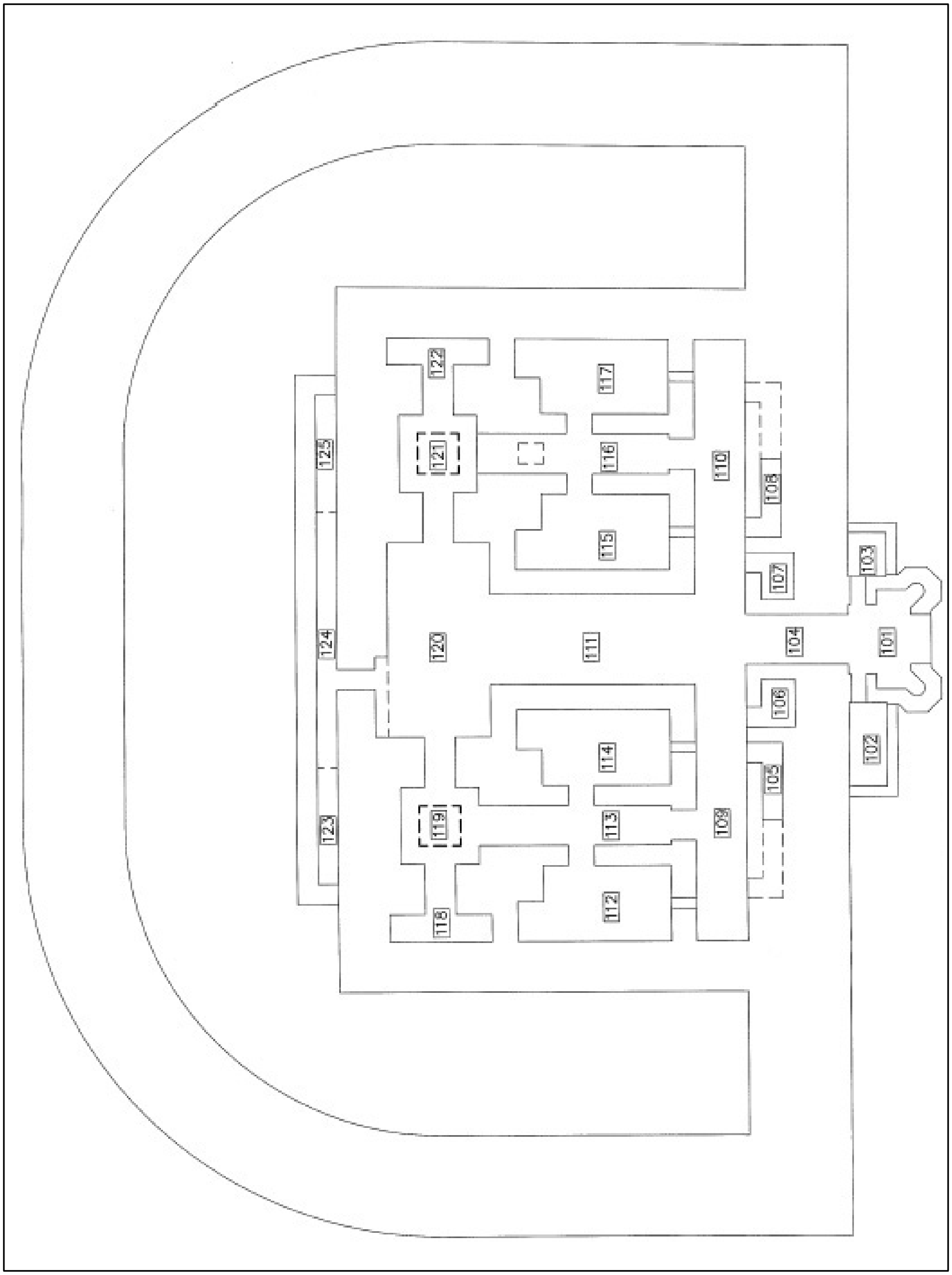


Figure 43. Battery Potter, first-floor plan with room numbers. Not to scale.

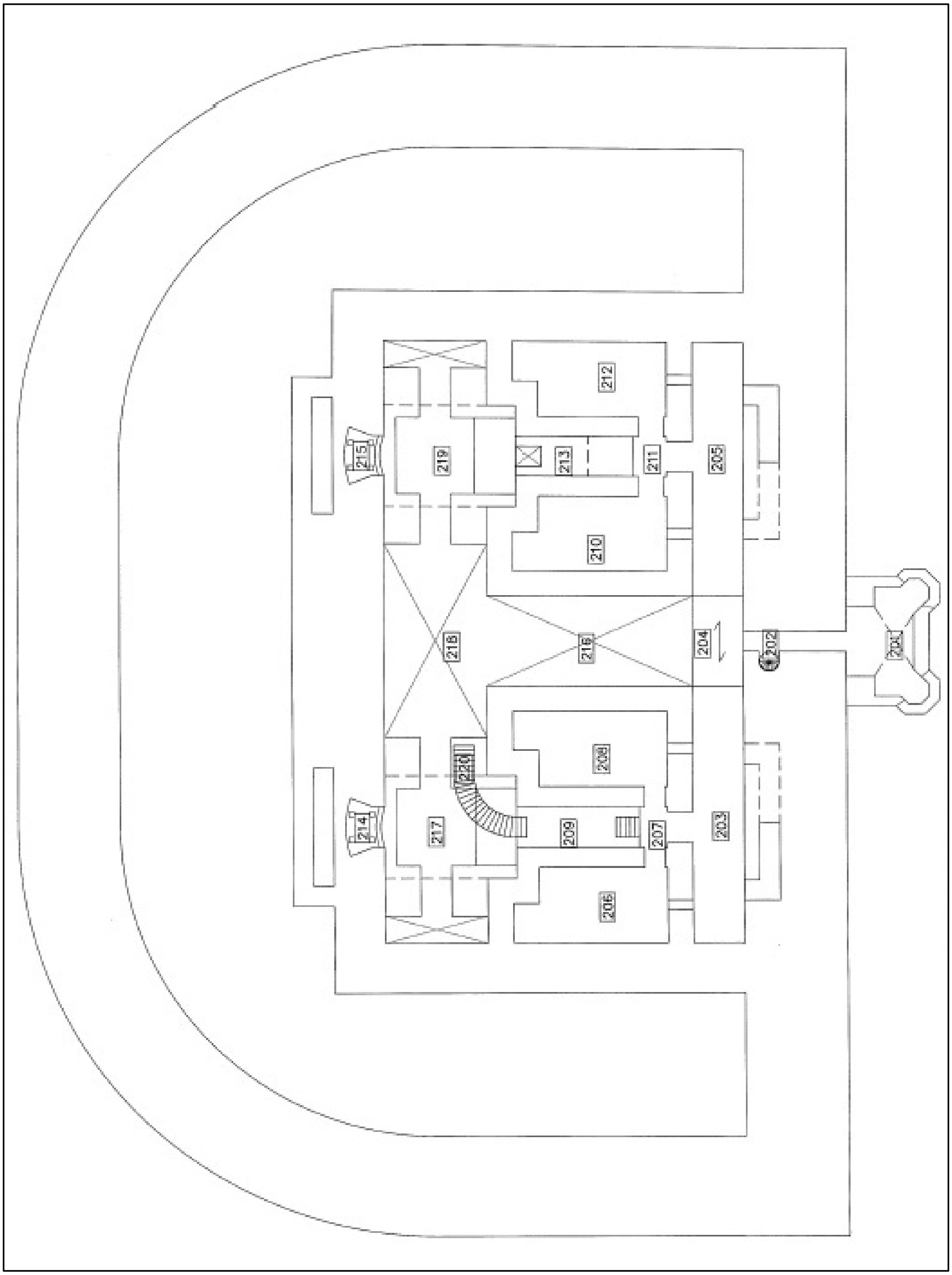


Figure 44. Battery Potter, second-floor plan with room numbers. Not to scale.

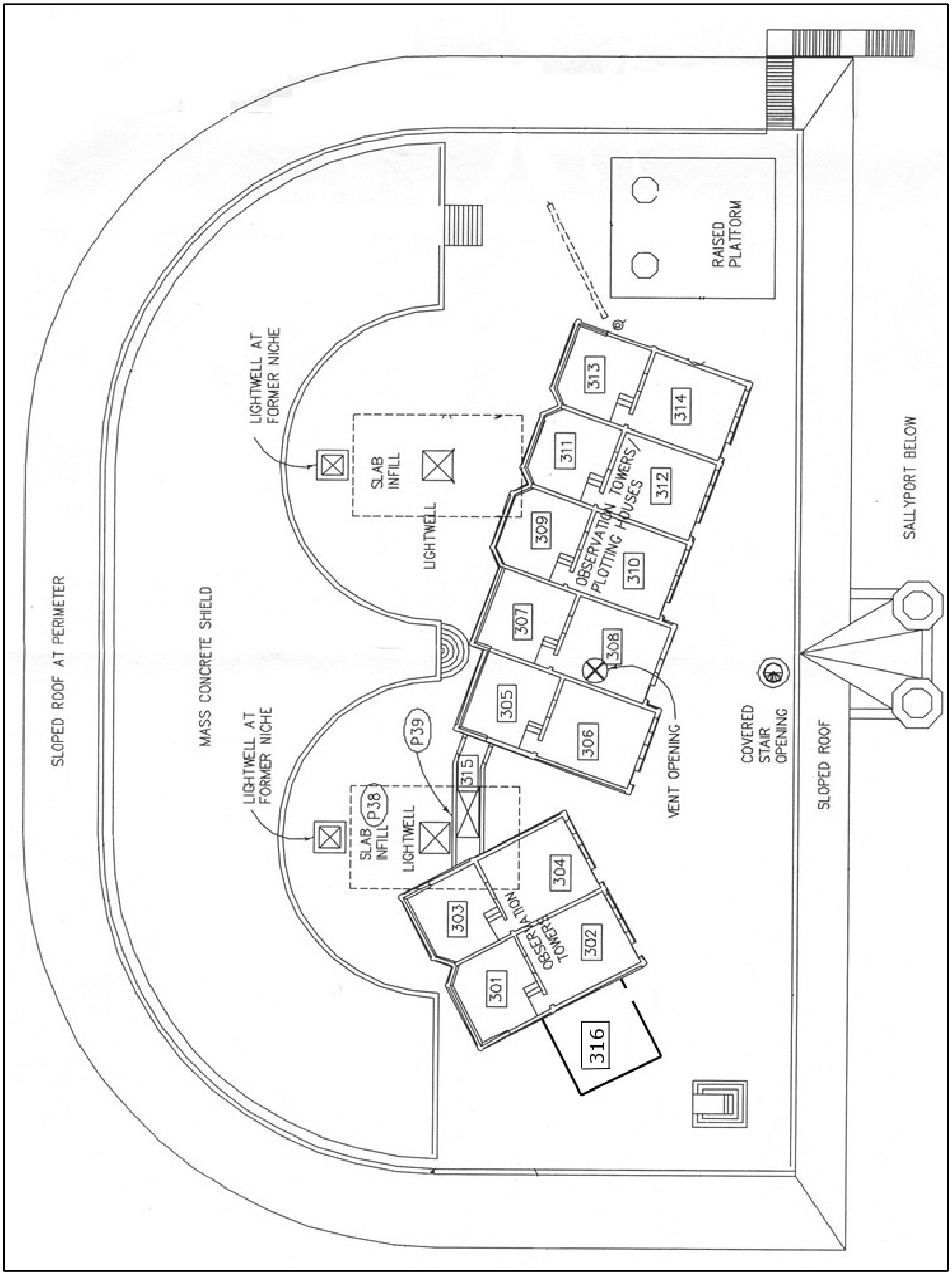


Figure 45. Battery Potter, terreplein, superior slope, and fire-control stations floor plan with room numbers. Not to scale.

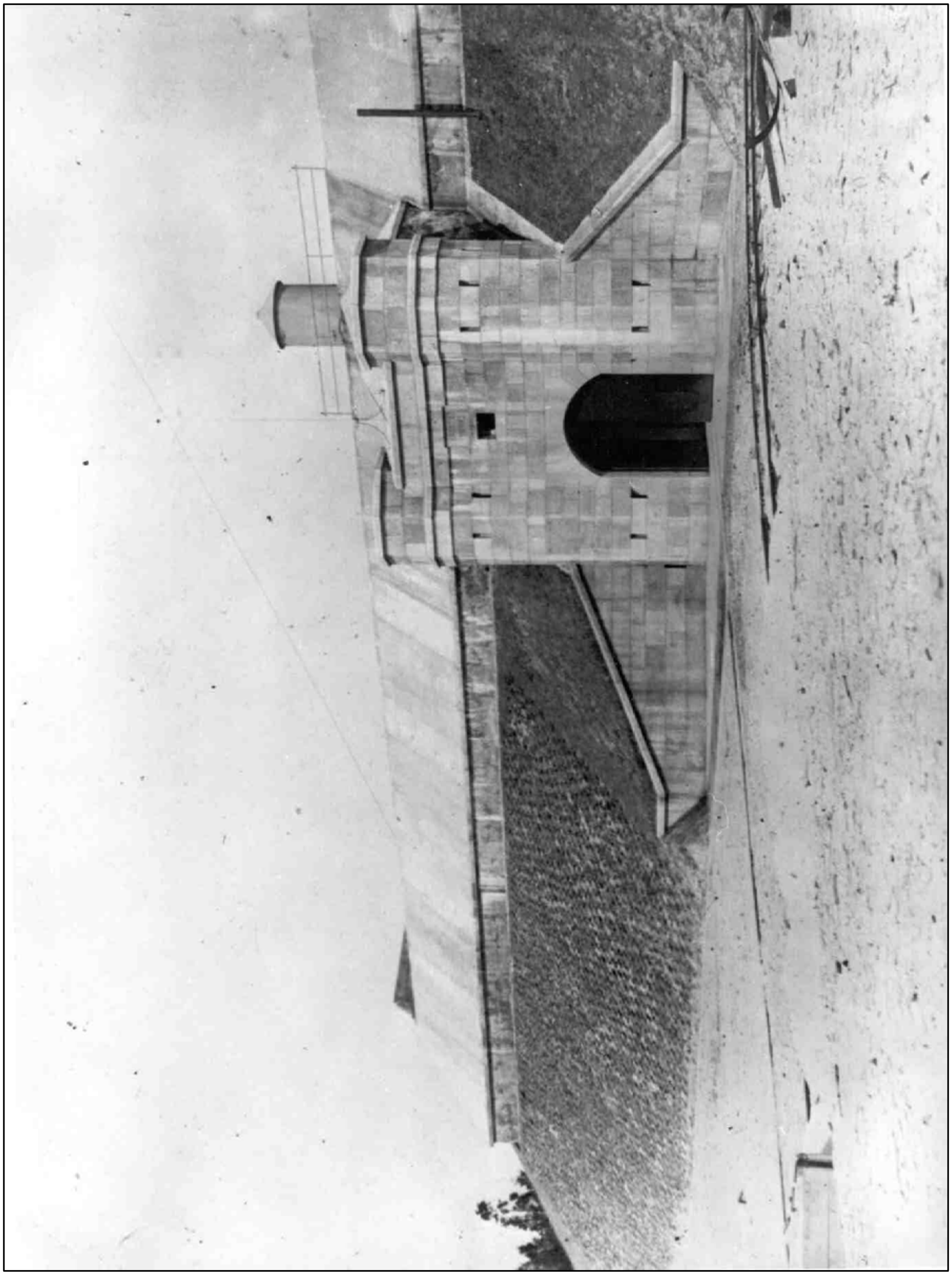


Figure 46. Battery Potter, west elevation with defensible entrance, circa 1893.

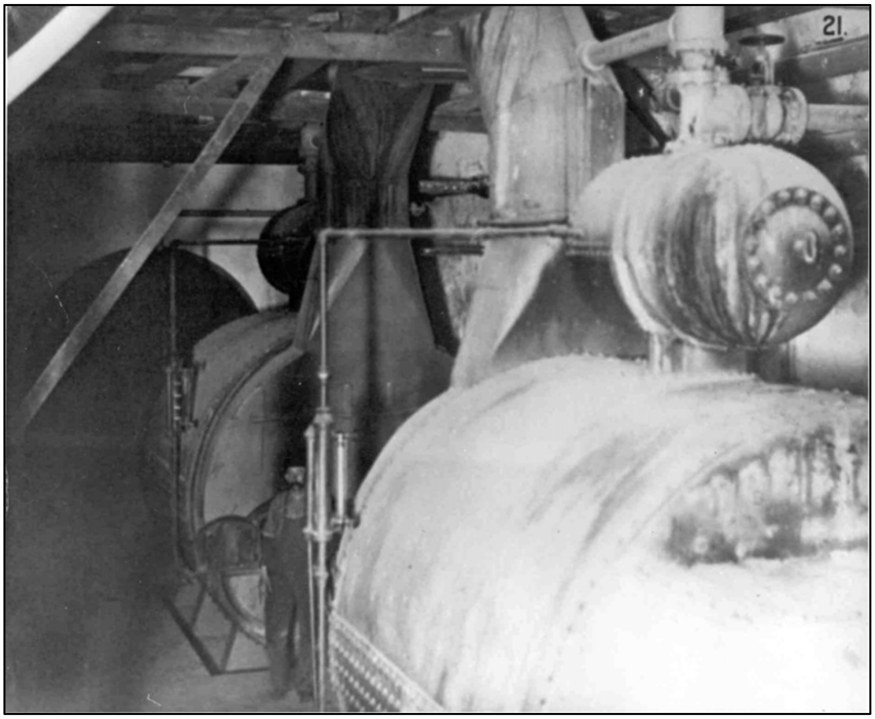


Figure 47. Battery Potter, main gallery/boiler room. Photograph no. 21 of 39 with F.Y. 1893 Annual Report.

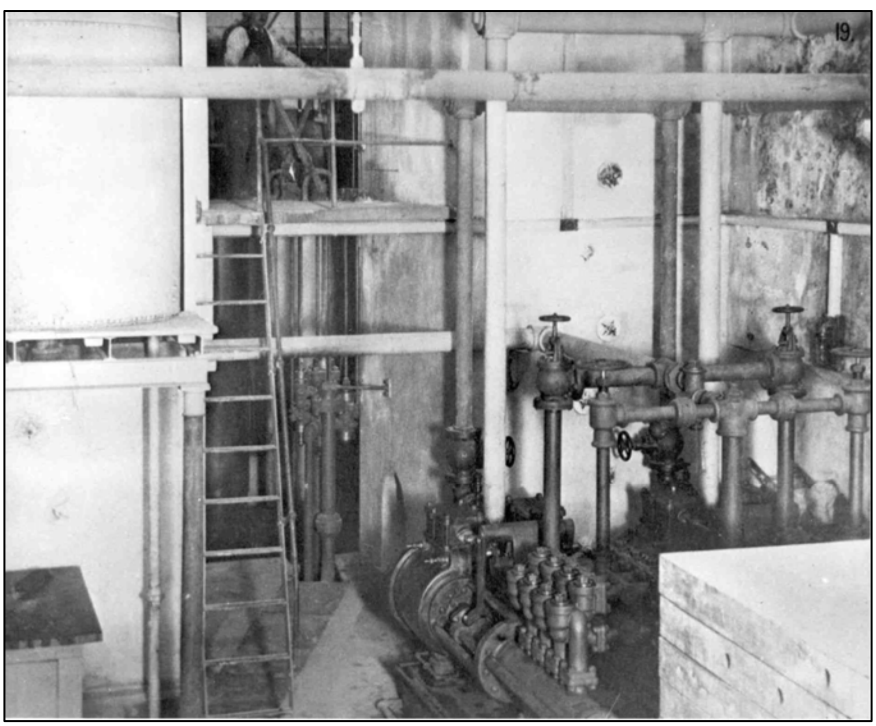


Figure 48. Battery Potter, accumulator room pumps and operating platform, April 1893. Photograph no. 19 of 39 with F.Y. 1893 Annual Report.

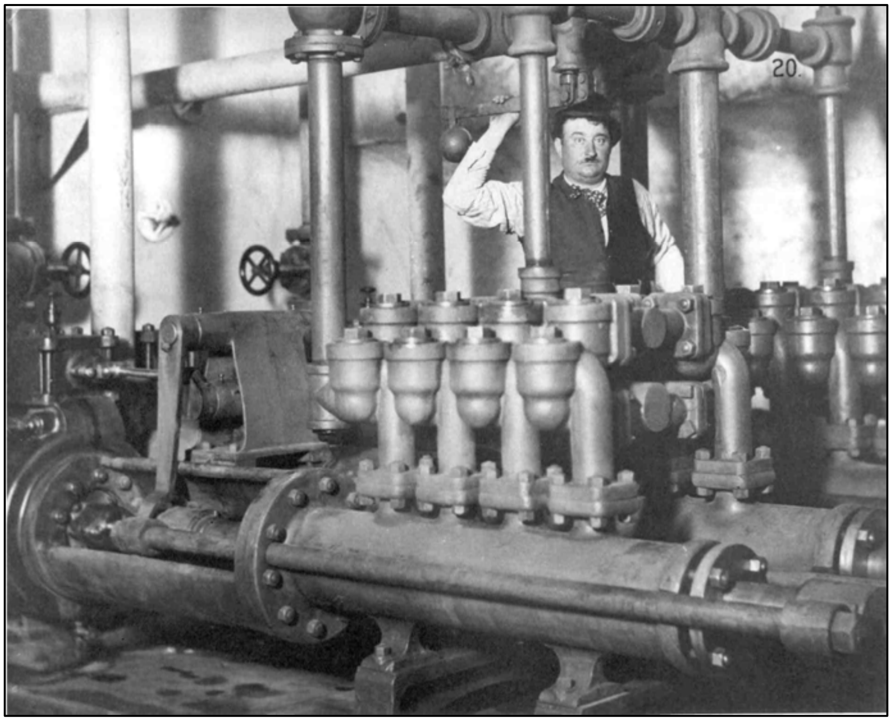


Figure 49. Battery Potter, accumulator room pumps. Photograph no. 20 of 39 with F.Y. 1893 Annual Report.

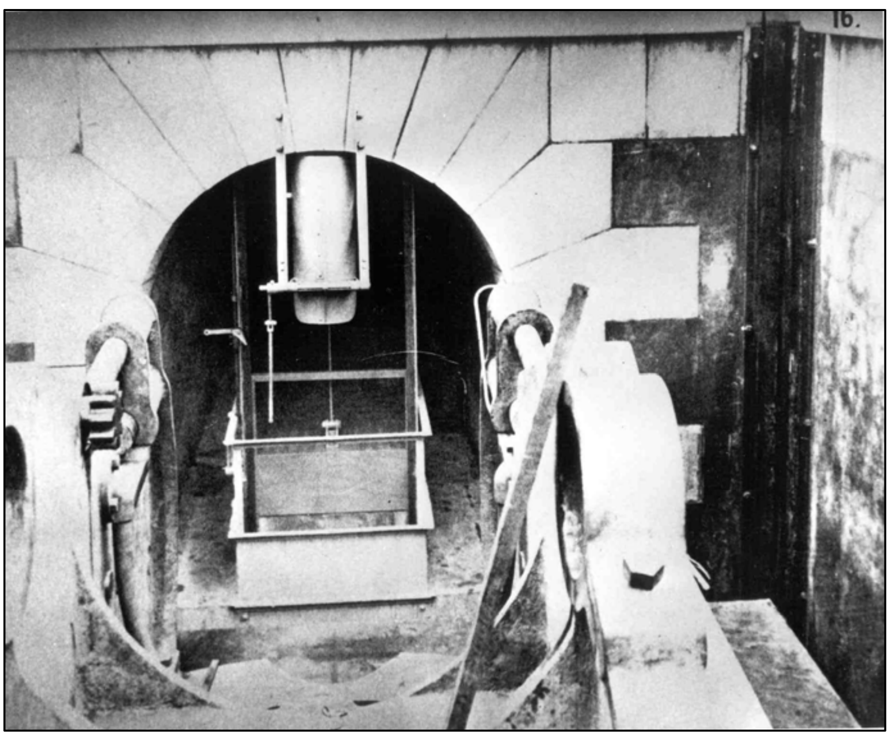


Figure 50. Battery Potter, loading gallery, north lift. August 25, 1892. Photograph no. 16 of 39 with F.Y. 1893 Annual Report.

ALTERATIONS

Battery Potter – Maintenance and Alterations

The Period 1895 – 1906

The estimate for the maintenance of Battery Potter during its first fiscal year of operation was placed at $5,000 by Lieutenant McGregor. Chief of Engineers Casey approved the F.Y. 1895 budget on September 25, 1894, and allotted the $5,000 from appropriations for the "Preservation and Repair of Fortifications, Act of August 1, 1894."[17]

The completion of Battery Potter and the submission of specifications and drawings in 1895 should have ended the Corps of Engineers' direct involvement with the battery. However, Fort Hancock was still in the planning stages, and the only military presence at Sandy Hook during this period was the Corps of Engineers and the Ordnance Department. The absence of an Artillery garrison meant that the Engineers had to continue their oversight of Battery Potter.

The documents reviewed indicate that the budgets for maintenance of the battery were used to pay the wages of civilian employees, to purchase coal for the boilers, and for miscellaneous maintenance items such as painting. However, procuring funds for the maintenance of Battery Potter appears to have been somewhat of a struggle. Lt. Col. Gillespie's budget of $4,000 for F.Y. 1897 was denied by the Board of Ordnance and Fortification because it deemed that Battery Potter had "been reported as a type" and required no further testing, and so was no longer eligible for appropriations under their control.[18] The $5,000 allotted in June 1895 was stretched until October 17, 1896. In that same month, Gillespie reported that some expenses were covered from proceeds of the sale of horses to Major Knight of the Corps of Engineers.[19]

One improvement to the hydraulic system for the gun lift proposed by Lt. Col. Gillespie was the installation of stop valves in the piping of the system. The valves would be installed between the power plant and the lifts and hoists for each emplacement. Designed by Continental Iron Works, they would allow the engineer to shut down either side of the battery while allowing the other side to remain operational. Lt. Col. Gillespie's request for

[17] McGregor to Casey, Aug. 23, 1894; with approval by Casey, Sept. 25, 1894; File 7539; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[18] Board of Ordnance and Fortifications to Brig. Gen. Alexander Mackenzie, Chief of Engineers, Sept. 15, 1896; File 9716, enclosure 42; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[19] Gillespie to Brig. Gen. Wm. Craighill, Chief of Engineers, Sept. 9, 1896; File 9716, enclosure 41; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

$500 to implement this change was endorsed by Chief of Engineers Craighill on September 17, 1895.[20]

Lt. Col. Gillespie was persistent in his requests for funds. The budget for Battery Potter for F.Y. 1898 submitted on October 27, 1896, included $1,080 for a civilian engineer, $720 for an assistant engineer, $540 for coal, $180 for painting the iron work and ammunition trolley, and $100 to repair the slopes. In response, Chief of Engineers Craighill suggested that two Artillery men be stationed at the battery for training by the civilian engineer, and that the battery be transferred to the Artillery Corps.[21] However, no transfer occurred until the permanent garrison of troops arrived at Fort Hancock in 1898. Two men were assigned to man the battery during F.Y. 1897, but funds were still stretched when Lt. McGregor requested $90 in May 1897 to cover repairs and the payment of the civilian engineer for the last month of the fiscal year.[22]

Even after Battery Potter was transferred to the Artillery Corps, the Corps of Engineers was still involved in the maintenance of the structure. A report on the Harbor Defenses of Sandy Hook notes that the guns and lift mechanism were overhauled in 1898, and the elevated smokestack exposed to gun fire was removed. Steam fans were installed to provide the necessary draft for the boilers.[23]

Edwin Bearss stated that in 1898, an allotment of $200 from the "National Defense Act" was used to install two emergency range-finder piers for portable instruments at Sandy Hook.[24] The installation of these piers may be referring to the two piers on the terreplein of Battery Potter evident in the 1906 photographs of the battery (figs. 51-52). One was a concrete platform and pier located near the northwest corner of the terreplein; the other was the concrete steps and pier situated between the gun parapets.

The pier at the northwest corner of the terreplein was apparently constructed between 1893 and 1906. The platform was not present in a photograph that accompanied the F.Y. 1893 Annual Report, but was built by the time Battery Potter was disarmed in 1906 (fig. 51). The structure was terraced in construction, with six steps ascending to a small platform. The 1906 photograph of the structure depicts a pier mounted on the top platform, and evidence of the pier was observed during the current investigation. The existence of the pier suggests that the platform was initially used as a position- and range-finding platform for the guns of Battery Potter.

---

[20] Gillespie to Craighill, Sept. 5, 1895, with endorsement by Craighill, Sept. 17, 1895; File 9716, enclosure 32; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[21] Gillespie to Craighill, Oct. 27, 1896; File 13121; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[22] McGregor to Brig. Gen. John M. Wilson, Chief of Engineers, May 27, 1897; File 9716, enclosure 47; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[23] *The Harbor Defenses of Sandy Hook*; Entry 317; RG 392; NARA –Northeast Region (NY).
"History of Fort Hancock and of the Defenses of Sandy Hook"; Entry 317; RG 392; NARA - Northeast Region (NY).

[24] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983), p. 116.

Like wise, the pier constructed between the gun parapets did not appear in the 1893 photograph or the 1984 completion drawings. However it was depicted in the 1906 photographs of the battery (figs. 51-52). The structure was semicircular, with four terraced steps ascending to a platform. A pier positioned adjacent to the wall was constructed on the platform. Again, the existence of the pier suggests that the structure was initially used as a position- and range-finding platform for the guns of Battery Potter. Incidentally, in 1904 a plotting house was planned for Battery Potter that was to be constructed around this pier (fig. 53). Though the plotting house was never built, the plan for the plotting house further indicates that the pier was used for the range-finding instruments at Battery Potter.

Based on the historic photographs and completion drawings, it seems clear that the two piers on the terreplein of Battery Potter were the emergency range-finder piers referenced by Edwin Bearss as having been constructed in 1898 . Bearss also noted that alterations were made to the range-finder pillars in F.Y. 1899.[25]

One recurring problem at Battery Potter was the migration of water into the battery. Though Lt. McGregor's inspection of the magazines found them dry in 1895, five years later a letter from Major William Marshall reported that the thin coat of Rosendale cement on the interior walls was scaling off. Marshall had consulted the gun-lift engineman to find out what processes had been applied to try to correct the scaling problem. It was interesting to note the various methods pursued to correct the scaling.

> The walls were first treated with melted paraffin in a manner similar to that by which the obelisk in Central Park was treated. They have been painting with white lead and raw oil, with white lead and turpentine, with Portland cement grout, with lime, soap and alum, with lime and Portland cement mixed with salt water, and with asbestine [sic] cold water paint. In addition, the arches were washed with a mixture of lime, salt, rice, Spanish whiting and glue, as prescribed by the Light House Department for whitewashing the exteriors of stone light-houses.[26]

However, Marshall attributed the scaling to water infiltration from the terreplein level of the battery, and he did not believe the scaling could be stopped until that problem was addressed.[27]

Major Marshall related his solution to the problem in a letter to the Chief of Engineers on December 1, 1900. Major Marshall's letter included the following proposals for stopping the water infiltration:

> No. I To take up and replace flagstone pavement on waterproof course, consisting in:
>
> A thin, smooth surface of Portland cement mortar painted over with Asphaltic roofing paint.

---

[25] Bearss, *The Sandy Hook Defenses,* p. 116.
[26] Maj. William Marshall to Wilson, Nov. 21, 1900; Vol. I, p. 305; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).
[27] Marshall to Wilson, Nov. 21, 1900.

> A course of waterproofing consisting of 4 layers (shingled) of Asbestos felting, each layer painted with roofing paint.
> A layer 2" thick of porous mortar, 1 cement to 6 coarse sand on which the flagging is to be laid, with joints filled with pitch.
>
> This is substantially the waterproofing used with success in this city in laying pavements above cellars and rooms under sidewalks.
>
> No. II Same waterproofing with flagstones replaced with granolithic pavement.
>
> The estimated cost for No. I is
> 2,000 sq. yds., at $2.50....$5,000.00
>
> For No. II
> 2,000 sq. yds., at $4.00....$8,000.00
>
> The difference between I and II is in the cost of a granolithic mass 6" thick, to replace the flagstones, at 33 1/3 cents per cubic foot or 16 2/3 cents per sq. foot of pavement.
>
> I recommend that for the present the first plan be tried.[28]

The Chief of Engineers approved proposed method No. I for waterproofing the terreplein, and the allotment of funds was made on December 4, 1900. The work was to be performed when the weather improved. [29] In April 1901 a crew of workmen installed the waterproofing on the terreplein, and during the following fiscal year the cracks in the pavement around the gun carriages were cut out and the joints filled with waterproof cement. These procedures stopped the water infiltration for the moment.[30]

Assistant Engineer Hurlbut estimated that the maintenance and repair of the defenses at Fort Hancock would total $10,525 during F.Y. 1903. That included the following items for the gun-lift battery: $1,250 for relaying floors and drainage systems; $1,200 for scraping, plastering, and whitewashing the interior walls; and $1,200 to hire one engineer for the care of the gun-lift mechanism. The required funds for the projects were allotted by Chief of Engineers Gillespie, and the work was completed by Hurlbut and his workmen.[31]

---

[28] Marshall to Wilson, Dec. 1, 1900; Vol. I, p. 315; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).
[29] Marshall to Wilson, Feb. 5, 1901; Vol. I, p. 363; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).
[30] Bearss, *The Sandy Hook Defenses*, p. 116.
[31] Bearss, *The Sandy Hook Defenses*, p. 224.

Gun-Lift Battery No. 1 was named Battery Potter, in honor of Brigadier General Joseph H. Potter, on May 25, 1903 (see the previous section "Historical Background and Context").[32] The heavy bronze letters designating the battery were ordered by Major Marshall and installed above the gate of the defensible entrance during F.Y. 1904.[33]

Ironically, soon after receiving its designation and nameplate, Battery Potter was considered obsolete by the Artillery Corps. Only a year after the battery was named, Colonel Greenough of the Artillery Corps wrote to the Adjutant General that the battery was expensive to operate and the loading process was slow. He did note that the battery provided the only guns with all-round fire at Sandy Hook, and that new guns should be emplaced prior to decommissioning Potter. Greenough also thought that the battery would make an excellent site for range-finding stations for the other emplacements at Sandy Hook.[34] The Artillery Corps' comments and concerns were ultimately referred to now-Lt. Col. William Marshall for remark. Marshall's reply on June 1, 1904, elaborates on the issues related to the obsolescence of Battery Potter, and also gives some insight as to how the battery operated during that period:

> Respectfully returned to Colonel Amos Stickney, Corps of Engineers, Engineer Office Atlantic Division.
>
> The guns of this battery are raised, lowered, and loaded by hydraulic machinery. Fire is always kept under one of the boilers and a steam engineer kept employed to operate the mechanism of the lift. I understand that with banked fires about 130 tone of coal are consumed each year. In active service many times that amount would be required each year, and additional mechanics, also firemen.
>
> The steam engineer is the only man at Fort Hancock acquainted with the machinery and able to operate it, where as the operation of all guns in our defensive works should be well understood by the enlisted men of the Artillery, as well as by the officers. This is a serious objection in my mind to this battery, especially in view of the cost of maintenance, even when so inadequately provided with men having knowledge of its working parts as now.
>
> The loading and firing of the guns, while not so slow as with the old smooth bore muzzle loaders, are slow operations compared with modern disappearing rifles of the same caliber.
>
> Battery Potter (gun lift) includes the only guns at Fort Hancock, having an unlimited field of fire. The dangerous positions in Sandy Hook Bay that might be occupied by an enemy are covered by the gun lift battery only, being within the inferior limit of the mortar fire. The mechanism of the lift has never been out of order, (except once for about 15 minutes), since its installation. These facts constitute the only reasons for the retention of the battery. There has not been devised an unlimited fire disappearing carriage and emplacement for 12-inch B.L. rifle.

---

[32] Fort Record Book, Fort Hancock, New Jersey, Oct. 1924, p. 10; Entry 224; RG 392; NARA - Northeast Region (NY).

[33] Bearss, *The Sandy Hook Defenses*, p. 118.

[34] Col. G. G. Greenough, Artillery Corps, to Adjutant General, Department of the East, May 22, 1904; File 96; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

> Fort Hancock, without guns covering Sandy Hook Bay, is untenable, and the guns of Battery Potter can be used but awkwardly and extremely slowly when traversed so far to the rear (180 degrees from the elevating and loading position) as to cover Sandy Hook Bay.
> It is recommended that a battery of two 12-inch or two 10-inch B.L.R., and two 6-inch B.L.R., in (sic) disappearing carriages be at once constructed at old Camp Low, to cover Sandy Hook Bay, (and part of Raritan Bay), especially the deep water west of the Hook not now covered by the guns of the Fort, other than gun lift, and that may be occupied by deep draft vessels of war that after the construction of Ambrose channel may pass into the Lower Bay through the main channels, in moderately misty or foggy weather; and that Battery Potter be disarmed and the emplacements of the battery be used for sites for the primary range and position finder stations for which the battery is admirably located; the lower rooms and boilers therein to be used for the central power plant.[35]

While Lt. Col. Marshall's remarks brought up some important points, Chief of Engineers Mackenzie noted that insufficient funds were available to make the changes to Battery Potter, but that estimates for two 6-inch emplacements had been requested.[36] The fate of the guns at Battery Potter was spared for the moment, but this discussion essentially ended the battery's days as a gun emplacement.

Battery Potter is Disarmed, 1906

Since the completion of Battery Potter, the construction of Endicott System emplacements had continued apace at Sandy Hook. The construction of the Mortar Battery was concurrent with that of Battery Potter, and both emplacements were completed by 1894. These two emplacements constituted the beginning of the effort to fortify Sandy Hook in accordance with the recommendations of the Endicott Board.

Additional emplacements included Battery Granger, started in 1896. It was equipped with two 10-inch breech-loading rifles on disappearing carriages in 1898.[37] The nine-gun battery was the next installation, which was composed of four separate emplacements that were constructed next to one another. The first of these was 10-inch Battery No. 2, which was mounted with three 10-inch rifles on disappearing carriages in 1898.[38] 12-inch Battery No. 2 was tied into the right side of 10-inch Battery No. 2, and was armed with two breech-loading rifles on disappearing carriages in 1899 and 1900.[39] In 1900 the combined batteries were named Battery Halleck.[40] Over the next four years, two more emplacements were added to

---

[35] Marshall to Col. Amos Stickney, Corps of Engineers, Atlantic Division, June 1, 1904, 6th endorsement with Col. Greenough's letter to the Adjutant General; File 96; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[36] Mackenzie, 11th endorsement with Col. Greenough's letter to the Adjutant General; File 96; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[37] Bearss, *The Sandy Hook Defenses*, p. 197.

[38] Bearss, *The Sandy Hook Defenses*, pp. 211-216.

[39] Bearss, *The Sandy Hook Defenses*, pp. 217-219.

[40] Bearss, *The Sandy Hook Defenses*, p. 222.

Battery Halleck, each armed with two 12-inch breech-loading rifles on disappearing carriages.[41] In 1904 Battery Halleck was redesignated as four separate batteries: Battery Halleck, Battery Alexander, Battery Bloomfield, and Battery Richardson.[42] The construction and arming of these emplacements made Sandy Hook and Fort Hancock a formidable force in the defense of New York Harbor.

The development of these emplacements made the gun-lift battery increasingly obsolete. Originally a second gun-lift battery had been planned for Sandy Hook, but advances made in the construction and armament of Endicott System emplacements resulted in the substitution of Battery Granger for it.[43] The primary reason for retaining Battery Potter, as elucidated by Lt. Col. Marshall, was the fact that it was the only emplacement that could cover Sandy Hook Bay and Horseshoe (or Spermaceti) Cove. However, plans for a battery at Camp Low that would have three 8-inch disappearing guns and would cover these critical areas began in 1905. Construction of the battery, which was designated Battery Arrowsmith, began in the fall of 1906.

In the meantime, plans for the fire-control system for the emplacements at Sandy Hook had progressed, and Battery Potter was among the sites being considered for the primary fire-control stations (see the subsequent section "Primary Fire-Control Stations"). These plans, and the construction of the battery at Camp Low, essentially sealed the fate of Battery Potter, and plans for its disarmament progressed.

Lt. Colonel Henry L. Harris of the Artillery Corps notified the Adjutant of the Southern Artillery District of New York on August 30, 1906, that the 12-inch guns of Battery Potter had been dismounted and placed on the superior slope of the battery. He also wrote that the carriages would be dismounted in the next three weeks (fig. 52).[44] Though this meant the end of the gun-lift battery as an armed emplacement, it marked the beginning of a new use for Battery Potter.

---

[41] Bearss, *The Sandy Hook Defenses,* pp. 219-228.

[42] Bearss, *The Sandy Hook Defenses*, p. 234.

[43] Col. Henry Abbott, N.Y. Board of Engineers, to Casey, June 21, 1889; File 2776a, p. 14; Correspondence, Blueprints, and Reports Relating to Defense, 1873- 1919; Entry 225; RG 77; NAB.

[44] Lt. Col. Henry L. Harris to Adjutant, Southern Artillery Dist. Of New York (Adjutant); enclosure 15; folder 150; box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

Gun-Lift Machinery Dismantled, 1907 - 1909

Though the guns of Battery Potter had been removed in 1906, the machinery of the gun lift had remained in place. The machinery was inventoried *in situ* in 1907 by Assistant Engineer Hurlbut, and consisted of:

> 2 Scotch Marine Boilers, 90-horsepower, each 9-by-9 foot, with breeching.
> 2 Heavy Duty Pressure Pumps, Worthington make, 20" x 4 ¾" x 15", steam water stroke.
> 1 Boiler Feed Pump, Smith & Vaile make.
> 1 Hot Air Rideler Engine, one-eighth h.p.
> 1 Dynamo, 8 k.w., and 1 case engine 10 h.p. Direct connect and switchboard.
> 2 Hydraulic Lifts, estimated weight, 125 tons each, with cages.
> 2 Accumulators, estimated weight 375 tons.
> 2 Loading Rammers with platforms and fixtures, estimated weight about 2 tons, one dismounted.
> 1 Wheeler High Pressure Condenser, 200 h.p., with 10" circulating pump attached and hot well.
> 1 Iron Cylinder Tank, 5' x 5' x 10', capacity 1,500 galls.
> 1 Boiler Feed Tank, capacity 250 galls
> 2 1-½" Metropolitan Injectors.[45]

For all practical purposes, the old machinery was obsolete. In July 1908, Lt. Colonel Solomon W. Roessler assumed the position of Engineer in charge of the Eastern and Southern Defenses of New York Harbor, following Lt. Colonel Marshall's promotion to Chief of Engineers. Lt. Col. Roessler reported to Marshall that he wanted to have the machinery inspected and condemned on December 26, 1908. General Marshall approved of Roessler's plan, and an inspection of the machinery was ordered.[46]

The subsequent inspection of the machinery determined that most of it was old and nearing the end of its usefulness. Discussions on the best way to use and dispose of the machinery ensued over the next several months. Most of the machinery was considered obsolete and was to be sold as salvage. However, Lt. Col. Harris – the commander of the Coast Artillery Corps (CAC) at Fort Hancock – suggested that the boilers would make a good nucleus for a central heating plant.[47] However, a central heating plant for Fort Hancock was not built. In July, Lt. Col. Roessler notified the Quartermaster that the two Scotch Marine Boilers and related equipment would be turned over to the Quartermaster Department by Assistant Engineer Hurlbut.[48]

---

[45] Assistant Engineer Hurlbut to Marshall, Jan. 23, 1907; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[46] Bearss, *The Sandy Hook Defenses*, p. 152.

[47] Harris to Adjutant, June 11, 1909; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[48] Lt. Col. Solomon W. Roessler to Quartermaster, Fort Hancock, July 2, 1909; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY). No further documentation concerning the disposition of the boilers was discovered.

The public bid for the removal of the remaining machinery at Battery Potter was advertised in June 1909. Marine Metal & Supply Co. was awarded the contract to dismantle and salvage what remained of the gun-lift mechanism. Work progressed on the salvage through October 1909, when Marine Metal ran into problems removing some of the machinery embedded in the floors of the lift-gun elevator shafts. With approval from Lt. Col. Harris, the company used explosives to remove the remainder of the machinery.[49]

The project was practically completed by the close of 1909, but Marine Metal & Supply failed to remove all the remaining pieces of iron. Correspondence between Lt. Col. Roessler and Stephen McArdle of Marine Metal requested the removal of all remaining machinery. This was completed by June, except for some heavy iron that required the use of the Ordnance Department's locomotive crane.[50] By the end of June, Marine Metal had the use of the locomotive crane, and the last pieces of the gun-lift machinery were removed.[51]

Post-Disarmament Maintenance and Alterations, 1906 - Present

1906 – 1915

Though Battery Potter was under the control of the Artillery Corps, the Corps of Engineers was still involved in the maintenance of the structure. The interior magazines of Battery Potter were used by the Ordnance Department for the storage of powder and supplies, as well as the assembly of cartridges. When the fire-control stations were constructed, an interior stairway for access to the terreplein and stations was planned to go through the north gun-lift opening (see the subsequent section "Primary Fire-Control Stations"). The stairway was proposed in planning documents,[52] and the plans depict the stairway. The plans were approved, and the stairway was apparently constructed. However, the existing stairway in that location appears to be more modern, and may have replaced an earlier stairway.

---

[49] Marine Metal & Supply Co. to Roessler, Oct. 30, 1909; endorsed and forwarded Roessler to Harris, Nov. 2, 1909; endorsed by Harris Nov. 4, 1909; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[50] Roessler to Stephen McArdle, Dec. 3, 1909, and McArdle to Roessler, June 2, 1910; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[51] Bearss, *The Sandy Hook Defenses*, p. 154.

[52] Marshall to Mackenzie, Nov. 16, 1906; Vol. IV, p. 396; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).

The Coast Artillery Corps notified the Adjutant at Fort Hancock that the interior rooms used for storage were dangerous, with damp, musty, and unsightly conditions, and the corps asked if the floors would be replaced.[53] Later in the month, Lt. Col. Roessler requested that Hurlbut patch the floor with cheap concrete, which Hurlbut estimated would cost $102.50.[54]

The poor condition of the lighting system at the battery was brought to the attention of Lt. Col. Roessler by Col. Thomas White, Coast Artillery Corps, in January 1911.[55] On February 4, Asst. Eng. Hurlbut forwarded an estimate of $815.75 for a new lighting system for the interior of the battery, which included44 new marine electric-light fixtures.[56] The plans were approved in August 1911, but the budget had been reduced to $500.[57] Hurlbut proceeded with the installation, and had it completed before winter. However, in August 1912, Col. White complained that condensation was causing shorts in the system.[58] This problem was solved by replacing the leather gaskets in the plug boxes with rubber, and drying out the fixtures.

Meanwhile Battery Potter required regular maintenance to keep the interior serviceable. Asst. Eng. Hurlbut observed in January1911 that the two interior iron stairways needed scraping and painting.[59] The work was performed by Engineer troops during that winter.

Exterior Stairway, 1915

Lt. Col. Samuel E. Allen, Coast Artillery Corps, requested in January 1914 that District Engineer Roessler consider the construction of exterior stairways to Battery Potter's terreplein. Lt. Col. Allen argued that this would give the Artillery Corps easier access to the fire-control stations, and would provide the Ordnance Department with better access to, and use of, the interior of the battery for storage.[60] Allen forwarded a sketch of the battery that depicted the possible locations of two exterior stairways (fig. 54). Lt. Col. Roessler advised that the construction of two exterior stairways would be expensive, and he suggested a single stairway. Roessler's position was upheld by Brig. General Dan C. Kingman, Chief of Engineers, and Brig. General E.M. Weaver, Chief of Coast Artillery, who suggested a staircase on the west elevation of the battery, south of the defensible entrance (position "A"

---

[53]Capt. Coast Artillery to Adjutant, Fort Hancock, May 9, 1910; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[54] Roessler to Hurlbut, May 12, 1910, and Hurlbut to Roessler, May 14, 1910; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[55] Col. Thomas White, CAC, to Roessler, Jan. 13, 1911; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[56] Hurlbut to Roessler, Feb. 4, 1911; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[57] Roessler to Hurlbut, Aug. 19, 1911; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[58] White to Roessler, Aug. 14, 1912; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[59] Hurlbut to Roessler, Jan. 11, 1911; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[60] Lt. Colonel Samuel E. Allen, CAC, to Roessler, Jan. 14, 1914; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

on fig. 54). Lt. Col. Roessler called for the stairway to be constructed at the southeast angle of the battery (position “F” on fig. 54).[61] Two sheets of drawings were submitted by the New York District Office to the Chief of Engineers on December 15, 1914, which showed the location of the proposed stairway, as well as the materials and method of construction (plans with “indorsements,” figs. 55-56). The plans were approved by the Secretary of War on January 29, 1915, and the stairway to the terreplein of Battery Potter was constructed during that year.

As indicated by the plans, the exterior stairway at Battery Potter was constructed with cast-iron elements. The stairway was constructed in two sections, with a landing between the sections. The upper section of steps led to the terreplein, where a section of the parapet wall had been removed to allow access from the stairway.

The lower section of the stairway was composed of 10-inch iron treads with a 7 ¾-inch rise between treads. The treads were attached to a 12-inch-wide stringer that ascended approximately 35 feet to the landing. Though the plans did allow for a two-piece stringer on each side, extant evidence suggests that the stairway was built with a single stringer on each side. The stringer was supported by a bracket about halfway up the lower section of the stairway. The bracket was also made of cast iron, and was tied into the exterior concrete wall of the battery. The iron treads were supported by L brackets bolted to the stringer. The lower section had 33 steps up to a cast-iron landing measuring 4 feet 6 inches by 4 feet 7 inches. The upper section of the stairway was constructed in a similar manner as the lower section, but had 9-inch treads with a 9-inch rise. Both sections of the stairway had a railing 1 ½ inches in diameter on both sides, which was supported by 1-inch iron balusters. The iron treads and the landing were cast with a 1 ¼ -inch grid, which was composed of a pattern of raised rectangles measuring one-quarter of an inch by 1 inch, with half-inch holes (fig. 56). The stairway was constructed as planned, and provided the artillery personnel with easier access to the fire-control station on the terreplein of Battery Potter.

1920 – 1974

The main structure of Battery Potter has remained stable over the years. The records reviewed indicated that the iron elements, including the stairway and main doors and gate, were painted periodically.[62]

Review of the historic photographs and investigation of the existing structure indicated that the terreplein of Battery Potter was repaired prior to 1930. The terreplein had originally been covered with flagstone, and the 1901 repairs indicated that the flagstone would be reinstalled over the proposed waterproofing material (see the previous section “The Period 1895-1906”). Photographs from 1906 depict what appears to be a flagstone terreplein with tight joints between the pavers. However, the existing paving consist of 6-foot-square slabs of concrete with approximately 1 inch between each section. The same concrete slabs were

---

[61] Roessler to Allen, April 4, 1914; with endorsement of Brig. Gen. E.M. Weaver, Chief of CAC, May 16, 1914; folder 5, box 33; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA -Northeast Region (NY).

[62] Preservation and Repair, Miscellaneous; folder 16, box 35, Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

depicted in a ca.-1930 photograph of the range-finding instruments and personnel on the terreplein of Battery Potter (fig. 57). The evidence presented by these photographs suggests that water infiltration from the terreplein level of the battery continued to be a problem, and that the flagstones were replaced with concrete in an effort to correct that problem. The concrete appears to be in good condition in the ca.-1930 photograph, which suggests that it was installed not long before then, possibly ca. 1920. The documents reviewed did not provide any further information regarding the replacement of the materials on the terreplein of Battery Potter.

After the guns of Battery Potter had been removed, the concrete platform located near the northwest corner of the terreplein was no longer needed as a range-finding platform. Historic photographs from the World War II period depict the use of the platform for launching and tracking weather balloons, which would help determine the wind speed and assist in accurate positioning of the guns (fig. 58). Those photographs show that the range-finding pier had been removed from the platform by that time. The use of the platform for weather balloons was apparently linked to the meteorological station located in the smaller of the two concrete fire-control station buildings (see the subsequent section "Primary Fire-Control Stations, Maintenance and Alterations").

Battery Potter continued to be used for storage until the end of military use of Fort Hancock in 1974.[63] In 1970, Post Commander Colonel John A. Pierce had Battery Potter tidied up for the 75th anniversary of Fort Hancock. Debris and trash were removed from the interior of the battery, and some of the undergrowth was removed from the exterior. The open house at Fort Hancock held on October 31, 1970, included a bus tour that stopped at Battery Potter.[64]

1974 – Present

Since the Fort Hancock was transferred to the Department of the Interior, the National Park Service has been determined to preserve Battery Potter. At a meeting to determine guidelines for the preservation of Fort Hancock in 1977, it was decided that Battery Potter should receive partial restoration.[65] The General Management Plan (GMP) and GMP Amendment for Gateway NRA called for the rehabilitation of the battery in accordance with *The Secretary of the Interior's Standards for Rehabilitation*.[66]

In 1976 the NPS installed a new interior lighting system at Battery Potter. The system used metal conduit, which was damaged by the high amount of moisture in the battery. The conduit was replaced with the extant plastic conduit in 1990.

---

[63] Bearss, *Historic Resource Study, Fort Hancock, 1948-1974, Gateway NRA, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, November 1982), p. 190.

[64] Bearss, *Fort Hancock, 1948-1974*, pp. 150 – 151.

[65] Jack E. Stark, NARO Regional Director, to Superintendent, Gateway NRA, July 7, 1977. Copy at Northeast Region Offices, 115 John Street, Lowell, MA.

[66] *General Management Plan Amendment: Development Concept Plan and Interpretation Prospectus: Sandy Hook Unit, Gateway National Recreation Area, New York/New Jersey* (U.S. Department of the Interior, National Park Service, January 1990), p. 9.

The Sandy Hook Unit, Gateway NRA, proceeded with a project to stabilize Battery Potter in 1984. The project dealt primarily with the defensible entrance of the battery. The North Atlantic Historic Preservation Center of the North Atlantic Region prepared a set of five plans for the project, and recommended cleaning and repointing the granite-block façade of the entrance. The plans also specified repairs to the concrete floor at the second story of the entrance. In addition, the second-story wooden bridge (figs. 44 and 204) spanning the two ends of the transverse gallery was reconstructed by a contractor.

Battery Potter was also included in the project "Stabilization of Historic Concrete Batteries at Fort Hancock." This project included core testing of the masonry of the battery, and culminated in 1990 in a report with recommendations for stabilization.[67]

More recently, the Sandy Hook Unit has made efforts to address visitor safety and allow guided tours to the roof of the battery. Work performed in 2003 included the removal of loose and failing concrete along the west parapet wall, rehabilitation of the metal exterior stairway on the south side of the battery, and the installation of pipe railing along the top of the gun parapet walls and south of the fire-control stations.

The park is currently in the process of planning the preservation and rehabilitation of three Endicott System gun batteries, including Battery Potter. The Project Management Information System (PMIS) project statement says that the repairs on Battery Potter will focus on deteriorating and falling concrete, and will address visitor safety concerns at the battery.[68] The preservation of Battery Potter will strengthen the park's goal to interpret the history of Fort Hancock and the coastal defenses of the United States.

[67] Todd Rutenbeck, *Stabilization Investigations, Historic Concrete Batteries, Fort Hancock, Sandy Hook Unit, Gateway NRA, New Jersey* (Denver: Bureau of Reclamation, June 1990).

[68] Project Information Management System (PMIS) Project #57952. NPS website, http://165.83.198.10/ pmis_search_projectdetail.cfm.

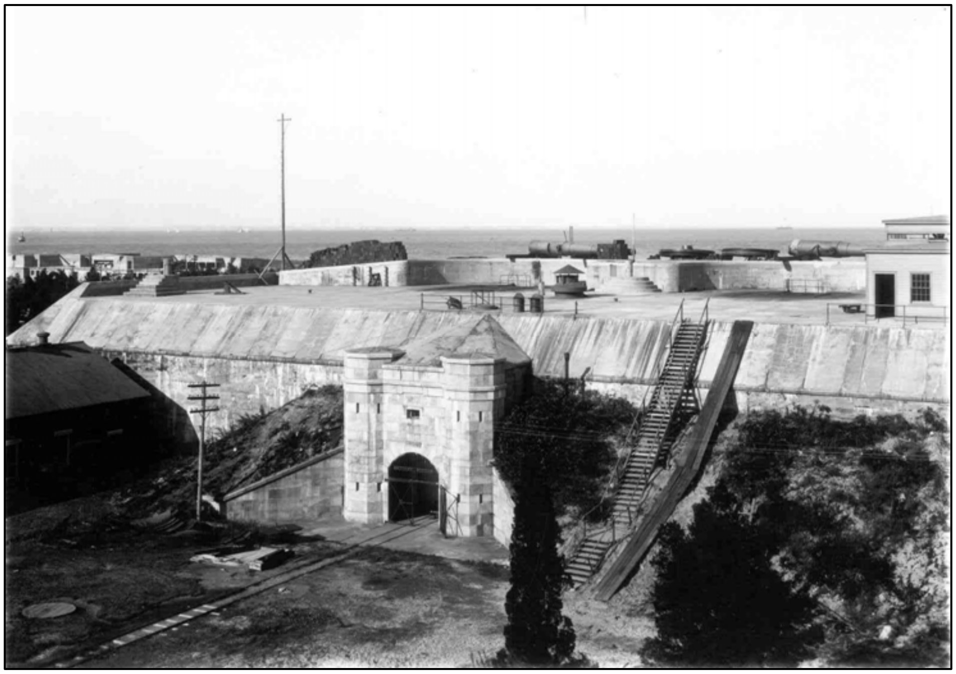


Figure 51. Battery Potter, west elevation and terreplein with 12-inch guns dismounted, circa 1906. Note range-finding platforms at northwest corner and at parapet wall.

Figure 52. Battery Potter, terreplein with 12-inch guns and carriages dismounted, circa 1906. Note range-finding platform at parapet wall behind soldier on right.

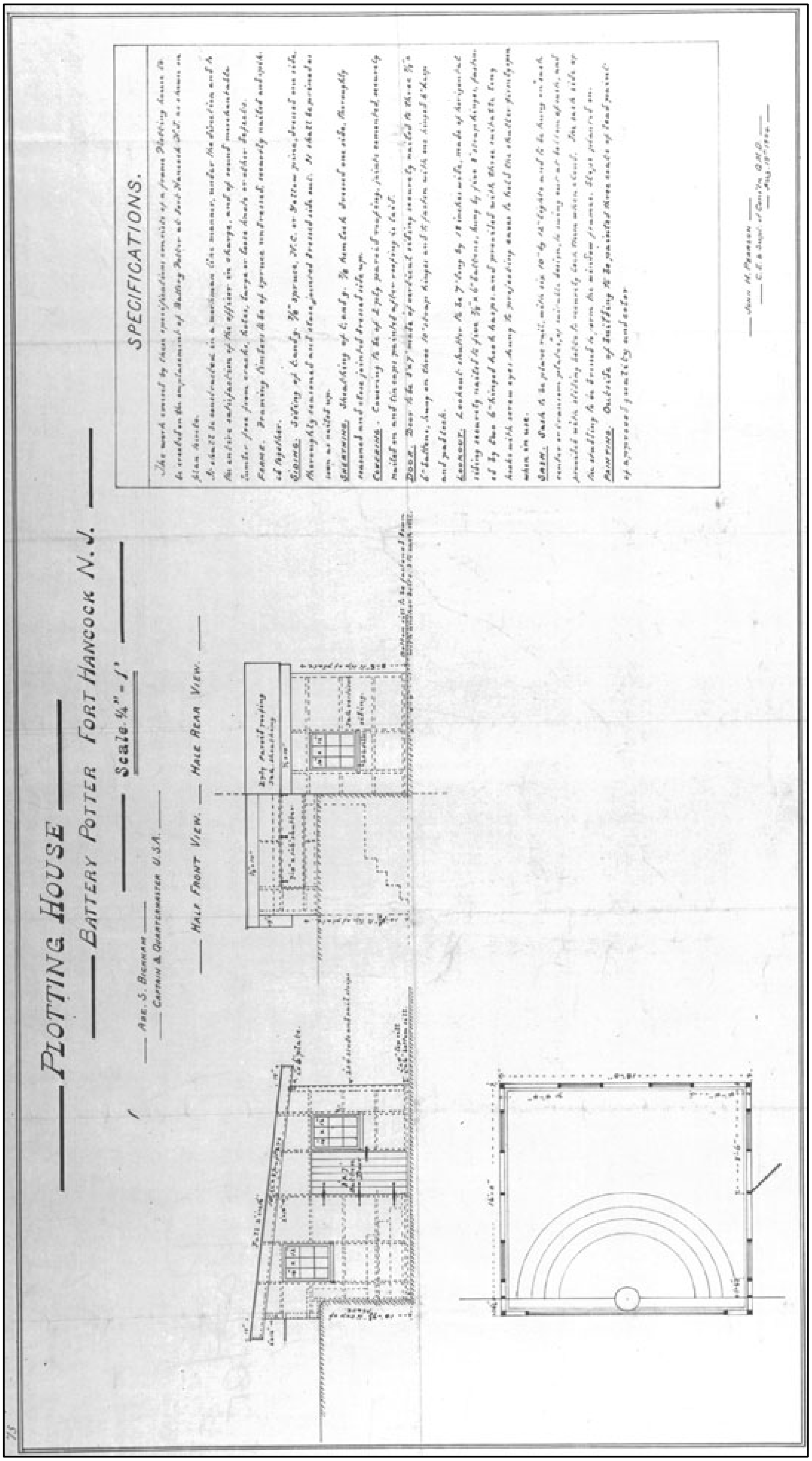


Figure 53. "Plotting House, Battery Potter, Fort Hancock, N.J." Note the plotting house structure to be situated along the parapet wall between the north and south emplacements was apparently not built.

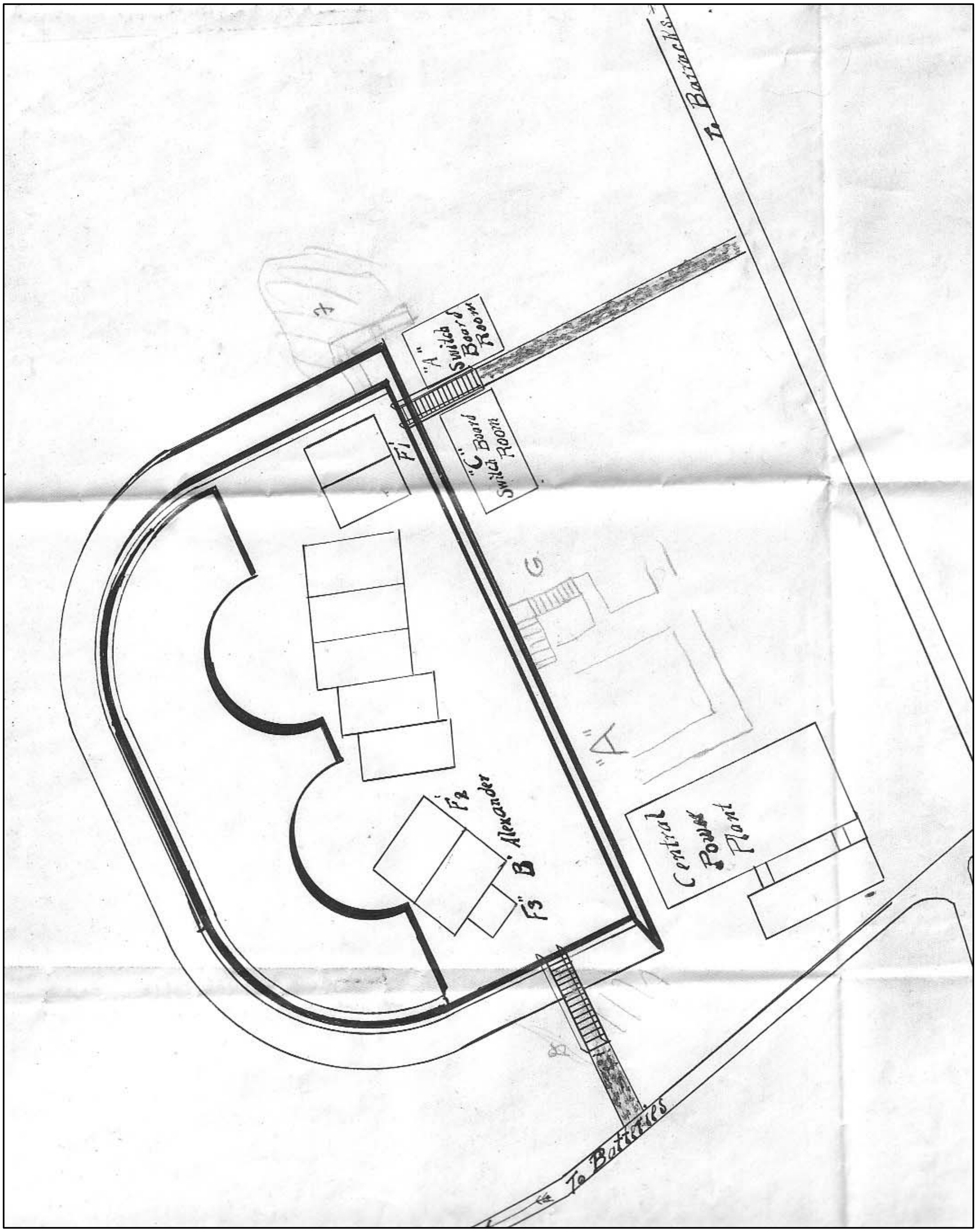


Figure 54. Schematic plan of Battery Potter, showing possible locations for exterior stairways and fire-control stations (1914).

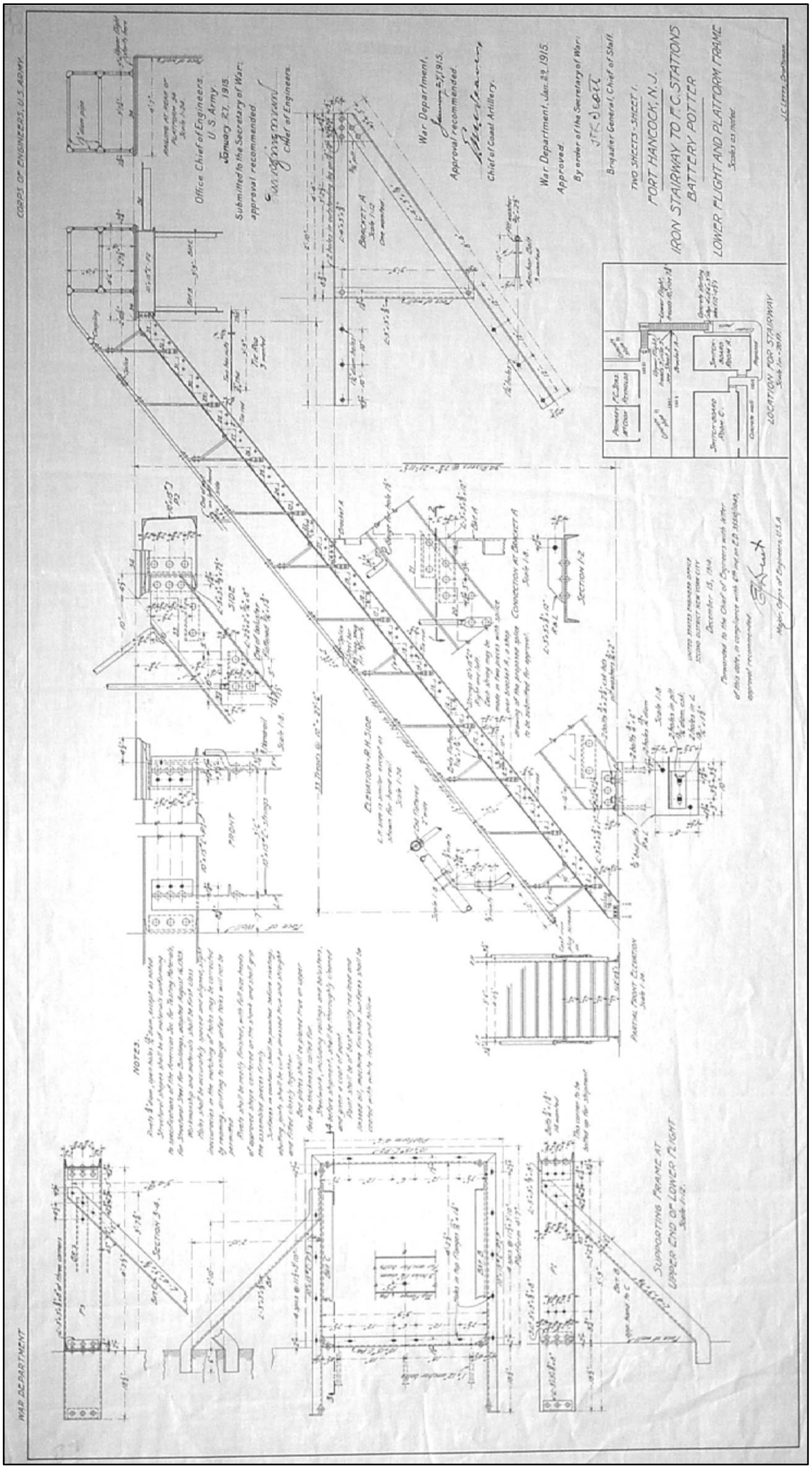


Figure 55. "Fort Hancock, N.J., Iron Stairway to F.C. Stations, Battery Potter, Lower Flight and Platform Frame." Exterior stairway situated at the southwest corner of Battery Potter, Sheet 1 of 2. Drafted by J.C. Letts, January 1915.

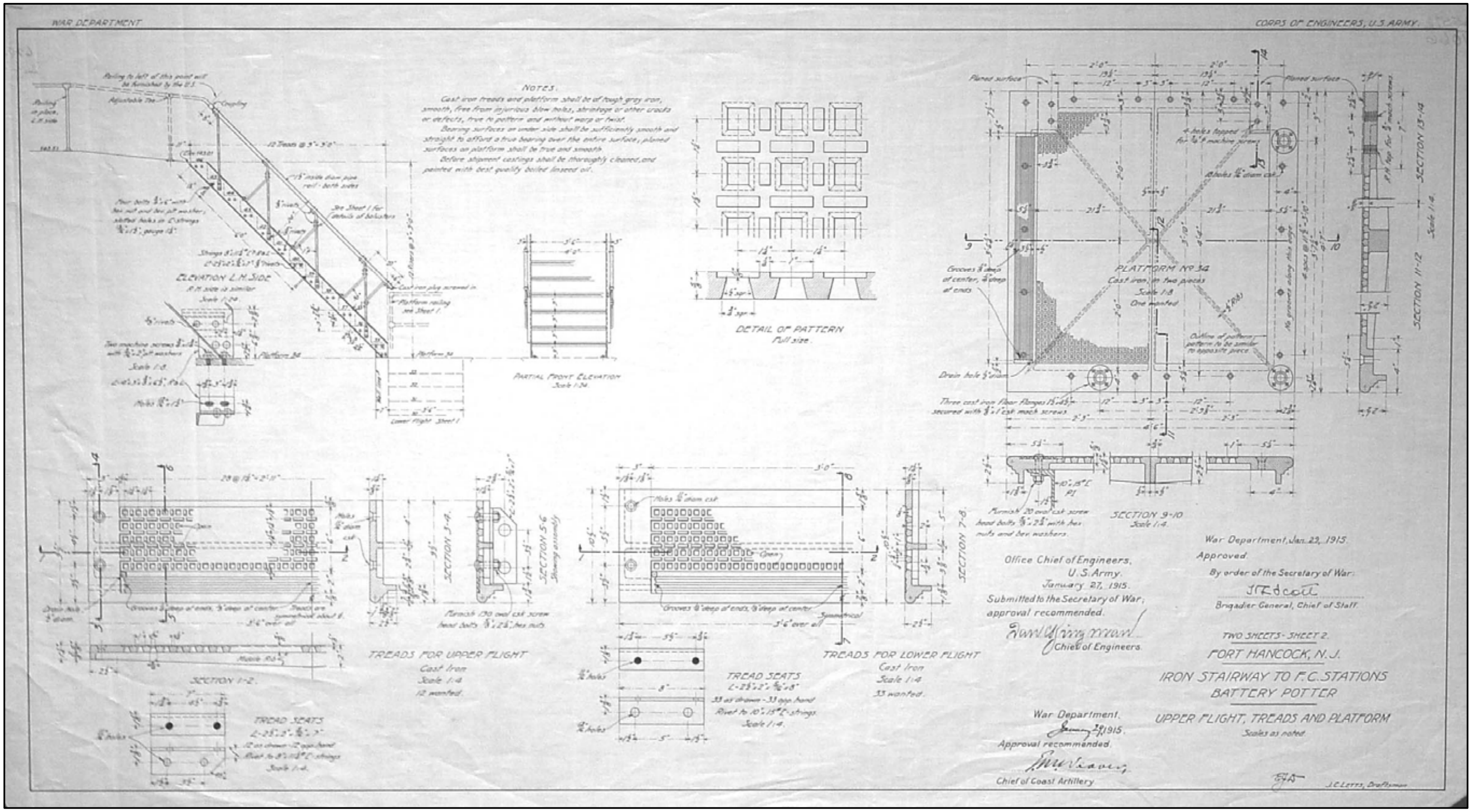


Figure 56. "Fort Hancock, N.J., Iron Stairway to F.C. Stations, Battery Potter, Upper Flight, Treads and Platform." Exterior stairway situated at the southwest corner of Battery Potter, Sheet 2 of 2. Drafted by J.C. Letts, January 1915.

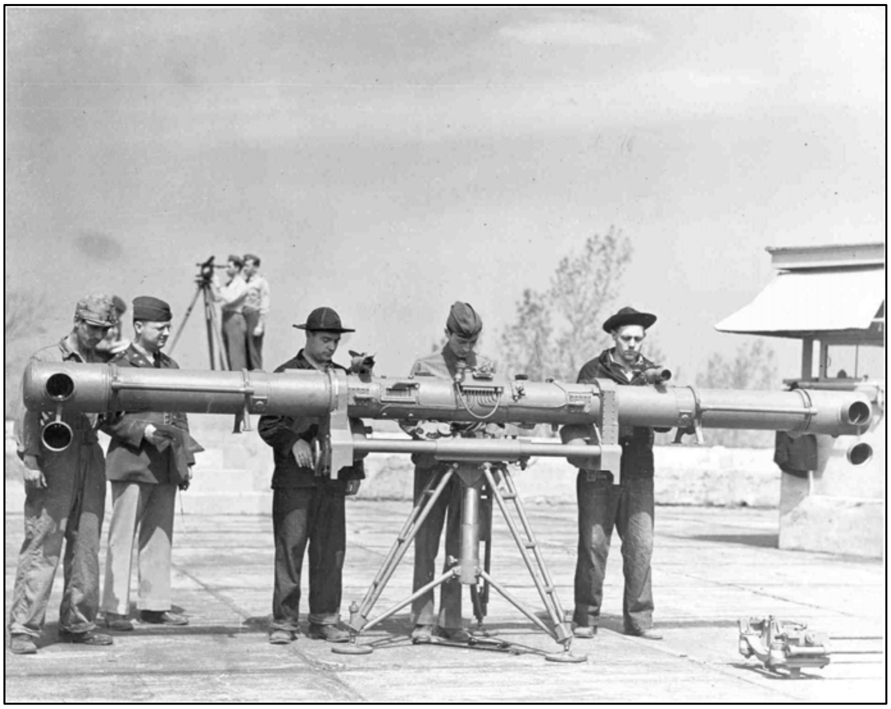


Figure 57. Battery Potter, view of terreplein, showing training of personnel on height finder, ca. 1940. Note the paving of the terreplein is similar to extant paving.

Figure 58. Battery Potter, meteorological personnel checking wind velocity from platform in northwest corner of terreplein, ca. 1940.

Battery Potter – Addition of Primary Fire-Control Stations

Background

The Corps of Engineers, along with the Ordnance Department and the Signal Corps, was charged with developing a fire-control system for the Endicott System emplacements in the late 1890s. The system developed included range- and position-finding instruments, and strategically placed stations to house the instruments. Components of this system were constructed at Fort Hancock beginning in F.Y. 1900 and continuing through 1907.[69]

Lt. Col. Marshall's response of June 1, 1904, to Col. Greenough's May 22 letter to the Adjutant General was the first mention of the possible use of Battery Potter as a location for range- and position-finding stations.[70] Upon investigation of alternate sites at Fort Hancock, and preparation of proposals for fire-control stations at those sites, Colonel Marshall determined that the installation of fire-control stations on Battery Potter's terreplein would save the government $13,000.[71]

Lt. Col. Marshall's correspondence to Chief of Engineers Mackenzie on February 16,1905, included a tracing showing the proposed location of the fire-control stations for the Mortar Battery (Battery Reynolds), as well as the rear elevations of nine buildings clustered in two groups as proposed by the "Harris Board" in 1904 (fig. 59). The letter noted that the nine buildings were planned as low structures with two rooms in each building: one for the observation room, and one for the plotting room. As planned, the level of the observation room floor would be 2 feet 5 inches above that of the plotting room; the instruments in the stations for the Mortar Battery would be mounted 4 ½ feet higher than those in the other stations.[72] It is interesting to note that while the elevation shows two stations for the Mortar Battery and nine stations for other batteries, the plan of the terreplein only depicts the building housing the two stations for Mortar Battery. Apparently the plans for the Mortar Battery stations were more advanced than those for the other batteries. Indeed, more detailed plan and section views of the primary stations for the Mortar Battery were submitted by Lt. Col. Marshall on March 22, 1905 (fig. 60). The building housing the two fire-control stations for the Mortar Battery was constructed during the spring and summer of that year. In September 1905, the Artillery Corps was notified of the completion of the two stations, and it took possession of them in October.[73]

---

[69] Bearss, *The Sandy Hook Defenses*, pp. 129 -132. See Bearss' report for a more detailed discussion of the development of this system on the national level, as well as range and position towers at Fort Hancock, pp. 129-135.

[70] See fn. 34.

[71] Bearss, *The Sandy Hook Defenses*, pp. 136 -137.

[72] Marshall to Mackenzie, Feb. 16, 1905; Vol. III, p. 485; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).

[73] War Department to Commanding General, Atlantic Division, September 25, 1905, with endorsement by Col. Marshall, Oct. 13, 1905; File 35510/532; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

During the following year, plans for the other fire-control stations progressed concurrent with plans for dismounting the guns and carriages of Battery Potter. Lt. Col. Marshall subsequently submitted final plans, which now included only seven primary fire-control stations, to the Chief of Engineers on November 16, 1906 (fig. 61). The seven stations were positioned on the terreplein of Battery Potter adjacent to the parapet wall, and were to be constructed in two clusters; one building with five stations, and one building with two stations. The plans showed the locations of the stations and the plans, sections, and elevations of the two-building cluster, which represented the general layout for all of the structures, as well as construction details (fig. 62). As previously discussed, the plans for the fire-control stations included an access stairway from the interior of the battery through the north gun-lift opening.

Though Battery Potter had been relieved of its duty as the first gun emplacement at Sandy Hook, and the first of its type in the United States, it continued as an important component of the defenses at Fort Hancock.

Construction of Fire-Control Stations for the Mortar Battery

The 1905 building housing the two fire-control stations for the Mortar Battery was placed in the southwest corner of Battery Potter's terreplein, as indicated in the plan (fig. 59). Though the structure is no longer extant, photographs of the exterior and interior indicate that it was built as specified in the plans submitted by Lt. Col. Marshall (figs. 63-64). The following description was derived from historic photographs of the building and the plans drafted by J.C. Letts.

Plan

The March 1905 plans depict a wood-framed structure with an overall size of 33 feet 6 inches wide (north to south) by 30 feet long (east to west). It was divided in half lengthwise, to form two stations; the northern one served the northern pits of the Mortar Battery (designated Battery McCook in 1906), and the southern one served the southern pits (Battery Reynolds).

Each station had the same basic layout on two levels. The first level measured 16 feet 9 inches wide by 30 feet long (exterior measurements), and was further subdivided into two rooms; the west room was the plotting room, and the east room contained the lavatory and a storage area under the stairway. The second level consisted of a single room over the east room of the first story; its exterior dimensions were 16 feet 9 inches wide by 14 feet 10 ½ inches long. This was the observation room, and it had a 360-degree view. (The interior partition wall between the two stations' observation rooms was equipped with glazed sashes so as to not obstruct the sightlines). The plans for the fire-control stations of the Mortar Battery were quite detailed, providing information on layout, framing, and materials.

Foundation

The wood-frame structure was built on a concrete slab measuring 33 feet 6 inches by 30 feet long, which was poured on top of the battery's terreplein. Situated in the east half of each station was a concrete pier for mounting the type- "A" instrument used in the observation room. The octagonal piers were 8 feet 8 inches tall, and tapered from 4 feet 6 inches in diameter at the first level to 3 feet 6 inches at the second-level observation room.

Structural Framing

The plans for the fire-control stations for the Mortar Battery showed some of the structural details. The structure was built on a concrete slab. The 4-inch-square sill was fastened to the slab with three-quarter-inch bolts. The exterior walls and the interior partitions were framed with 2 by 4 studs spaced 16 inches on center. The plates also consisted of 4-inch-square members. The roof framing consisted of rafters, collar ties, and a ridge board, all 2 by 6 lumber. A wide opening between the west and east first-level rooms was framed with a 6 by 8 "yellow pine header" supported by a 4 by 4 post in the exterior wall, and a 6 by 6 post in the interior corner. This header supported the west ends of the second-level floor joists by means of joist hangers. The east ends of the joists rested on a 4 by 4 girt on the east wall, according to the drawings. The floor joists themselves measured 3 by 8 inches. At the second level, an 8-inch steel **I**-beam spanned the east and west walls above the continuous observation-room windows.

Exterior Elements

The exterior of the building was clad with clapboards installed with a 4-inch reveal. The corner boards and trim details were constructed with lumber 4 inches wide by 1 $^{1}/_{8}$ inches thick. The water table was 8 inches high, and was capped with a 3-inch-wide board set at a slight angle.

Plans and photographs depict that the first story of the west elevation had four windows – two per station – measuring 3 feet wide by 4 feet 6 inches high, with double-hung, eight-over-eight sashes. The south and north elevations each had a pair of windows with tilt sashes, each measuring 3 feet 6 inches wide by 2 feet 6 inches high, with eight glazed lights. The tilt sashes were separated by a 4-inch wide mullion; they illuminated the plotting rooms. The east elevation is not depicted in any of the photographs reviewed for this report, so the drawings are the only record of the fenestration here. The plans for the building depict four double-hung windows with eight-over-eight sashes, two per station, similar to those on the west elevation.

As previously mentioned, the second level of the fire-control station was the observation room. At that level, the building was equipped with what appeared to be fixed sashes extending all the way around the building, providing a 360-degree view. The sashes measured approximately 3 feet 4 inches wide by 1 foot 2 inches high, and each sash held a single pane of quarter-inch plate glass.

The west elevation of the structure had two entry doorways on the first level, one for each station. The doors in each doorway were 3 feet wide by 7 feet high, with three horizontal panels below a large single pane of glass. The plans and photographs of the building indicate that these were the only points of entry to the fire-control stations.

The west half of the first level was covered with a half-hipped roof, and the second story of the building was built with a hipped roof. The plans indicate that the original roof covering on the second level was "tin roof on 1¼ inch T & G boards with paper between." The same materials were specified for the lower half-hip roof, and drip guards were installed over the doorways. Though photographs do not provide enough detail to determine the roof covering, it is likely that the materials specified in the plan were used.

Interior Elements

First Level

The first level had two rooms, as explained previously. The interior of the west room, which served as the plotting room, measured 16 feet wide by 14 feet 9 ¼ inches deep. The east room was the lavatory and storage room, and its interior measurements were 16 feet wide by 14 feet 2 ¾ inches deep. The plans indicate that the walls of both rooms were covered with tongue-and-groove boards 3 inches wide. A photograph of the interior depicts vertical boards (presumably tongue-and-groove) covering the interior walls, which appear to have been similar to the type of boards typically used for wainscoting (fig. 64). The same material was apparently used on the ceilings.

Each plotting room had two double-hung windows on its west wall and a pair of windows with tilt sashes on its other exterior wall (the north wall for the northern half, and the south wall for the southern half). Additionally, the plotting room had an opening in the east wall approximately 7 feet 8 inches above the floor level that opened into the observing room on the second level; this provided communication between the two rooms. Three louvered sliding panels were installed in this opening. Each lavatory room had two double-hung windows on its east wall, based on the plans.

In each station, the stairway leading from the first level to the second level was situated along the north wall. The first four steps ascended east to a landing, which was equipped with a doorway and door. From the landing, eight steps ascended north to the second level. Another doorway with door led to a storage area underneath each stairway. The interior doors were constructed with four vertical panels, and measured 2 feet 3 inches wide by 6 feet 10 inches high.

Second Story

The interior of each station on the second level was one open room measuring 16 feet wide by 14 feet deep. As previously mentioned, both observation rooms had a 360-degree view. This was possible because the partition between the two stations was constructed with an opening that ran the entire depth of the building. The opening was 4 feet 3 ¼ inches above the floor level, and was equipped with five sashes; three of these were horizontal sliding sashes, and two were swinging sashes.

The plans indicated that the walls and ceilings on the second level were covered with the same material as the first-level rooms. The floors on the second level, as indicated by the plan, were constructed of yellow pine floor boards seven-eighths of an inch thick, laid over a subfloor of spruce boards.

At this level, the concrete pier was covered with a "drum" that was 1 foot above the floor level. The type-"A" instrument was mounted on this pier. South of the pier was a pedestal for the type-"B" instrument. The windows on the second level were constructed so that the horizontal axis of the type-"A" instrument had an unobstructed view.

Assistant Engineer Hurlbut informed Lt. Col. Marshall that the two primary stations were completed and ready for transfer to the Artillery Corps on September 20, 1905. The transfer of the primary fire-control stations for the Mortar Battery took place on October 9, 1905.[74]

Construction of Seven More Primary Fire-control Stations

Lt. Col. Marshall wrote to the Chief of Engineers on November 16, 1906, forwarding plans and a brief description of the seven additional primary fire-control stations (figs. 61-62). Among other items, Marshall noted that the primary stations for Richardson, Granger, and Gunnison – at the southern end of the fire-control stations – would not have a complete view over the field of fire without the removal of the fire-control stations for batteries Reynolds and McCook.[75]

Marshall's drawings for the primary fire-control stations depicted details of the design of the seven-station complex. This was to consist of two structures, one containing two fire-control stations and one containing five stations. In particular, the plans showed the construction details of the primary station for Battery Alexander.[76] One of the plans depicts the organization of the fire-control stations and which battery they were designated to serve (fig. 61). The two-station unit was situated behind the former north gun emplacement of Battery Potter. In that building, the control station for Alexander was on the left, and Fire Commander Station No. 2 was on the right. Fire Commander Station No. 2 later became the fire-control station for Battery Peck. The five-station building was situated behind the former south gun emplacement of Battery Potter. From left to right, the stations served Halleck, Bloomfield, Richardson, Granger, and Gunnison.

[74] Hurlbut to Marshall, Sept. 20, 1905; enclosures 27 & 29; folder 45; box 31; Letters Received Sandy Hook 1901-1902; Entry 829; RG 77; NARA - Northeast Region (NY).

[75] Marshall to Mackenzie, Nov. 16, 1906; Vol. IV, p. 396; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).

[76] Marshall to Mackenzie, Nov. 16, 1906; enclosure 753; File 35510; General Correspondence 1894 - 1923; Entry 103; RG 77; NAB.

The following description of the fire-control stations relied on extant building materials, historic photographs of the buildings, and the drawings by draftsman J.C. Letts. Since the two buildings had different orientations, the description refers generally to front and rear elevations. The front elevation refers to the elevation facing the ocean, which was north of the two-station building and east of the five-station building. Obviously, the rear elevation is the one opposite the front elevation.

Plan

The seven primary fire-control stations were planned as one two-station building and one five-station building. Both buildings were lower than the fire-control stations for the Mortar Battery, and were protected to the east by the parapet wall of Battery Potter. The two-station building was situated by the parapet of the former north gun, and faced due north. The five-station building was situated at an angle across the parapet of the former south gun, and faced east. The plans and the extant structures demonstrate that the seven fire-control stations shared the same basic layout. The minor differences between the stations, evident in the plans and the existing buildings, were the beveled corners of the observation rooms and the roof configurations (fig. 61).

Each station was built with two rooms, a plotting room and an observation room. The plotting room was the first room upon entry, and was located at the rear of the station. It measured 16 feet wide by 17 feet 6 inches deep. The observation room was approximately 2 ½ feet higher than the plotting room, and was at the front of the station. It measured 16 feet wide by 14 feet deep. The front corners of some of the observation rooms were beveled (fig. 61). This, combined with the added height and orientation of the observation rooms, provided the required angle of view for the instruments installed in each room.

Foundation

Work began on the stations in the spring of 1907. Upon the removal of Battery Potter's guns, the gun pits were covered with reinforced concrete supported by steel I-beams. The fire-control stations were built on top of Battery Potter's terreplein. The structures were concrete, and the lower level (plotting room) was constructed with a concrete slab foundation. The lower 2 feet of the concrete walls of the observation room were 12 inches thick, forming a sill that carried the floor framing for the room.

Exterior Elements

The exterior walls of the fire-control stations were constructed of reinforced concrete with a relief panel above the water table. The typical wall was 8 inches thick, and was reinforced with half-inch vertical rebar spaced 12 inches on center. The rebar in the front walls ran horizontally to accommodate the window opening of the observation room. The sections of concrete above the window openings were reinforced with twisted rebar.

The observation room was built with a band of windows that extended across the entire front elevation of each station. The typical sash was 3 feet wide by 1 foot 3 inches high, and was glazed with quarter-inch polished wire glass. The sashes of the observation room were hinged at the bottom and tilted outward. When in the open position, the sash rested on a galvanized pipe held with galvanized brackets. A galvanized iron awning was positioned over the band of windows to reduce sun glare.

Each station had two windows on the rear elevation that had double-hung, two-over-two sashes with wire glass. The windows measured 3 feet wide by 5 feet high and opened into the plotting room. The window casings were constructed with metal-clad pine trim.

Each station also had a single exterior doorway on the rear elevation. The doors were 3 feet wide by 6 feet 10 inches high. They were paneled doors with a single window glazed with ribbed wire glass above two horizontal panels. The doors were surrounded with metal-clad trim in the same manner as the windows.

The roof configurations of the two buildings varied, as illustrated by the drawings (figs. 61-62). The plotting room of each station was covered with a shallow half-hip roof with a ventilating skylight installed at the ridge. The skylight was glazed with ribbed wire glass. The roofs were supported by 2 by 8 rafters attached to a 2 by 8 plate bolted to the top of the concrete wall. The ridge was also constructed with 2 by 8 lumber, and the skylight opening was framed with 2 by 8 stock.

The observation-room roofs were slightly higher than the roofs of the plotting rooms, and they varied in design. The two-station building had a single hip roof over both observation rooms. The five-station building had one hip roof over the observation rooms of the three southernmost stations; the observation rooms of the other two stations in this building had their own hip roofs. The plate, rafter, and ridge construction of these roofs utilized 2 by 8 lumber similar to the roofs of the plotting rooms. However, due to the band of windows along the front elevations, special steel-plate roof supports were used in the corners of the observation room roofs. These supports extended from the window sill to the concrete header that supported the plate and rafter system, and were embedded in the concrete (fig. 62).

All of these roofs had a shallow pitch, and the plans specified "Economite" tile roof over tongue-and-groove boards. Based on the examination of historic photographs and extant building materials, it was not possible to determine the original roofing material.

Interior Elements

As previously discussed, each station was divided into two rooms. The partition wall between the two rooms of each station was reinforced concrete. The plotting room was open, and historic photographs indicate that it was typically equipped with a plotting table and radios. The partition wall had three openings in it. On the left side of the wall was the doorway to the observation room. An opening roughly centered on the partition wall and 5 feet above the floor also opened into the observation room. The opening was 3 feet wide and 2 feet 6 inches high, and had a louvered shutter that could slide horizontally. The third opening in the partition wall was in the right corner at the ground level. This opening provided access to the area below the observation-room floor, where utility pipes and wires were run for the stations.

The doorway to the observation room held a paneled door with one glazed pane of ribbed wire glass over three horizontal panels. Three steps ascended to the floor level of the observation room.

The observation room was an open room with a band of windows along the front elevation. The room was equipped with a concrete pier for a type-“A” instrument. The pier was located 3 feet from the front wall and was centered side-to-side. A semicircular seat was constructed around the back of the pier. The pier was positioned so that the type-“A” instrument’s horizontal axis was at reference 52.0 (52 feet above the mean low water level). The observation room also had shelves for two type-“B” instruments. As noted by Lt. Col. Marshall, the Commanding Officer at Fort Hancock was consulted on the exact location of the instrument piers.[77]

The interior masonry of the fire-control stations was trimmed with some wooden architectural elements, which were depicted in historic photographs, and which are in some cases extant (fig. 65). The window and doorway surrounds were constructed with molded boards and corner blocks with a radial design. The window sills in both rooms were trimmed with a plain board fascia with a beaded edge and a quarter-round elliptical molding between the sill and fascia. The ceilings of both rooms were constructed with tongue-and-groove yellow-pine bead board, which was also used to finish the skylight opening in the plotting room. Other wooden elements in the rooms included nailing strips along the top of the walls, and wire moldings.

The drawings specified that the interior concrete walls of the fire-control stations would be painted a light color. The extant paint evidence revealed several layers of paint. The paint layers were not analyzed for this report, but a cursory examination of the paint evidence revealed paint colors ranging from white and light gray to light-green and khaki green.

Completion

Lt. Col. Marshall notified Chief of Engineers Mackenzie on November 16, 1907, that Hurlbut and his crew had completed seven primary fire-control stations and one secondary station on the terreplein of Battery Potter.[78] Though the drawings did not depict the secondary station, it was apparent that the station was added to the left/west side of the two-station building for Battery Alexander and Battery Peck. The secondary station was a one-room structure that measured 12 feet square, but was otherwise constructed in the same manner as the adjacent structures.

[77] Marshall to Mackenzie, Nov. 16, 1906.
[78] Bearss, *The Sandy Hook Defenses*, p. 145.

This station was apparently added to serve as a secondary, observation station for Battery Arrowsmith, which was under construction at the time. Indeed, Lt. Col. Marshall had gotten permission and funding approval from the Chief of Engineers to construct – among other buildings – one secondary station for the 8-inch battery (Arrowsmith).[79] This also concurs with the Fort Record Book, which noted that the secondary station for Battery Arrowsmith with the designation of F"3 was completed on November 10, 1907.[80] This station was first depicted in a ca.-1907 photograph of Battery Potter (fig. 66), and on a 1914 diagram of the battery, which labeled the structure F"3 (fig. 54).

On December 12, 1907, the seven new primary fire-control stations on Battery Potter were transferred to the Coast Artillery at Fort Hancock.[81] They immediately became an important part of the defenses at Sandy Hook (fig. 66).

Maintenance and Alterations for the Primary Fire-Control Stations

The first repairs to the fire-control stations occurred in March 1910, when Assistant Engineer Hurlbut wrote Lt. Colonel Roessler that the roofs of the primary stations needed repairs. Later that month, he also reported that the windows of the Mortar Battery station had been broken, and that the siding loosened when the 12-inch rifles at Battery Bloomfield were fired.[82]

The guns of the nearby batteries also affected other elements of the fire-control stations. Hurlbut reported to Roessler the deteriorated condition of the doors and sills of the stations on October 5, 1912, noting that the shock waves from the guns and lack of regular maintenance had contributed to the poor condition of the metal doors. It was suggested that the rusted parts be removed, and that the doors and woodwork be painted with a mix of one pound of lamp black to 10 gallons of oil.[83]

It was also noted that the metal-clad trim around the doorways and windows of the fire-control stations was in need of repair. However, that work was left to the Artillery personnel to accomplish when better weather arrived.[84]

During World War I, Battery Potter continued as the location of the primary fire-control stations for the active batteries. In the winter and spring of 1920, the guns and carriages of the Mortar Battery were dismantled, and the wood-frame fire-control station was no longer needed for that emplacement. The documents reviewed indicated that the fire-control

[79] Mackenzie to Marshall, Dec. 5, 1905; enclosure 14; folder 150; box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA -Northeast Region (NY).
[80] Fort Record Book, Fort Hancock, New Jersey (revised Nov. 4, 1942), p. 65; Entry 224; RG 392; NARA - Northeast Region (NY).
[81] Bearss, *The Sandy Hook Defenses*, p. 145.
[82] Bearss, *The Sandy Hook Defenses*, pp. 146 – 147.
[83] Bearss, *The Sandy Hook Defenses*, p. 147.
[84] Bearss, *The Sandy Hook Defenses*, p. 157.

stations received regular maintenance during the 1920s, and continued as an important part of the defenses at Fort Hancock.[85]

During the 1930s, the number of troops stationed at Fort Hancock was reduced, and several of the batteries were put on reserve status. Batteries Reynolds and McCook (i.e., the Mortar Battery) had been disarmed since 1920. The early fire-control system was becoming outdated, and new range-finding towers and fire-control stations were being constructed. The fire-control stations atop Battery Potter thus became available for new uses.

With the advent of World War II and Fort Hancock's status as the New York Harbor Defense Command Post (HDCP), the two former stations for the Mortar Battery were converted to the Harbor Entrance Control Post (HECP) signal station.[86] "Advanced Harbor Entrance Control Post #1" (HECP #1) was established in the former fire-control station for the Mortar Battery on Battery Potter on May 1, 1943, and functioned as an important part of the defense system for New York Harbor. The mission of HECP #1 was to identify all ships proceeding toward New York Harbor, and to determine whether r not they were a threat. The second part of the HECP's mission was to deny the enemy an opportunity to launch a surprise attack. The station on Battery Potter continued in this mission until operation ceased at 2400 hours on June 18, 1945.[87]

As part of the HECP, a CXAS radar unit was positioned on top of Battery Potter. The documents reviewed did not indicate the exact location of the radar unit, but a photograph from 1951 does show additional towers on the former fire-control station building for the Mortar Battery (fig. 67). These towers were most likely related to the HECP station in that building, which was the last known use of the building.

Also during World War II, the primary fire-control stations for Batteries Peck and Gunnison atop Battery Potter were discontinued. The smaller concrete structure on the north side of the terreplein that had originally housed the primary fire-control stations for Peck and Alexander was converted to a signal station and a meteorological station. The signal station was later moved to a new location, but the building did continue in use as a meteorological station.[88] The five-station structure on Battery Potter became a Command and Observation Post for the HDCP. It served as such until it was deactivated on March 1, 1944.[89]

The HECP and HDCP were apparently the last official uses of the fire-control stations on Battery Potter. During the remaining active years of Fort Hancock, the stations were vacated. After the deactivation of the New York Harbor Defense program in 1950, it appeared that the fire-control stations on Battery Potter received minimal maintenance. The closing of Fort Hancock in 1950 and its subsequent reactivation during the Korean War did not appear to include further use of the stations on Battery Potter. A photograph dated "12/56" depicts the

---

[85] Preservation and Repair, Miscellaneous; folder 16, box 35, Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[86] Fort Record Book, p. 126.

[87] Major C.G. Bovis, Coast Artillery Corps, "History of HECP [Harbor Entrance Control Post], Fort Wadsworth, New York," Section I, pp. 1 – 2, and Section III, p. 6. Copy at Gateway NRA, Sandy Hook.

[88] Bearss, *The Sandy Hook Defenses*, pp. 158 – 159.

[89] Fort Record Book, p. 32.

smaller station at the north end of the terreplein as an apparently abandoned structure (fig. 68).

Edwin Bearss recommended refurnishing and interpreting one of the primary fire-control stations in his *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948*.[90] However, the park has been concerned about safety issues of Battery Potter, due to the deteriorated condition of the stations and the terreplein. Though the terreplein and superior slope of the battery is currently open for guided tours, the park would like to open the roof to unescorted visitors. The current plans for the rehabilitation of Battery Potter will further address visitor safety concerns, and will include modifications that will allow visitor access.[91] Though this does not include access to the stations, visitors would have a better opportunity to view the structures from the terreplein of the battery.

Battery Potter – Related Structures

Background

Historic photographs from the early 20th century, as well as plans from the World Wars I and II eras, depict other buildings that were constructed around Battery Potter in support of Fort Hancock and the functions of the primary fire-control stations (figs. 69-70). In addition, a 1915 photograph shows an encampment of the "Range Section" west of the battery (fig. 75).

The following descriptions were based on previous reports, observations of existing structures, and historic photographs of the buildings. The dormitories and some of the other buildings are no longer extant. However, the buildings adjacent to the west elevation of Battery Potter, including the power plant, coal shed, and switchboard rooms, survived. The extant structures provide a context for the development of the area around the battery from soon after its construction, through its use as a location for the primary fire-control stations.

Central Powerhouse and Coal Shed

The central powerhouse was constructed in 1901-02 to service the coast defenses. The building was a one-story structure constructed with brick walls, a stone foundation, concrete floors, and a slate roof.[92] The exterior walls had a belt course level with the tops of the windows, and quoins at the corners. The windows and doorways had similar quoins on either side, and had limestone lintels and sills. The west elevation had two oculus windows in

[90] Bearss, *The Sandy Hook Defenses*, p. 160.
[91] PMIS Project #57952.
[92] Fort Record Book, p. 118; Harbor Defenses of New York, 1901 – 1942; Entry 224; RG 392; NARA - Northeast Region (NY)? See also Bearss, *Historic Resource Study, Fort Hancock, 1895-1948, Gateway National Recreation Area, New York/New Jersey* (Denver: U.S. Department of the Interior, National Park Service, May 1981), p. 226.

the gable section of the wall. The powerhouse contained the boilers and the transformers that powered the electrical lighting system for Fort Hancock.[93]

The boiler in the powerhouse was fed from two coal bins located on the north side of the building. In 1903 a coal shed was constructed to the north of the powerhouse, and the bins were removed. The building was a 20- by 40-foot brick structure with a south-sloping shed roof. Coal was delivered to the shed from a railroad spur that was extended along the north side of the structure.[94]

The central powerhouse and the coal shed are extant, and are currently used for storage.

Switchboard Rooms

Two switchboard rooms to be located near the southwest corner of Battery Potter were being planned in 1906. On June 8, 1906, Lt. Col. Marshall notified Chief of Engineers Mackenzie that the plans had begun,[95] and one month later he forwarded the preliminary plans to the Chief Signal Officer, Department of the East, New York.[96] On October 8, 1906, Lt. Col. Marshall informed Assistant Engineer Hurlbut that $4,000 had been allotted for the construction of the two switchboard rooms.[97]

Marshall's instructions to Hurlbut were to build the two switchboard rooms in accordance with the plans sent to him dated September 20, 1906. Marshall also said that window details and locations for the buildings were included on an enclosed blueprint. Hurlbut was further instructed to build the floors of the rooms last, and that they should be constructed in accordance with the requirements of the Signal Corps.[98]

The plans for the buildings called for one type-"A" switchboard room and one type-"C" switchboard room (fig. 71). The plans for the smaller building, type "A," called for two rooms; one was 4 ½ feet wide by 15 feet long, and the other was 15 feet wide by 20 feet long. The plans for the larger building, type-"C," also included two rooms; one was 19 feet wide by 19 ½ feet long, and the other was 19 feet wide by 19 feet long. In each of the buildings, one of the two rooms was to be used for the storage battery.[99]

---

[93] Bearss, *Fort Hancock, 1895-1948*, p. 225.
[94] Bearss, *Fort Hancock, 1895-1948*, p. 226.
[95] Marshall to Mackenzie, June 8, 1906; Vol. IV, p. 306; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).
[96] Marshall to Lt. Col. George P. Scriven, Chief Signal Officer, Dept. of the East, New York, July 10, 1906; Vol. IV, p. 396; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).
[97] Marshall to Hurlbut, Oct. 8, 1906; Vol. IV, p. 381; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).
[98] Marshall to Hurlbut, Oct. 8, 1906.
[99] Bearss, *The Sandy Hook Defenses*, p. 142.

The buildings were constructed from reinforced concrete that was scored to resemble a rusticated stone exterior. The low-pitched gable roofs were apparently covered with tile roofing that was pierced by ventilators and one chimney per building. The windows of the buildings had double-hung, two-over-two sashes, and the exterior doorways were fitted with five-panel doors. The two switchboard rooms were completed in October 1907 and transferred to the Coast Artillery Corps on October 25, 1907.[100]

The switchboard rooms are extant, and have been preserved and maintained by the park.

Battery Commander's Tower

Edwin Bearss noted that a 60-foot range-finder tower and shelter house were constructed for Battery Potter in1899.[101] Historic photographs and plans depict a tower west of Battery Potter that was originally constructed as the battery commander's station/tower and range-finder shelter for the battery (fig. 72). The "Report of Completed Works – Seacoast Fortifications" compiled in July 1921 documents that the "Battle Commander Station" was located on a tower approximately 300 feet to the rear/west of "emp. #1 old gun lift battery." The location and description appear to match the tower built in 1899. The tower was described as being constructed with wood and steel, and the station atop the tower was sheathed with galvanized iron.[102]

A World War II map of Sandy Hook indicated that this structure was the "Command & Observation Post Hancock Groupment C -1" (fig. 70). The tower and station were used at Fort Hancock through World War II. The concrete base of the tower remains west of Hudson Road, but the tower is no longer extant.

Dormitories

Lt. Col. Marshall's correspondence to Fort Hancock's Commanding Officer in 1906 indicated that two dormitories would also be erected near Battery Potter for the accommodation of personnel assigned to the primary fire-control stations.[103] The plans for the dormitories for officers and enlisted men were forwarded to the Chief of Engineers on February 14, 1908. The dormitories were to be constructed with reinforced concrete in a manner similar to the switchboard rooms. The plans were approved by Brig. Gen. Mackenzie on February 20, 1908, and the dormitories were subsequently built.[104]

---

[100] Bearss, *The Sandy Hook Defenses*, p. 143.

[101] Bearss, *The Sandy Hook Defenses,* p. 131.

[102] "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921"; RG 77; NARA - Northeast Region (NY). See also Bearss, *The Sandy Hook Defenses*, p. 131.

[103] Bearss, *The Sandy Hook Defenses*, p. 142.

[104] Marshall to Mackenzie, Feb. 14, 1908; with approval of Mackenzie, Feb. 20, 1908; File 35510/922; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

The 1921 “Report of Completed Works” documents two dormitories associated with the fire-control structures, which appear to be the dormitories erected west of Battery Potter. The report documents that the buildings were located northwest of the “Battle Commanders Station,” which was west of Battery Potter. One building was an officers’ dormitory, which measured 16 feet 8 inches wide by 28 feet long (fig. 73). The second was an enlisted men’s dormitory that measured 24 feet wide by 70 feet long (fig. 74). The report further documented that both structures were constructed with concrete, and the roofs were covered with “Indian Red” asbestos shingles.[105] The location and description of the dormitories suggest that these were the structures erected for the personnel assigned to the primary fire-control stations.

Both of these structures were depicted in early 20th-century photographs and maps (figs. 69-70). The dormitories served the personnel at Battery Potter through World War II, but are no longer extant.

[105] “Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921.”

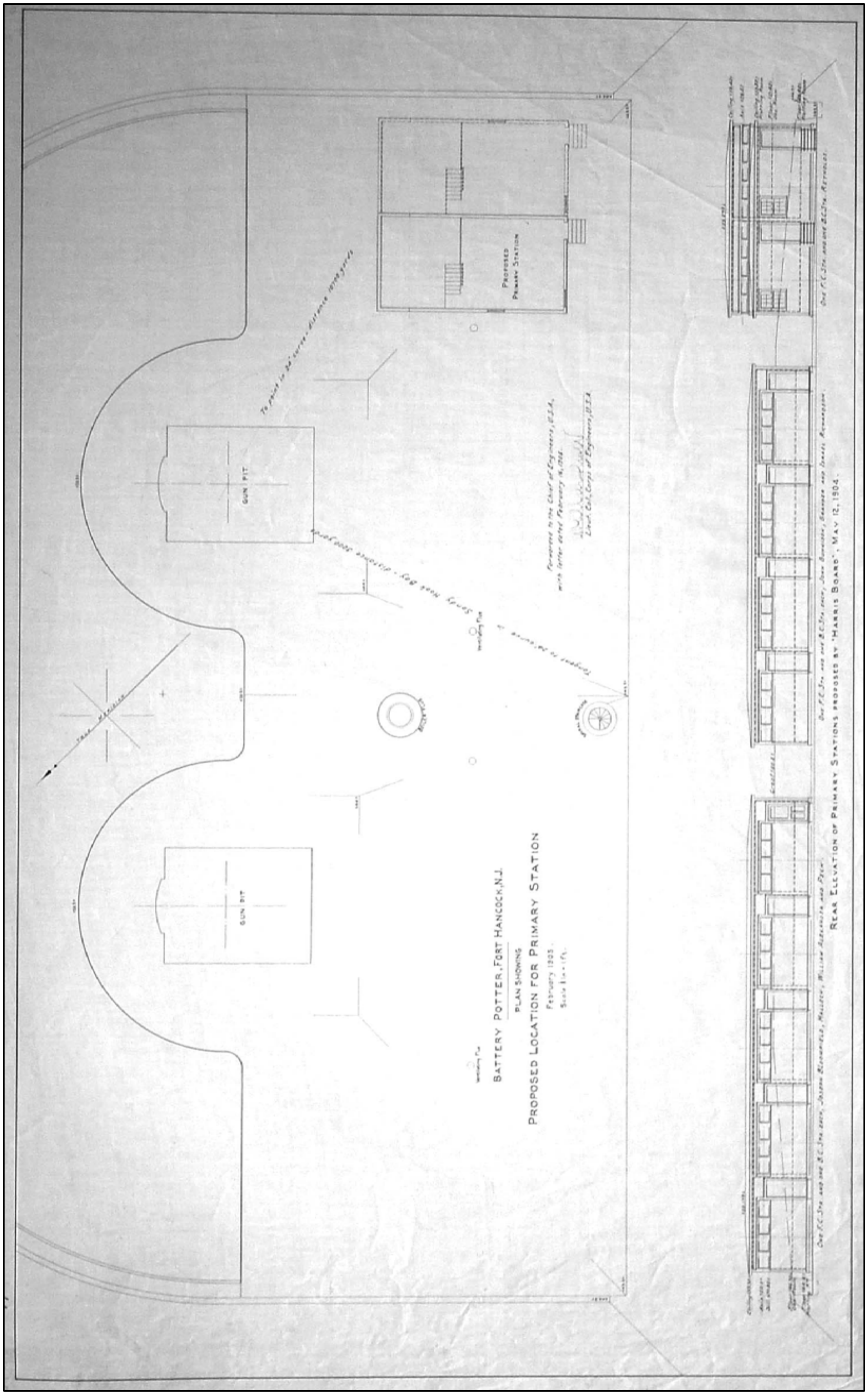


Figure 59. "Battery Potter, Fort Hancock, N.J. Plan Showing Proposed Location for Primary Stations. February 1903." Shown is location of stations for Mortar Battery and rear elevations of stations proposed by the "Harris Board."

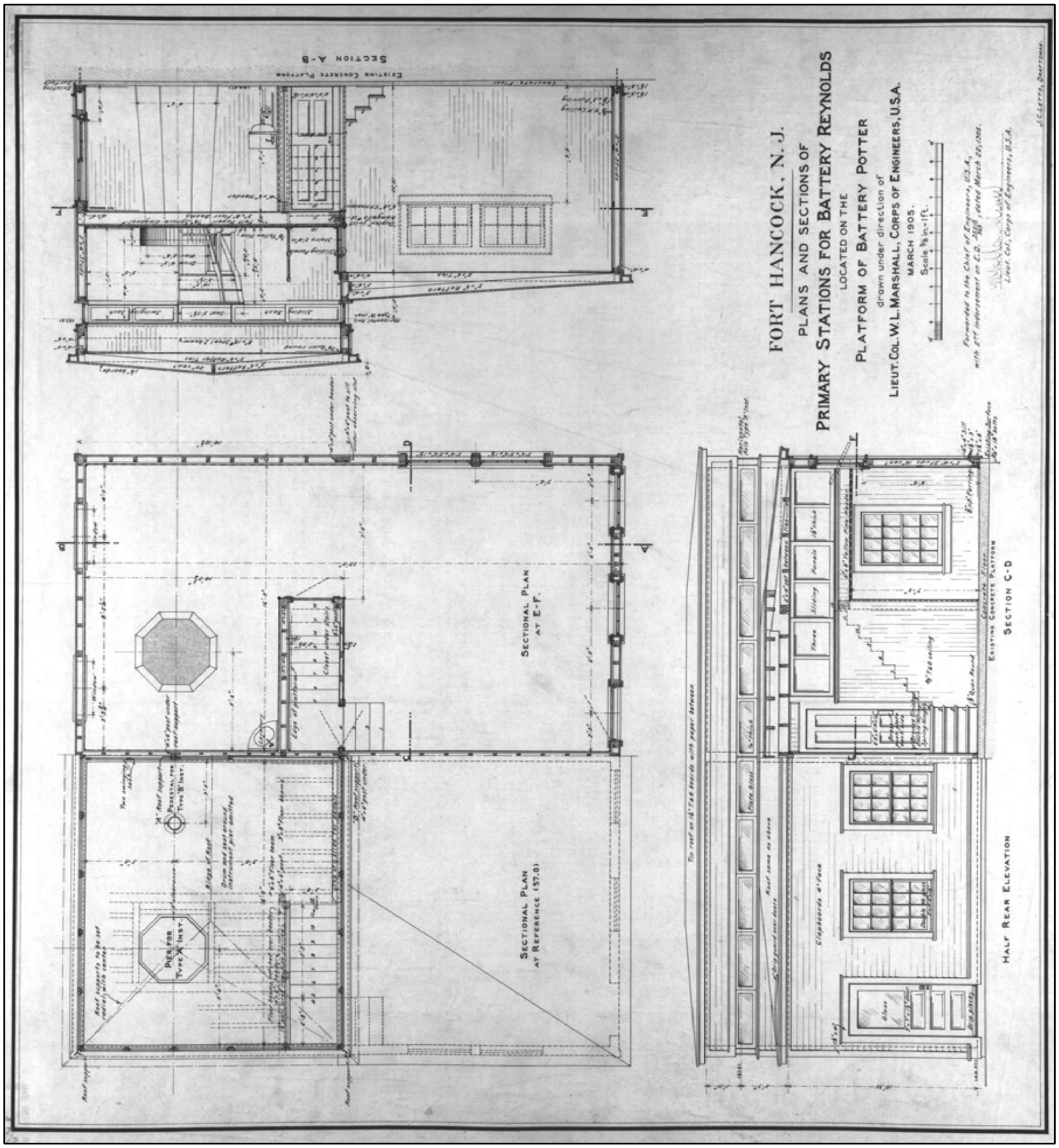


Figure 60. "Fort Hancock, N. J. Plans and Sections of Primary Stations for Battery Reynolds, Located on the Platform of Battery Potter," March 1905.

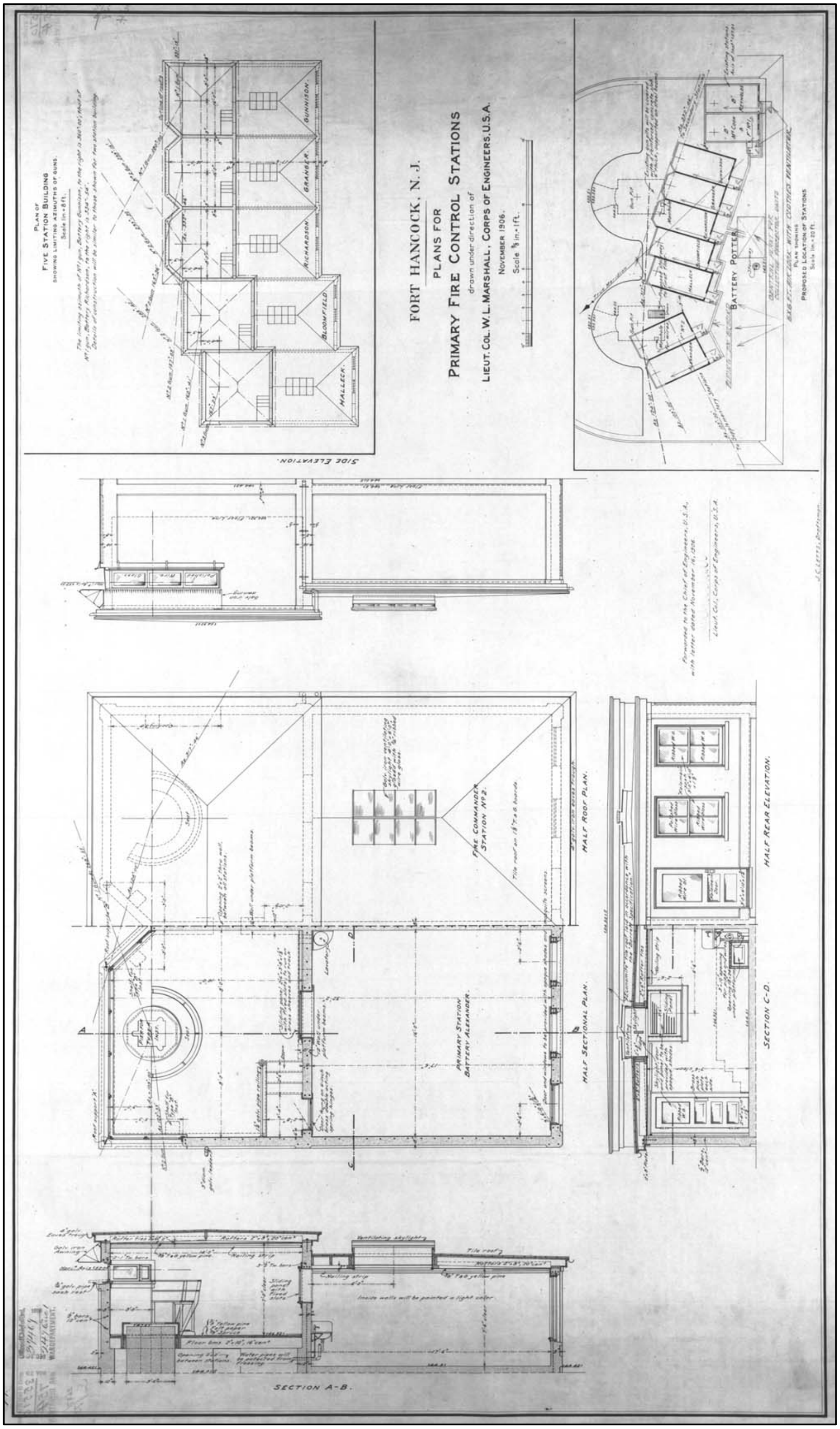


Figure 61. "Fort Hancock, N. J. Plans for Primary Fire-Control Stations" located on the terreplein of Battery Potter, Nov. 1906.

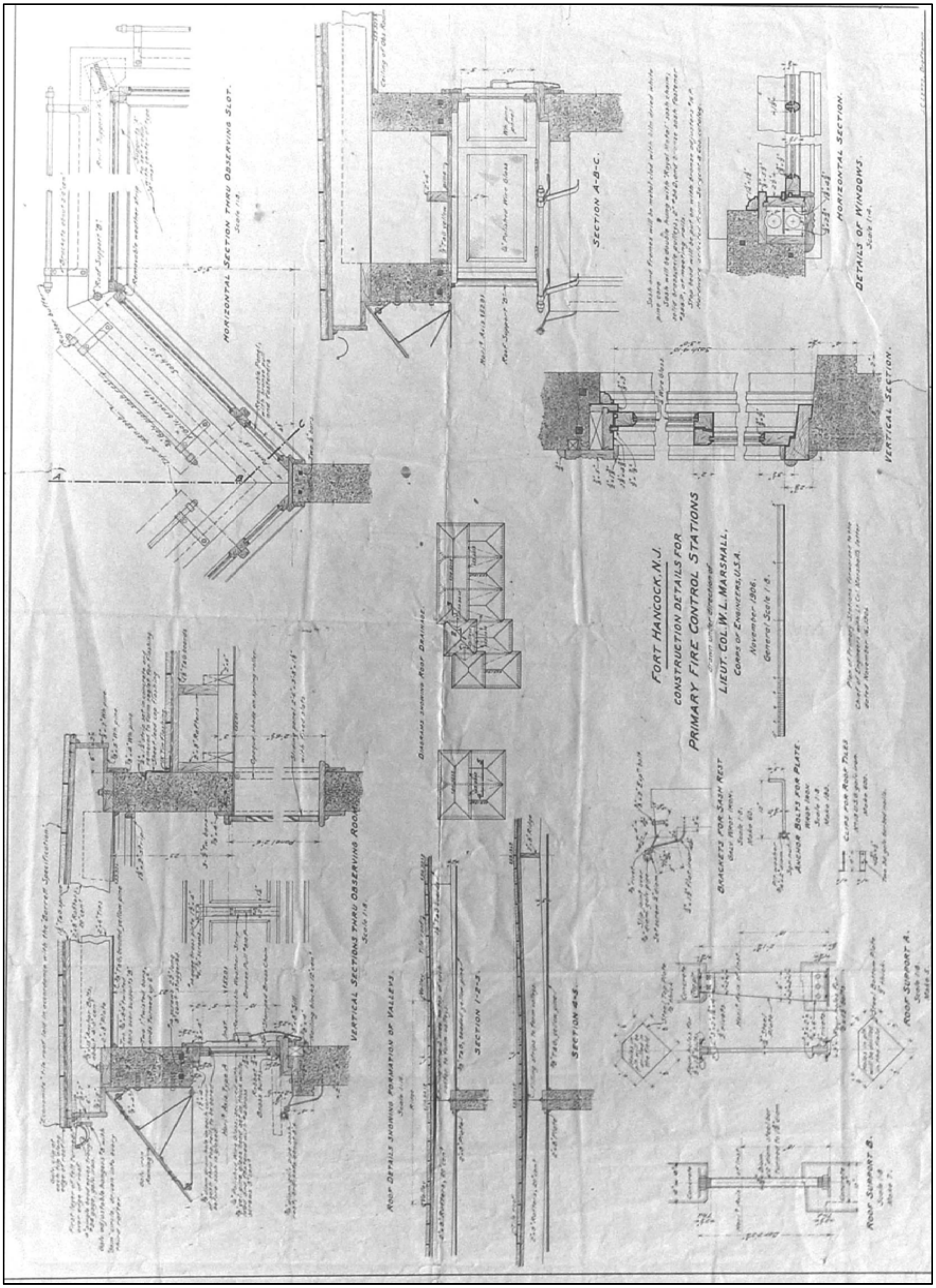


Figure 62. "Fort Hancock, N. J. Construction Details for Primary Fire-Control Stations" located on the terreplein of Battery Potter, Nov. 1906.

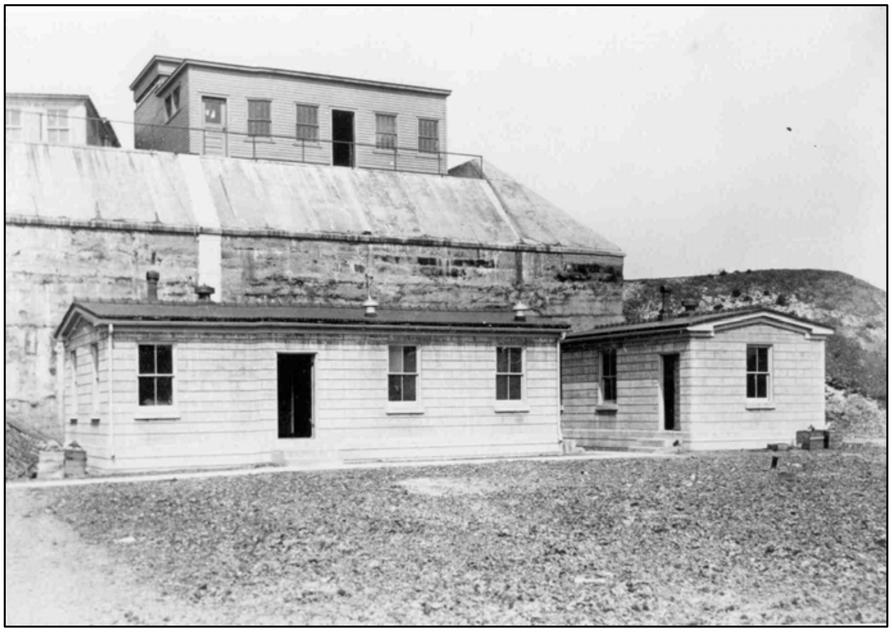


Figure 63. Battery Potter, view eastward, showing primary fire-control station building for Mortar Battery (top) and switchboard buildings (below), circa 1907.

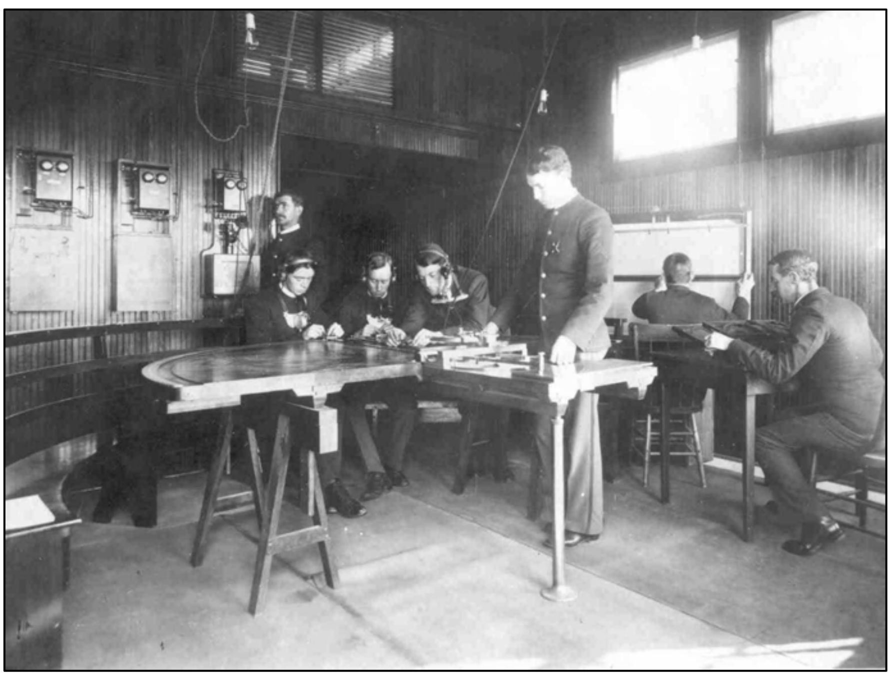


Figure 64. Battery Potter, interior of plotting room of one of two primary fire-control stations for Mortar Battery, circa 1907.

Figure 65. Battery Potter, interior of plotting room of primary fire-control station, June 24, 1919.

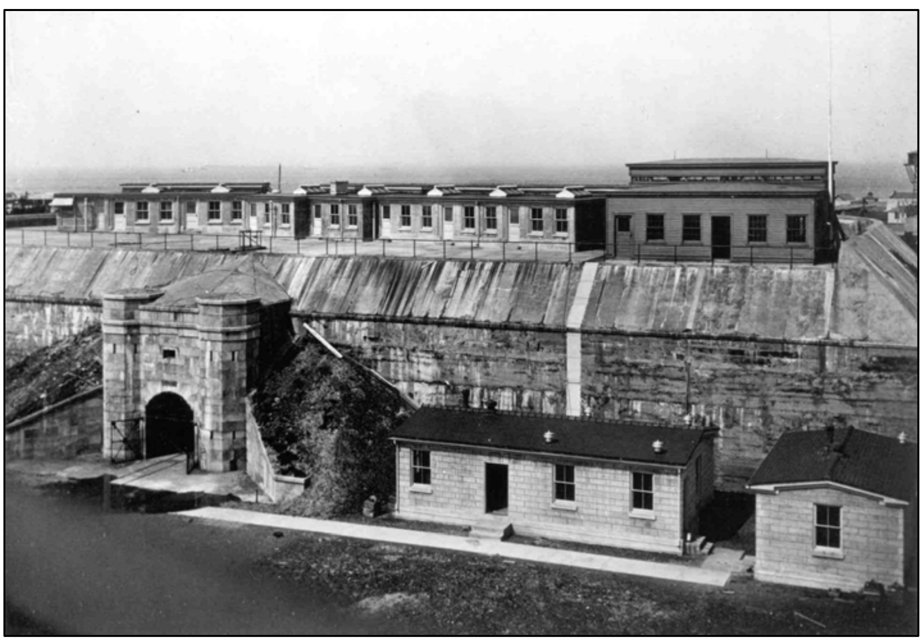


Figure 66. Battery Potter, west elevation, showing primary fire-control stations on terreplein and switchboard buildings in foreground, circa 1907.

Figure 67. Battery Potter, view of west elevation, showing primary fire-control stations, radar towers, and switchboard buildings, 1951.

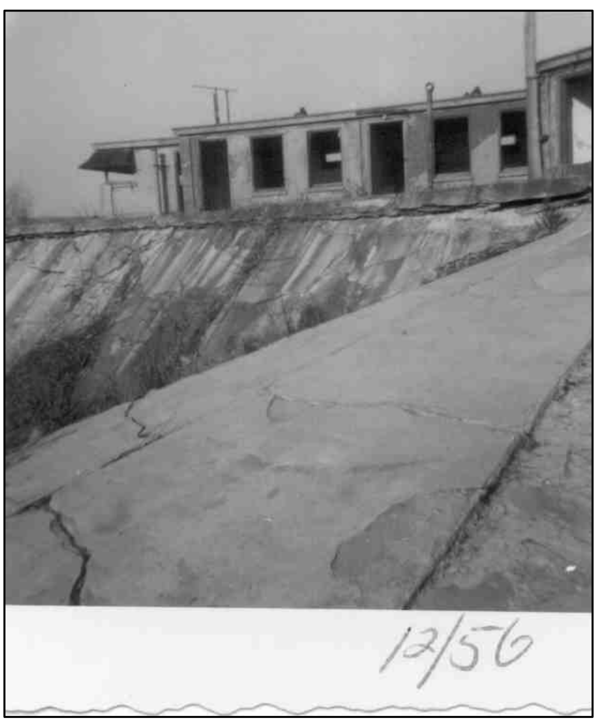


Figure 68. Primary fire-control stations on Battery Potter, Dec. 1956.

Figure 69. Signal Corps aerial view of Fort Hancock, N.J.: detail of Battery Potter and surrounding structures, circa 1919.

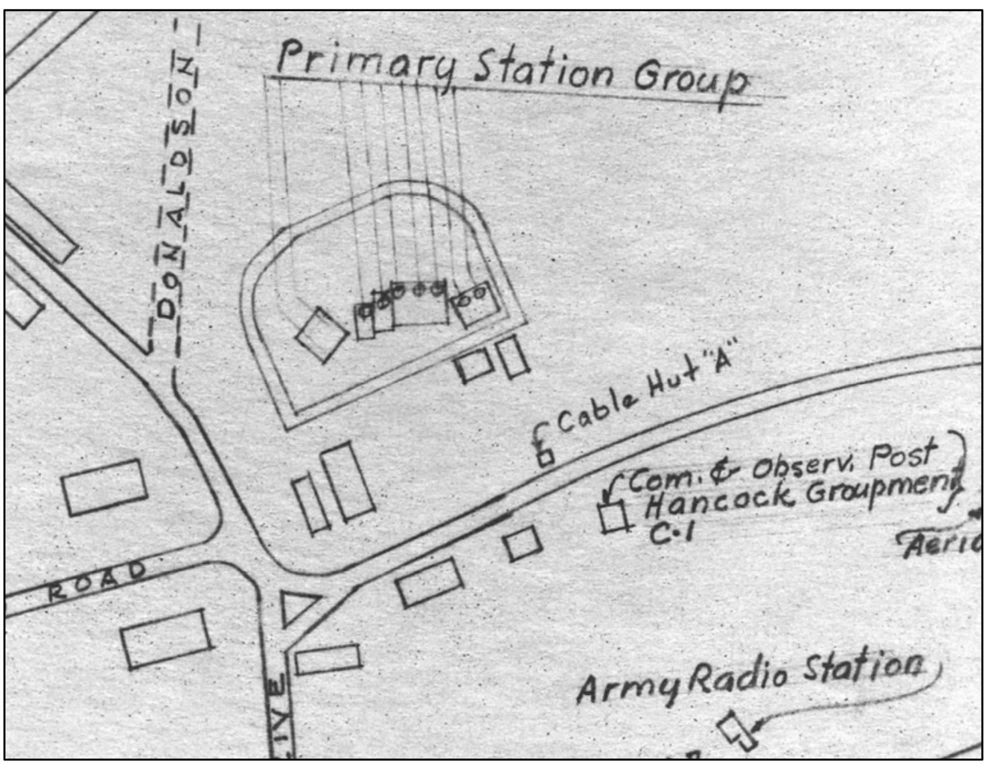


Figure 70. Detail from map of Sandy Hook during World War II, showing Battery Potter "Primary Station Group" and surrounding structures.

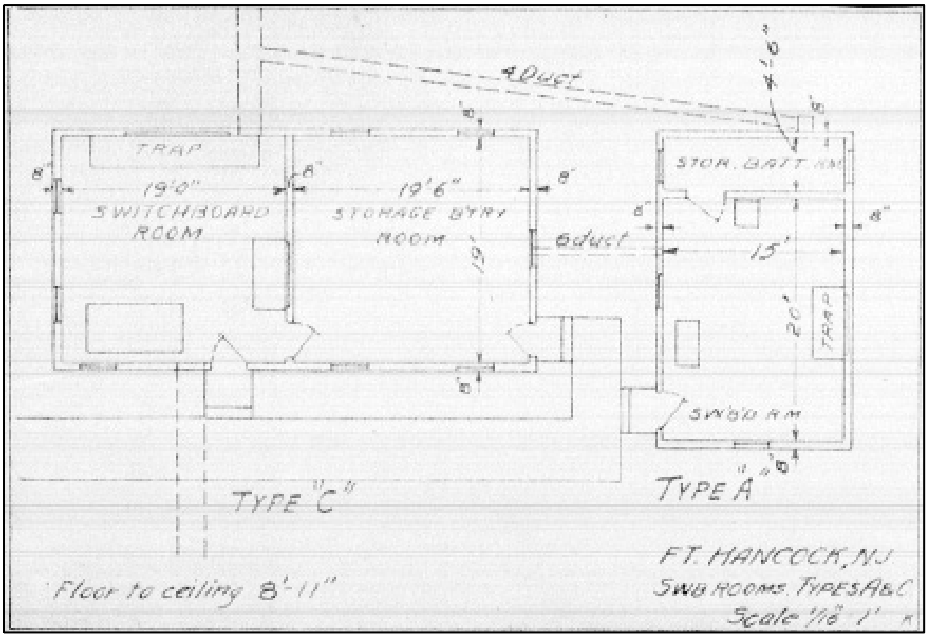


Figure 71. Plan of switchboard rooms Type "A" and Type "C," constructed on the west side of Battery Potter, July 1, 1921.

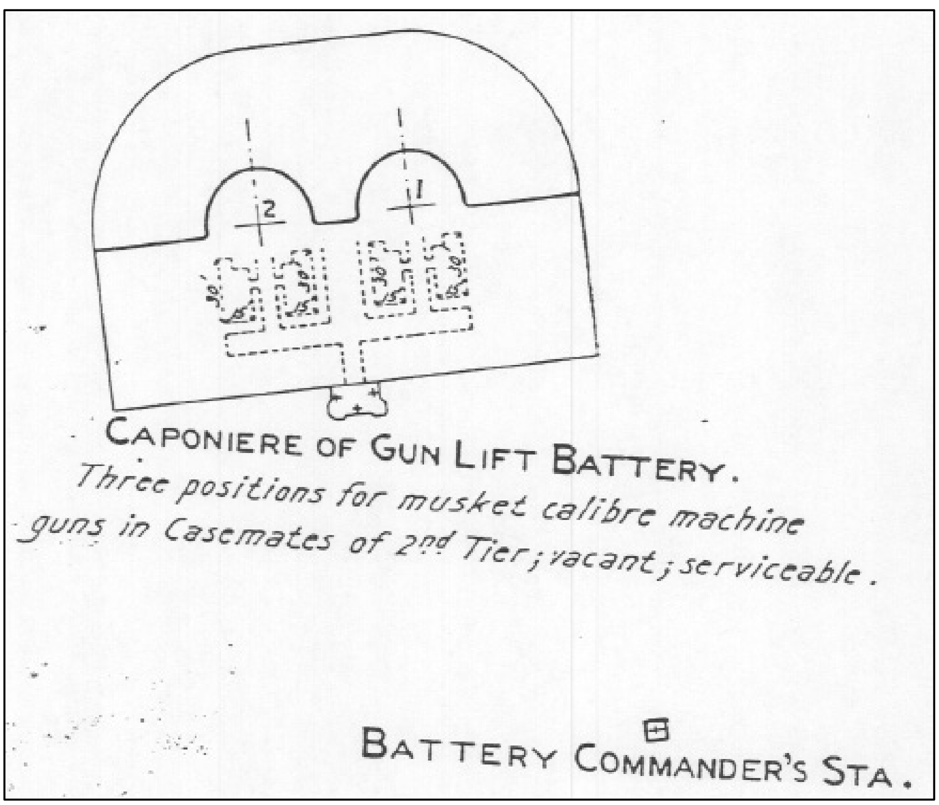


Figure 72. Plan depicting Battery Potter and battery commander's station/tower, December 31, 1901.

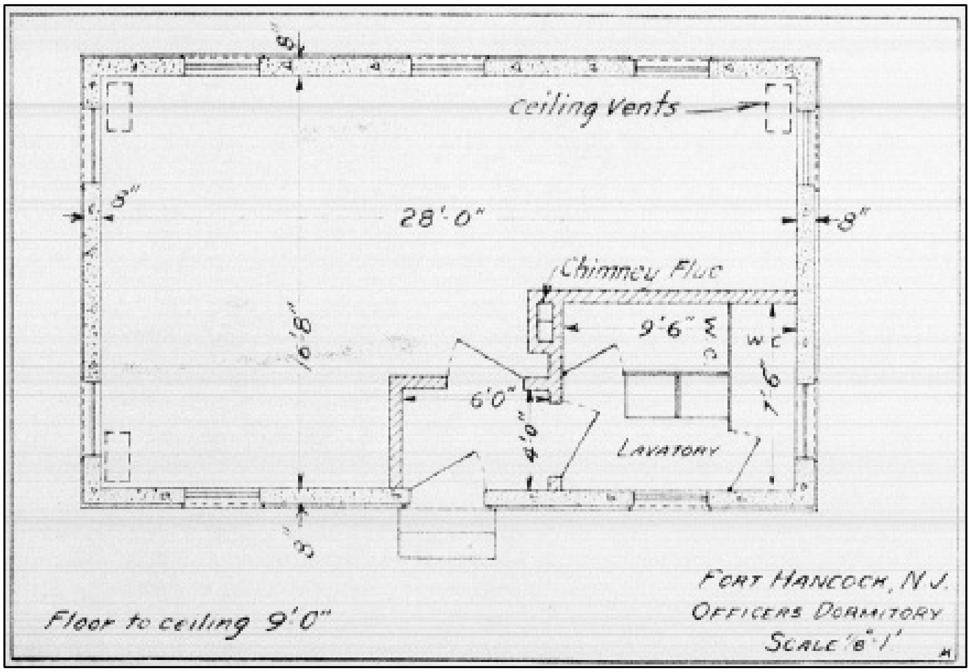


Figure 73. Plan of officers' dormitory built west of Battery Potter, July 1, 1921.

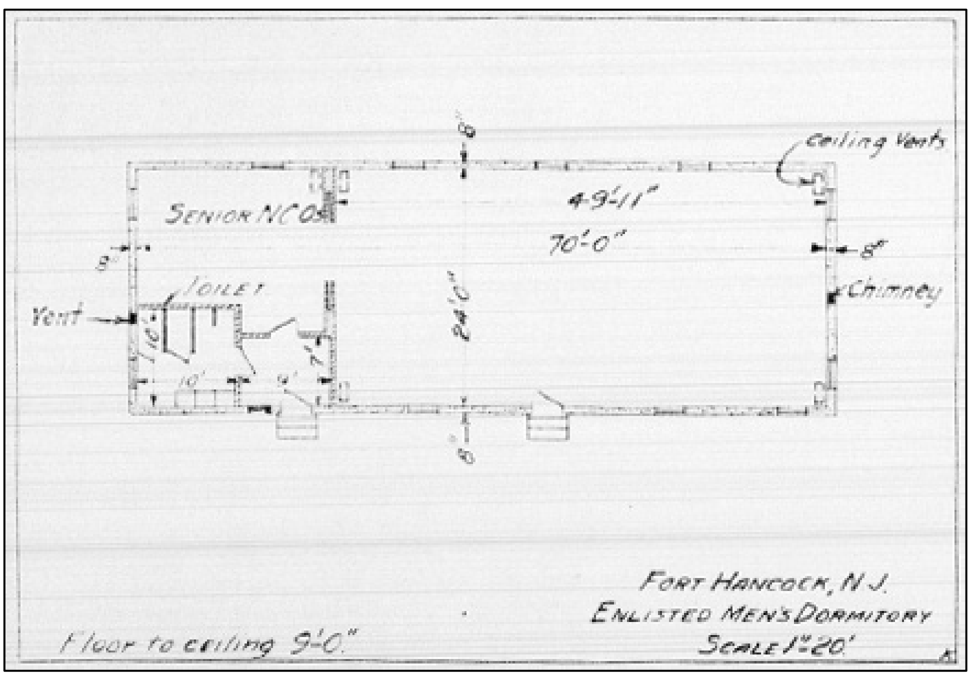


Figure 74. Plan of enlisted men's dormitory built west of Battery Potter, July 1, 1921.

Figure 75. "Camp of Range Section at Fort Hancock, N.J. Oct. 25 -15."
Temporary encampment west of Battery Potter, Oct. 1915.

CURRENT PHYSICAL DESCRIPTION

Introduction

The following physical description of Battery Potter is meant to augment the descriptions in the preceding sections on original appearance and maintenance and alterations. Much of the existing material appears to be original, and so has been described previously. The addition of the primary fire-control stations and other modifications to the battery and the fire-control stations have also been discussed in the sections on maintenance and alterations. Those descriptions should be considered as part of the current physical description, and will not be reiterated here.

Plans of Battery Potter with room numbers are provided as references to the interior rooms of the battery and the fire-control stations (figs. 43-45). The photographs included with this section are intended to illustrate the current physical description. This report does not include a condition assessment, but many of the following descriptions note existing conditions as part of the existing physical characteristics. A separate report, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*, includes a section on existing conditions at Battery Potter.[1] It should be noted that the current condition, as documented in many of the photographs included with this report, is poor. In spite of this, many of the extant elements of Battery Potter are significant and can be stabilized. The fire-control stations are in an advanced state of deterioration, but could also be stabilized.

Battery Potter – Exterior Elements

Battery Potter is a massive concrete emplacement measuring 162 feet 4 ½ inches wide by 238 feet 9 inches long. The battery is D-shaped in plan, with its curved walls facing east. Viewed from the ocean (east) side, the exterior concrete walls of the battery are camouflaged by sand embankments and vegetation that extend around the north and south elevations of the structure (fig. 76).

Approached from the west, Battery Potter displays a fortress-like presence (fig. 77). The granite-block "defensible entrance" is centered on the west elevation, and as previously described, the castellated edifice suggests an impenetrable bastion. The granite façade appears as it did upon the completion of the battery. The octagonal granite towers rise on either side of the arched entrance doorway; they are flanked by granite-block retaining walls

[1] Einhorn, Yaffee, Prescott, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery, Sandy Hook Unit, Gateway NRA, New Jersey* (May 2005), section 2, pp. 1-4.

that hold back the sand embankment. The granite block used to construct the Defensible Entrance appears to be in good condition, but it requires repointing.

The massive concrete walls of the battery retain their original configuration, but are more exposed than originally due to removal of the sand bank and erosion. The exterior walls of Battery Potter do show evidence of deterioration. Spalling and cracks were evident in the vertical concrete walls above the sand embankment. Vegetation covering sections of the walls made it difficult to discern their condition, but given the circumstances, deterioration of the concrete should be expected. In addition, evidence of efflorescence indicates that water is leaching through the concrete and drawing out the salts, which causes the efflorescence. However, the concrete walls are very thick, and they retain a high degree of integrity. The overall mass of the battery appears to be stable.

The lower, vertical portion of each concrete wall rises to a sloped upper wall, and a granite cornice separates the two walls. On the west elevation, the upper concrete slope of the exterior wall extends to the terreplein level. On the other elevations, the sloping upper concrete walls form the parapet that protected the terreplein and the *chemin de ronde*. The upper sloped walls of Battery Potter conform to the original D-shape of the structure. The upper concrete surface of the sloped walls was constructed in sections or panels that were approximately 6 feet wide. This upper layer of concrete is spalling in many areas, being particularly evident on the west elevation.

As previously described, the sand bank that surrounds Battery Potter and originally covered the lower 20 feet of the concrete structure has deteriorated. When the central powerhouse was constructed in 1901-02, the embankment north of the entrance to the battery was removed down to grade. Only a small section of the embankment was kept near the entrance, which is held in place by the flanking walls of the entrance. In the same manner, the embankment south of the battery entrance was removed in 1907 when the switchboard rooms were located adjacent to the southwest corner of the battery. Again, a small section of the embankment adjacent to the defensible entrance was kept. The sand embankment surrounding the battery has naturally eroded over the years, and is completely overgrown with vegetation. There was documentation that the Corps of Engineers repaired and replaced the sand cover on many of the emplacements at Sandy Hook.[2] However, this has not been undertaken for decades, and the embankments of Battery Potter are in poor condition.

The cast-iron exterior stairway installed in 1915 is located in the southwest corner of Battery Potter; it provides access to the terreplein of the battery (fig. 78). The stairway was constructed with two flights of steps joined by a landing. The original cast-iron elements of the stairway are intact, and the configuration of the stairway retains the original design. An iron gate was installed at the base of the stairway to control access to the terreplein of Battery Potter. Additional bracing from the exterior battery wall to the stairway was apparently installed to support the stairway, and to spread the load from the original bracket. The structural integrity of the brackets and the connections to the concrete wall should be checked. Otherwise the cast-iron elements of the stairway have been maintained. The stairway is currently painted black, and appears to be well-preserved.

[2] Preservation and Repair, Miscellaneous; folder 16, box 35, Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

The main roof of the defensible entrance was constructed as a modified hip roof with five sections (fig. 79). Each section of the roof was wedge-shaped, starting at the granite cornice and tapering up to the terreplein level of the battery. Each wedge section of the roof was constructed with concrete, and the upper layer of concrete was constructed in sections approximately 6 feet long. As with many of the upper concrete surfaces, the upper layers of the roof concrete are spalling.

The tops of the octagonal towers of the defensible entrance rise above the main roof. The towers have granite cornices and concrete roofs that conform to the octagonal shape. The roofs are made up of eight triangular sections of concrete forming a conical hip roof. The upper layers of concrete are cracked and spalled, and vegetation is growing on them.

The terreplein portion of the roof of Battery Potter is primarily covered with 6-foot-square sections of concrete that are 6 inches thick (fig. 80). The gap between the sections is approximately 1 inch wide and apparently filled with concrete. The concrete on the terreplein appears to date from the World War I era, and is deteriorated. The top layer of many of the sections has spalled, and grass and weeds are growing between the sections. A membrane was observed below the 6-inch-thick sections. This appears to be a multiple-layer, tar-impregnated fabric. The membrane was not analyzed as part of this report, but the characteristics of the material suggest that it was used for waterproofing purposes. The deteriorated condition of the concrete is allowing water to seep into the interior of Battery Potter.

The sections of the terreplein west of the gun parapet wall were not paved with the same concrete pads (fig. 81). The area around the original openings for the gun-lift mechanism and 12-inch rifles retains the flagstone paving installed by the Corps of Engineers. The flagstone has since been covered with a deteriorated bituminous material in an attempt to waterproof the area.

The sections of the terreplein that were originally open for the gun lifts were filled in when the fire-control stations were constructed (fig. 81). The covers over the former gun-lift shafts were constructed of reinforced concrete supported by steel I-beams. Ventilation shafts were cut into the concrete slab, and some have been covered with metal plates. However, the smaller openings have been left open to promote air circulation in the battery. The materials in this section of the terreplein appear to be more stable, but are also allowing water to infiltrate to the interior of the battery.

Situated in the southwest corner of the terreplein, the foundation of the Mortar Battery's primary fire-control station building is extant (fig. 82). This is a 6-inch-thick slab of concrete measuring 30 feet by 33 feet 5 ½ inches. The concrete slab is cracked in several places, and has some vegetation growing up through the cracks, but appears to be stable. A section of the 4-inch-square wooden sill of the fire-control building is still bolted to the south edge of the slab. The two tapering octagonal piers for the range-finding instruments are located toward the east end of the slab. The instrument piers appear to be in good and stable condition.

A flagpole that had been standing on the roof of Battery Potter now lies at the south end of the terreplein. The flagpole once stood on the south side of the five-station fire-control building, and is depicted in a 1956 photograph of the battery (fig. 67; the flagpole is visible above the left corner of the Mortar Battery's fire-control building). The base for the flagpole remains embedded in the concrete of the terreplein.

A pipe railing was installed on the west side of the terreplein that extends along the entire length of the battery. A railing in the same location was evident in photographs from ca. 1907 (fig. 66), but was missing in a 1956 photograph (fig. 68). The current railing was installed by the park as a visitor safety precaution. Additional sections of railing have been installed by the park to separate the fire-control stations and gun parapets from the public access area of the terreplein. The railings are painted black, and appear to be stable.

The curved gun-parapet walls retain their original configuration and semicircular design for the protection of the guns when in firing position (fig. 81). The masonry on these walls is cracked and spalled. The cracks in the concrete walls primarily run horizontally, and have apparently occurred between the built-up layers of the concrete structure. In particular, a horizontal crack about 18 inches below the superior slope indicates the section that was added to the crest by Lt. Col. Gillespie after the initial gun tests at Battery Potter (see the previous section "Construction of Battery Potter, Masonry Construction"). As noted by the Corps of Engineers, the parapet walls did suffer some damage from the firing of the 12-inch rifles, but the current condition is far worse than that documented by historic photographs in 1906. However, the spalling appears to be limited to the outer layers of concrete, and the walls can be stabilized.

A semicircular concrete stairway leads from the gun-parapet area to the superior slope of the battery. The stairway is adjacent to the east elevation of the fire-control building, and has eight steps leading to the superior slope from each of the gun parapets. The existing concrete steps were constructed sometime after the installation of the fire-control stations, and replaced the terraced platform and pier for Battery Potter's range-finding instruments. The concrete steps are in poor condition.

The platform situated near the northwest corner of the terreplein, which served as a range-finding pier and a meteorological platform, is extant. The structure has a USGS elevation marker on top of the platform.

The superior slope of Battery Potter east of the gun parapets forms a gradual slope toward the exterior wall and the *chemin de ronde* (fig. 83). The superior slope was constructed with concrete, and the upper layers were cast in sections that conform to the D-shape of the battery. The upper layer of the concrete is spalling and cracked, with some vegetation growing between the sections and the cracks. However, the concrete structure below the superior slope is massive, and appears to be stable.

Black pipe railing similar to that on the terreplein level has been installed along the west side of the superior slope above the gun parapets. The railing appears to be in good condition, and serves as an effective safety barrier for the gun parapets.

As previously described, the *chemin de ronde* extends around the east side of Battery Potter at the edge of the superior slope (figs. 84-85; see the previous section "Defenses for Battery Potter, Flanking Defense"). The *chemin de ronde* is protected by the outer parapet wall, and can be accessed from the terreplein of the battery. Constructed as part of the defenses for Battery Potter, the *chemin de ronde* has retained its original form. The concrete walls of the *chemin de ronde* are deteriorated. The park is trying to control the vegetation that has grown up in the pathway, but this remains an annual problem. The top of the outer parapet wall is also deteriorated, and entire sections have spalled off. The *chemin de ronde* remains accessible, and should be stabilized.

A wooden stairway south of the gun parapet for access from the terreplein to the superior slope of the battery was constructed by the park in 2005. The stairway was built with 2 by 6 pressure-treated lumber. The stairway has eight steps with open risers leading from the terreplein to the superior slope. The stairway has a black pipe railing on both sides. The railing along the west side of the superior slope ties into the north railing of the stairway.

Battery Potter – Interior Elements

Overview

The interior spaces of Battery Potter – including the rooms, galleries, magazines, and casemates – retain the configuration of the original structure (figs. 43-45). The interior of the masonry structure is generally damp, with condensation evident in many places, and standing water in some areas of the first story. Apparently the battery suffers the effects of water infiltration from the exterior walls and roof structure, as well as water rising from the ground below the battery. Though water infiltration poses a threat to the battery, it does appear that the overall mass of the structure is stable.

Floors

The floors of Battery Potter have required few repairs since the battery was originally constructed. On the first story, the floor of the defensible entrance (room 101) retains the flagstone pavers that extend through the entrance gallery (room 104) and into the main gallery/boiler room (room 111). The rest of the first-story floor surfaces are concrete, and most appear to be in their original form (fig. 86). The depression in the floor of the main gallery where the boilers were originally installed has been filled in with concrete. The accumulator well in room 120 and the equipment trenches in that area were also filled in with concrete. Likewise, the floors of rooms 119 and 121 – originally 2 feet lower than elsewhere – were built up with concrete after the removal of the gun-lift mechanisms.

The concrete floors in the storage magazines (rooms 112, 114, 115, and 117) were constructed with a slight slope that pitches toward a drain in the center of the floor. The drains are extant, but it is not known if the drainage system of the battery is currently working.

Most of the 3-foot-gauge railroad tracks that originally serviced Battery Potter remain embedded in the floors of the battery. The tracks run from the entrance to a turntable in the transverse gallery (rooms 109 and 110). A set of tracks runs from that point through the main gallery/boiler room and into the accumulator room. This set of tracks was not shown on the completion drawings of the battery, and was not apparent in historic photographs. Also, the position of the extant track would have been in the way of the large boilers and the piping for the pumps and accumulator. These tracks were apparently added after the battery was disarmed, possibly to assist with the removal of the heavy machinery of the accumulator and gun-lift.

From the turntable in the transverse gallery, the tracks extend to the north and south magazine galleries (rooms 113 and 116). Each magazine gallery has tracks that run the length of the gallery to its ammunition lift (fig. 87). The tracks in the magazine galleries were also constructed with turntables positioned at the entrances to the storage magazines. The tracks and turntables in the magazine galleries and storage magazines were constructed with gun metal as a precaution against sparks that could have ignited the ordnance. Large sections of the railroad tracks are still intact and representative of the ammunition-delivery system installed by the Corps of Engineers. Some sections have deteriorated or been removed, exposing the wooden stringers on which they were laid (see the previous section "Original Appearance, Armament, Gun-lift Mechanism").

The floors in the second-story galleries, casemates, and the defensible entrance are also concrete. As with the storage magazines on the first story, the floors of the casemates (rooms 206, 208, 210, and 212) were constructed with drains that are extant. Also, the interior casemates (rooms 208 and 210) have trenches in the floor for conducting utility pipes.

The wooden bridge (room 204) that spans the transverse gallery at the second-story level was reconstructed by a contractor in 1984, using 2 by 6 pressure-treated lumber and a modern pipe railing on the east side of the bridge overlooking the main gallery (fig. 88).

The floors of both loading galleries (rooms 209 and 213) are paved with flagstones, which were part of the original construction. The front/east edge of each gallery is open where the ammunition lift originally delivered the ordnance from the magazine gallery below. That opening was constructed with granite block that is level with the floor of the loading gallery. In the south loading gallery (room 213), the opening for the ammunition lift is extant, and a small trench – for the hydraulics that operated the lift – runs from the wall to the edge of the granite, where the levers of the hydraulics were located. In the north lift's loading gallery (room 209), these openings were filled in when the stairway to the terreplein was constructed.

Walls

The interior concrete walls of Battery Potter were originally parged with a skim coat composed of a Portland cement mix, which was then covered with whitewash and a waterproofing treatment (see the previous section "Construction of Battery Potter, Masonry Construction"). Likewise, the interior walls of the granite-block defensible entrance are parged with a coat of cementitious material and top coatings. The only interior walls that were not parged were in the loading galleries (rooms 209 and 213), which retain the granite block with which they were constructed. These walls do not have any coating on them, and were probably never coated. The same is true of the granite blocks used in the construction of the gun-lift piers, which are extant.

As previously discussed, the failure of that parging in some areas led to several attempts to repair the parging and coat the walls. The existing wall coatings appear to be a conglomeration of the various coatings applied over the years to impede the moisture that infiltrates the battery. The wall parging and applied coatings are in various stages of deterioration, and do not appear to be effective against water infiltration. The interior concrete walls are generally damp, but overall the masonry structure of the walls appears to be in stable condition.

The west side of the transverse gallery on both the first and second stories is pierced with niches for the auxiliary lantern lighting system (fig. 89). At the north and south ends of the transverse galleries on both levels are additional shelves built into the wall for lantern lighting. All of these niches are also part of the battery ventilation system, which features 8-inch vent pipes that lead from the niches to vents at the terreplein level.

In the storage magazines on the first story (rooms 112, 114, 115, and 116), the niches that provided access to the bolts securing the guide rails for the lift cages are extant. The bolts for the guide rails are still in place, but are rusted. Likewise, the casemates on the second story (rooms 206, 208, 210, and 212) retain their niches for the bolts for the guide rails. Sections of the guide rails are also still in place on the piers in the gun-lift areas (rooms 119 and 121). As with most of the cast-iron elements in the battery, the guide rails are corroded and are pulling away from the piers in some places.

The interior walls of Battery Potter also bear the scars of various utility lines and cast-iron elements that have been installed and removed over the years. On the sections of wall where cast-iron elements are still attached, the iron is corroded and the walls are stained, deteriorated, and spalling. The conduit, junction boxes, and breaker panel for the current lighting system are attached to some of the interior walls.

Ceilings

The design of the massive concrete structure that is Battery Potter utilized arched construction, in which a system of arches and vaults is used to build the structure. Thus, the ceilings in most of the battery are vaulted. The concrete ceilings of the main battery were typically treated in the same manner as the walls, with a parged surface that was coated with whitewash and waterproofing. The ceilings of the battery are generally damp and show signs of cracking and spalling. Some of the ceilings currently have lighting conduit and electric light fixtures mounted on them. The ceilings are also scarred from the installation and removal of earlier utility and mechanical systems.

The ceiling on the first story of the defensible entrance was constructed with a series of small vaults. The vaults consisted of concrete that was placed between the iron **I**-beams used to support the second story of the entrance. The stabilization project at Battery Potter in 1985 included replacing the **I**-beams and the entire ceiling. The ceilings in the towers of the defensible entrance are vaulted, as are the second-story ceilings of the defensible entrance.

As discussed in previous sections, the ceilings of the two loading galleries were constructed differently from one another. The north gallery (room 209) was constructed first, and was built with an inclined arched ceiling that slopes down 3.5 feet from front to back (fig. 90). The front/east section of the ceiling is granite block, but it then transitions to a parged concrete ceiling at the west end of the gallery. The south loading gallery (room 213) was constructed in two sections (fig. 91). The front/east section corresponds with the granite-block section of the gallery, and was constructed with transverse-mounted iron **I**-beams with vaults between each beam, forming a groined ceiling. The west section of the ceiling was constructed with a concrete inclined arch. The Engineers considered the ceiling in the south gallery to be stronger, and it provided more room to operate the gun-lift.

When the 12-inch rifles of Battery Potter were removed, the openings in the terreplein where the gun-lifts had risen were covered over with concrete. On the interior of the battery, the concrete covering forms a shallow vaulted ceiling above the former gun-lift areas (room 217 and 219), and over the niches constructed for the gun barrels (room 214 and 215). The ceiling was constructed with ventilation holes, some of which have been covered over to prevent water from coming into the battery.

Doorways

The arched entry doorway of the defensible entrance retains the original doors constructed for the battery (fig. 92). As previously described, the large double doors were built with three layers of boards and covered on the exterior with quarter- inch iron cladding. The smaller door cut into the southern door is also intact. The doors are hung from large hinges on pintles that are set into the granite of the jamb of the doorway. Two gun loops were cut into each door. The gun loops are extant, but the iron that frames the openings is rusted; the horizontal iron shutters for the gun loops are also rusted, and in some are inoperative. The doors are painted with a dark-green paint that is degraded.

The doorways on the first story are arched, due to the method of constructing the battery. Most of the doors on the first story have been removed from their doorways and stored elsewhere in the battery. The doorway to the north magazine gallery (room 113) retains a set of double doors that were constructed with three layers of boards (fig. 93). Each door is hung on a pair of strap hinges and pintles that are set into the masonry jamb. The doors are finished with a dark-green paint that is degraded. The storage magazines on the first story were constructed with arched doorways and single arched doors. The doors are no longer in place, but some are stored in the battery. The door stored in the north powder magazine (room 112) is typical of these doors; it is an arched door constructed with three layers of boards. The door had originally hung on strap hinges and pintles. The door is coated with a dark-green paint that is degraded.

The doorways on the second story were also arched and fitted with arched doors. None of the doors at this level remain in place. At both the north and south ends of the battery, the doors to the hallways (room 207 and 211) that lead to the casemates were constructed with double doors that were probably similar to the magazine gallery doors. Some of the doors to the casemates are stored in the battery; similar to the magazine doors, they are arched wooden doors composed of three layers of boards. The casemate doors were hung from strap hinges and pintles set into the masonry. The doors stored in the battery are coated with a green paint that is degraded.

Openings

Since Battery Potter was constructed as a half-buried emplacement, the only openings other than doorways were the gun loops and gun ports in the defensible entrance. The gun loops that pierce the towers of the defensible entrance are extant (fig. 94). The narrow openings and embrasures are intact, and convey the intended use of the openings and the fortress-like entrance.

The gun ports on the second story of the defensible entrance that were designed for three Gatling guns are also extant (fig. 95). The gun ports are located on the north, west, and south sides of the second story of the entrance, and are larger than the gun loops. The granite blocks that surround the west gun port extend through to the interior walls of the defensible entrance. Likewise, the granite headers of the north and south gun ports extend through to the interior. The gun ports were constructed with vertical shutters, which are either missing or severely corroded. The metal bases for mounting the Gatling guns in the gun port remain intact.

Stairways

The second story is accessed via two stairways (room 105 and 106), which retain their original form and much of their original material. The stairway corridors are arched, and both stairways have cast-iron stairs leading from the first to the second story (fig. 96). The cast-iron treads and risers are set between cast-iron stringers. The stair treads have a raised grid for traction, and the risers were cast with a diamond-within-a-rectangle pattern, which is still discernable (fig. 97). Each stairway is equipped with a modern pipe railing on each side. It is evident from holes and rust stains on the walls that the current railing replaced an earlier element that had either fallen off or become unstable. As previously described, the cast-iron stairways of the battery were regularly maintained when Battery Potter was active as a gun battery, and during its later role related to the fire-control stations. The maintenance has been discontinued for decades, however, and the damp conditions in the battery have caused the cast iron to pit and rust; in some case, the surface of the iron has scaled off. However, the stairways appear to be stable, and continue to provide access to the second story.

Situated on the north side of the corridor (room 202) leading to the second story of the defensible entrance is a space 4 feet in circumference that holds a spiral staircase (fig. 98).

The spiral staircase, made of cast iron, extends to the terreplein of the battery. The staircase is corroded and was closed by the Army for safety reasons.

Cast-iron ladders originally led from the second-story north and south transverse galleries (rooms 203 and 205) to their respective loading galleries (rooms 209 and 213). The ladder to the south loading gallery (room 213) is extant, but it is corroded and considered unsafe. The ladder to the north loading gallery (room 209) was removed some time after the battery was disarmed. The ladder was replaced by the set of concrete steps cut into the wall leading to the gallery.

At the east end of the north loading gallery, a curved stairway (room 220) leads up to the terreplein level (fig. 99). This stairway was added to allow easier access to the fire-control stations on the terreplein level. The stairway was constructed with pre-cast concrete, and is equipped with a pipe railing. At the terreplein level, a concrete structure with a wood-framed roof was built to protect the stairway (see the subsequent section “Current Physical Description, Fire-Control Stations”). As previously described, the stairway appears to be a fairly recent structure, and may have replaced an earlier stairway installed by the Corps of Engineers.

Equipment/Utilities

Various parts of the original ammunition supply system remain at Battery Potter. As previously described, the supply and ammunition tracks for the battery are intact, and they add to the interpretive value of the emplacement. At both ends of the battery, the gun-metal turntables that lead to the storage magazines (fig. 100) are also intact. The north magazine gallery retains the ammunition lift that carried the ordnance to the loading gallery. Both of the shell-storage magazines (room 114 and 115) retain portions of the overhead system that was used to move the shells for the 12-inch rifles (fig. 101). The components of the “traveling bridge crane” are mounted at ceiling height approximately 7 feet above the floor level. Each system was composed of a crane apparatus that traveled along a set of I-beam tracks that run the length of the room. These tracks were set into the east and west walls and supported by half-arch brackets. The rails of the system are extant in both magazines (room 114 and 115). The crane apparatus was constructed with an I-beam spanning the tracks and a parallel axle that had a gear wheel at one end for hoisting the projectiles (extant in magazine room 114). As originally installed, the crane could hold up to 2,000 pounds. The positions where the ammunition hoists had once been mounted are also discernable on the ceilings of the galleries. The extant components are severely corroded, but they do enhance the interpretive value of the ammunition storage system.

Through out the battery are remnants of other mechanical and utility systems. Sections of the guide rails for the gun-lifts and the bolts to secure them are intact but rusted. Some brackets that secured various parts of the gun-lift mechanism remain on the walls of the accumulator room (room 120).

The existing electric-light system consists of metal and plastic conduits attached to the walls and ceilings; they run from the breaker box to the light fixtures. The circuit-breaker box is mounted in the entrance of the battery (room 101), and an additional junction box is mounted in the transverse gallery (room 109). The light fixtures are attached to the walls and ceilings via metal boxes and fitted with utility globes. During the recent site visits, condensation was noted in several globes.

Battery Potter – Primary Fire-Control Stations

Exterior Elements

Though in partial ruin, the primary fire-control stations continue to dominate the terreplein of Battery Potter (fig. 80). The wooden structure that was constructed for the Mortar Battery's two fire-control stations is not extant, but its concrete-slab foundation and the octagonal instrument piers remain (fig. 82). The other two structures, being built of reinforced concrete, are still extant. The five-station building is situated near the south-gun parapet. The three-station building is near the north-gun parapet. (As explained previously, this building was originally planned as a two-station building, but a third, secondary station was added to it for Battery Arrowsmith.) The structure covering the interior stairway runs between the two buildings.

Each station within the buildings is still discernable from the location of the doorways and windows, as well as the configuration of each station. The following descriptions of exterior elements pertain to all of the fire-control stations.

The exterior reinforced-concrete walls retain their original design and proportions, but are badly deteriorated (figs. 102-103). The concrete walls are spalling, and the reinforcing bar is exposed in areas.

The windows and doorways also retain their original proportions, but are in poor condition. Exterior doors are missing from the doorways, and the doorway trim is either deteriorated or missing. The windows on the rear of the stations are missing their double-hung sashes, and the windows along the front are missing the tilt sashes that were part of the observation rooms. Some of the metal-clad trim on the rear windows remains in place, but it is rusted. The cast-concrete window sills of the rear windows are extant but deteriorated. Sections of the metal rails and brackets on which the front tilt-out window sashes rested are in place, but are corroded and falling off the building. Remaining portions of the galvanized-metal components of the awnings that shaded the front observation windows are hanging from the building. Overall, the stations retain the arrangement of exterior openings, but the materials are deteriorated and missing.

The roofs of the fire-control stations are in varying states of disrepair. Some of the roof structures, including the framing, are completely missing. Other roofs are in an advanced stage of deterioration. Some skylights are extant, but they are also deteriorated and not adequately covered or protected. The most recent roofing material appears to have been asphalt shingles, with some built-up roofs of tar and gravel. Currently, none of the roofs are providing cover or protection for the stations.

As previously described, the bulkhead structure covering the interior stairway (room 315) physically connects the two fire-control station buildings, though there is no access between the buildings (fig. 104). The walls of the bulkhead are reinforced concrete; the roof is wood-framed and covered with metal and tar and gravel. The walls of the bulkhead appear to be stable. The roof structure is deteriorated at the edge and missing some fascia boards, but the roof is intact. The bulkhead has doorways on the east and west elevations, and each has an iron-bar security door, but is otherwise open to the elements. Of the structures associated with the fire-control stations, the bulkhead appears to be the most stable.

Interior Elements

The extant fire-control buildings retain the basic plan of each station. The spaces are defined by the reinforced-concrete walls that are still standing, although in deteriorated condition. The interior plan of each station is similar and consists of two rooms. The rear room was the plotting room, and the front room was the observation room. In some cases, the front corners of the observation rooms were angled to allow a greater field of view. The only plan that is different is the one-room station at the north end of the three-unit building, which was a secondary, observation station for Battery Arrowsmith.

The floors in the plotting room are concrete, and appear to be in stable condition. The floor of each observation room is three steps above the level of the adjacent plotting room, and consists of wood on wooden framing (fig. 105). The observation-room floors of the stations are severely deteriorated. Some have completely collapsed, while others are rotten and unsafe. However, there was enough extant evidence to determine the original elements as described in the previous section.

The interior walls of the stations, including partitions between rooms and stations, are reinforced concrete. The partition wall between each plotting room and observation room has a doorway and a window (fig. 105). The doors are not extant, but some of the doorway trim was still intact. The window was used for communication between the rooms, and was fitted with horizontal sliding shutters. Some stations have remnants of their shutters. An accumulation of paint layers on some of the interior walls indicate that the interior masonry was painted over the years. The colors ranged from white and light gray to light-green and khaki green. The interior walls appear to be in better condition than the exterior walls.

The ceilings of the fire-control stations are also deteriorated. Some are missing, along with the roof structure; others retain some evidence of the original materials. Sections of the tongue-and-groove ceiling boards are extant in some of the plotting room, and the framing of the sky lights is also evident. Overall, the ceilings are in poor condition.

The window sashes of the fire-control stations are missing, but in many cases the interior window trim is still in place (fig. 106). The extant trim for the double-hung windows includes molded casings and corner blocks. Some of the observation room windows retain a molded window sill with a beaded apron below. Since the window sashes are missing, the interior elements of the windows have deteriorated.

Remnants of the utilities for the fire-control stations are evident. Most of the plotting rooms are still equipped with a porcelain sink in the front right corner of the room (fig. 107). In some cases the porcelain fixtures for the electrical system are extant, as well as the wooden strips along which the wire was run. The pipes that carried the electrical service, water, and possibly heat are still in place under the floors of the observation rooms. The pipes were originally installed in a chase that ran from the interior of the battery up through the boiler vent and then through the partitions between the stations. Most of the extant utility equipment is miscellaneous, but it does indicate what might have been present when the fire-control stations were in use.

Figure 76. Battery Potter, view of east elevation, 2005.

Figure 77. Battery Potter, view of west elevation, 2005.

Figure 78. Battery Potter, exterior iron stairway, upper flight, 2005.

Figure 79. Battery Potter, roof of defensible entrance, 2005.

Figure 80. Battery Potter, view southward showing terreplein and extant primary fire-control stations, 2006.

Figure 81. Battery Potter, south gun parapet, 2005.

Figure 82. Battery Potter, view to the southwest, showing terreplein and extant elements of missing fire-control stations for Mortar Battery, 2005.

Figure 83. Battery Potter, superior slope in front of gun parapets, 2005.

Figure 84. Battery Potter, southeast section of *chemin de ronde*, 2005.

Figure 85. Battery Potter, parapet wall of *chemin de ronde*, 2005.

Figure 86. Battery Potter, interior view from main gallery/boiler room (room 111) westward through entry gallery (room 104) to defensible entrance (room101), 2006.

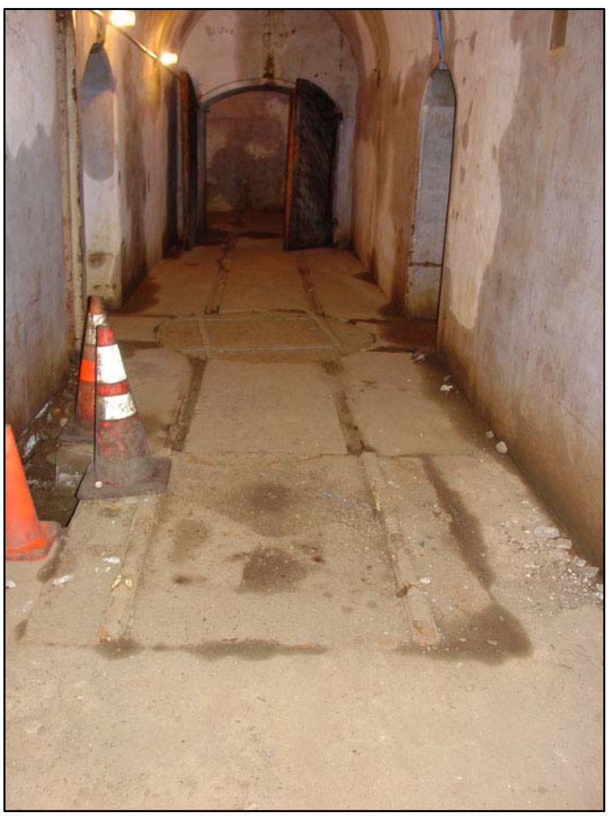


Figure 87. Battery Potter, interior view of north magazine gallery (room 113), looking west, 2006.

Figure 88. Battery Potter, interior view of second-story north and south transverse galleries (rooms 203 and 205), and wooden bridge connecting them (room 204), 2006.

Figure 89. Battery Potter, interior view of niche in wall of transverse gallery for auxiliary lantern lighting system, 2005.

Figure 90. Battery Potter, interior view of north loading gallery (room 209), looking west toward concrete steps, 2006.

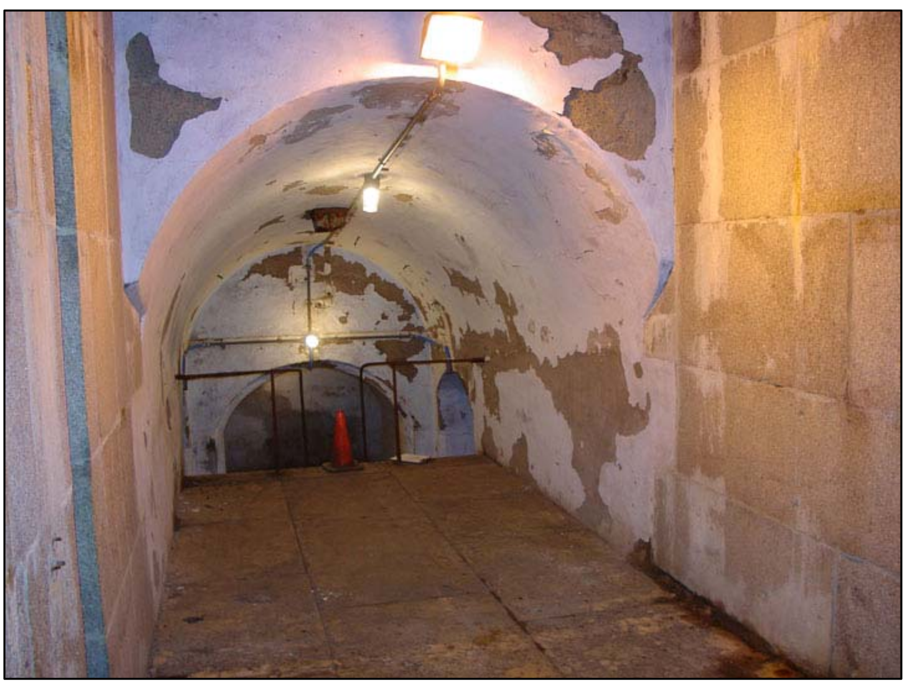


Figure 91. Battery Potter, interior view of south loading gallery (room 213), looking west toward cast-iron ladder, 2006.

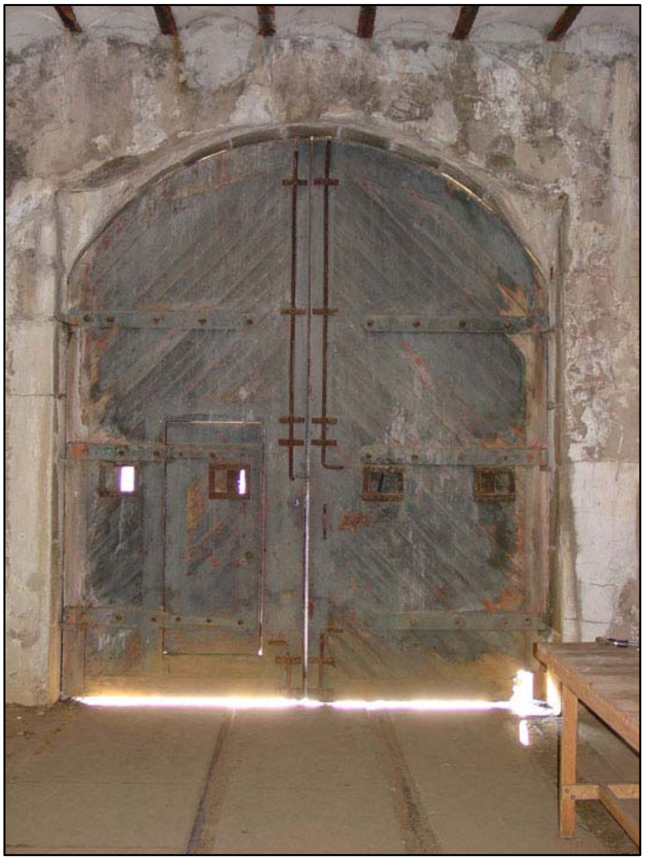


Figure 92. Battery Potter, interior view of doorway and doors of defensible entrance (room 101), looking west, 2006.

Figure 93. Battery Potter, interior view of doorway to north magazine gallery (room 113), looking east, 2006.

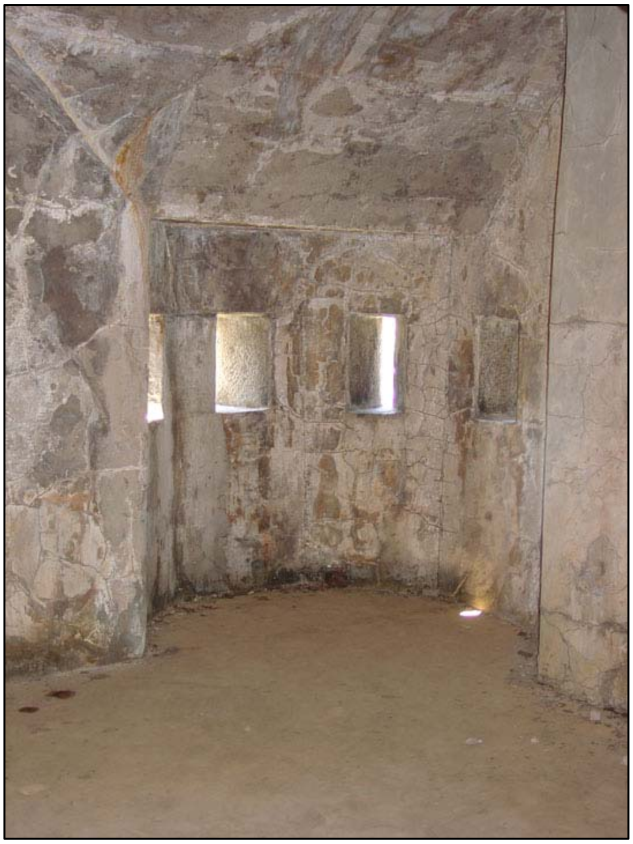


Figure 94. Battery Potter, interior view of second story of defensible entrance (room 201), north tower and gun loops, looking northwest, 2006.

Figure 95. Battery Potter, view of second story of defensible entrance (room 201), gun port in west wall, 2006.

Figure 96. Battery Potter, interior view of north stairway (room 105) connecting first and second stories, 2005.

Figure 97. Battery Potter, view of existing condition of iron steps of south stairway (room 108) connecting first and second stories, 2006.

Figure 98. Battery Potter, spiral stairway from second-story connecting gallery (room 202) to terreplein, 2006.

Figure 99. Battery Potter, view of concrete stairway (room 220) connecting north loading gallery (room 209) and terreplein, 2006.

Figure 100. Battery Potter, view of south magazine gallery (room 116), showing gun-metal turntable for ammunition-delivery system, 2006.

Figure 101. Battery Potter, interior view of north shell magazine (room 114), showing overhead trolley bridge for ammunition-delivery system, 2005.

Figure 102. Battery Potter, primary fire-control stations, west elevation of southernmost station (rooms 313 and 314), 2005.

Figure 103. Battery Potter, primary fire-control stations, east elevation of the east rooms (rooms 309, 311, 313) of the three southernmost stations, 2005.

Figure 104. Battery Potter, east elevation of bulkhead (room 315) covering stairway (room 220) that connected second story with terreplein and primary fire-control stations, 2005.

Figure 105. Battery Potter, view of typical primary fire-control station, showing observation room and interior partition, 2005.

Figure 106. Battery Potter, typical primary fire-control station, showing interior of plotting room and west wall, 2005.

Figure 107. Battery Potter, typical primary fire-control station, showing interior of plotting room and interior partition, 2005.

DEVELOPMENTAL HISTORY:

MORTAR BATTERY

CHRONOLOGY OF DEVELOPMENT AND USE

Introduction

The subsequent sections on development and use of the Mortar Battery discuss the history of the structure from planning and construction to present condition. Previous reports, specifically those by Edwin Bearss, cover some of the same information, as well as additional details. Some information relevant to Sandy Hook and Fort Hancock was included in the previous section on Battery Potter, and will not be repeated in the same detail in this section. Research for this report uncovered detailed reports on the construction of the Mortar Battery, as well as correspondence between the important parties in the planning and construction of the battery. Annual reports from important years of the construction phase and plans of the Mortar Battery are included in the appendices o this report.

The Mortar Battery was planned and constructed as two halves. It was actually built along a northeast/southwest axis, but it has been described historically as if its axis ran north/south. The north end of the battery was closest to the Atlantic shoreline, and the south end closest to Sandy Hook Bay. Each end of the Mortar Battery had two concrete firing pits, each pit containing four 12-inch mortars. These were designated the east and west pits for each end (fig. 108). When the Mortar Battery was first constructed, each of its pits were labeled with a letter ("A" through "D"), and the entire battery was named "Battery Reynolds" in 1903. A plan of Battery Reynolds dated December 20, 1905 (fig. 109), showed that the southeast pit was "A," the northeast pit was "B," the southwest pit was "C," and the northwest pit was "D."[1] When the north and south ends of the Mortar Battery were later renamed as Battery McCook and Battery Reynolds, respectively, the mortar pits were also relabeled. At Battery McCook, the northeast pit was labeled pit "A" and the northwest pit was pit "B." At Battery Reynolds, the southeast pit was labeled as pit "A" and the southwest pit was labeled pit "B." Plans reviewed from 1907 (fig. 144), 1910 (fig. 145), 1915 (fig. 148), and 1922 (fig. 150) confirmed that the mortar pits were labeled in this manner, which was the traditional manner for lettering mortar batteries. However, the Fort Record Book for Fort Hancock noted that when the Mortar Battery was divided, the " 'A' and 'C' pits became 'B' and 'A' pits, respectively, Reynolds; and 'B' and 'D' pits became 'B' and 'A' pits, respectively, McCook."[2] Plans of the battery from the 1940s depict the mortar pits with this same lettering. The lettering of the Mortar Battery was apparently reversed in the 1940s, as reflected in the plans and the Fort Record Book. In an effort to avoid confusion, the HSR will refer to the mortar

[1] Though this copy of that drawing was altered to show the later designations of "Battery Alexander McCook" and "Battery Reynolds," the letter designations from the original Battery Reynolds can still be seen.

[2] Fort Record Book, Fort Hancock, New Jersey, p. 106. Entry 224; RG 392; NARA – Northeast (NY).

pits by their directional orientation only. Thus the north end of the battery has a northwest pit and a northeast pit, and the south end has a southwest pit and a southeast pit (fig. 110). The construction documentation uses this same directional labeling, and therefore references to that information will be clear. As noted previously, the Mortar Battery itself went through a number of name changes; it was initially designated Mortar Battery No. I, Sandy Hook, New Jersey. In most cases, the following report will refer to the four mortar pits collectively as the Mortar Battery.

Mortar Battery – Construction

Planning

The site chosen for the Mortar Battery was one mile south of the extreme northern end of Sandy Hook, and adjacent to and east of the Sandy Hook Lighthouse (fig. 20). The battery was to be constructed according to the plans of the Board of Engineers dated September 28, 1888.[3] Drawings of the Mortar Battery commenced in September 1890 under the direction of Lt. Col. George L. Gillespie (fig. 111). Lt. Col. Gillespie's letter to Chief of Engineers Thomas Casey dated October 18, 1890, included an estimate for the Mortar Battery and plans for the battery. The estimate included the following:

Quantities.

Concrete:	Cubic Yards
Counterscarp wall	8,475
Passages, magazines, and quarters	8,925
Revetment of battery pits	5,600
Total	23,000
Sand excavation:	
Ditch and ditch revetment	19,530
Pits, passages, and magazines	35,120
Total	54,650
Sand filling: (exclusive of sand from above excavations)	
Inside the ditch	136,985
Glacis slopes	16,225
Total	153,210

[3] Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.

Cost.

Concrete, 23,000 cubic yards, at $7.00	$161,000
Excavating, 54,650 cubic yards, at 20 cents	10,930
Filling, 153,210 cubic yards, at 33 1/3 cents	51,070
Total	$223,000[4]

Gillespie noted that it might be possible to reduce the cost of the concrete to $6 per cubic yard, and he arrived at a final estimate of $201,000.[5] The plans and estimate were approved by the Chief of Engineers for the revised amount of $201,000, with an allotment from the "Gun and Mortar Batteries, Act of Congress August 18, 1890."[6]

The overall improvements at Sandy Hook were in preparation for both the Mortar Battery and Battery Potter (see the previous section "Battery Potter – Construction, Preparations at Sandy Hook"). The extension of the wharf, improvement of the laborers' quarters, and construction of the railroad were all efforts to have the site ready for concrete construction by April 1891.

The Mortar Battery site would also require large quantities of cement, broken stone, lumber, tools, and other supplies, as well as storage sheds for cement, stone bins, and concrete mixers. As with Battery Potter, Lt. Col. Gillespie proposed to procure the necessary materials through sealed bids invited by public advertisement, and to provide day laborers for the construction of the battery.

The Concrete Plant

The concrete mixing plant for the Mortar Battery was situated northwest of the battery site, and was connected to the railroad tracks that led from the wharf complex to the site. As indicated in the plans dated June 30, 1892 (figs. 112-113), as the tracks approach the site they split, with one branch leading to the concrete plant and one continuing toward the battery site. A spur off the main track led to the sand pit used during the construction of the Mortar Battery. Additional tracks were laid to facilitate the movement of materials within the plant site, and between the plant and the battery site (fig. 113).

The physical plant was similar to that used for Battery Potter, but with half the capacity. In this case, the wood-frame cement storage shed was built to one side of the railroad spur, and the stone yard was on the opposite side. The stone yard was constructed with trap doors for delivering stone to the gondola cars that traveled in a tunnel below the stone yard. The broken stone would be deposited in the gondola car, which would proceed along the track to the area where the cement and sand were measured out in the requisite amounts of each. The car would then travel up an incline to a platform above the concrete mixer, where it would

4 Gillespie to Casey, Oct. 18, 1890; Letters Sent; Vol. I, p. 16; Entry 815; RG 77; NARA - Northeast Region (NY).

5 Gillespie to Casey, Oct. 18, 1890.

6 Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.

discharge its load. The cubical mixer would mix the stone, cement, and sand with water introduced through a hollow pipe (see the previous section "Battery Potter, The Concrete Plant"). A historic photograph from the F.Y. 1893 Annual Report gives a rare view of the concrete plant at the Mortar Battery, in which horses were apparently being used to haul the concrete from the plant to the battery (fig. 114).

Materials and Contracts

The plans and estimates for the Mortar Battery were based on the construction of the massive concrete structure with natural cement. As with Battery Potter, Lt. Col. Gillespie proposed to procure the materials for the battery through sealed proposals invited by public advertisement, and to have the work performed by hired labor. Gillespie's advertisement dated October 29, 1890, for the delivery of 62,000 barrels of "Rosendale Cement" and 41,000 cubic yards of broken stone to Sandy Hook reflected the amount of masonry necessary for the construction of the Mortar Battery.

The contracts for these materials were awarded to the Lawrence Cement Company for 62,000 barrels of "Hoffman" brand natural cement for $1.02 per barrel, and John A. Bouker for 41,000 cubic yards of broken granite at $1.63 per cubic yard. According to the annual reports, of the materials contracted, 31,000 barrels of natural cement and 20,000 cubic yards of broken stone were designated for the Mortar Battery (see the previous section "Battery Potter, Contracts for Masonry Materials").[7]

The contract with the Lawrence Cement Company ran from December 29, 1890, through January 1, 1892, and was extended through August 1, 1892. The contract with John A. Bouker ran from December 29, 1890, through January 1, 1892, and was extended through November 1, 1892. However, both contracts were declared complete at the end of July 1892. At that time, Gillespie Gillespie awarded a new contract for 25,000 barrels of "Old Newark" Rosendale cement at 93.9 cents per barrel, and 20,000 cubic yards of broken stone at $1.28 ¾ per cubic yard to Calvin Tompkins of New York.[8]

The new contract with Calvin Tompkins appears to have been to supply the needs of both the Mortar Battery and Battery Potter, but the majority of the supplies went to the Mortar Battery. By the close of fiscal year 1893, Tompkins had delivered 23,410 barrels of natural cement and 12,102 cubic yards of broken stone to Sandy Hook, of which 19,773 barrels of cement and 10,000 cubic yards of stone were used in the construction of the Mortar Battery.[9]

In addition to the masonry of the battery, contracts were also awarded for the materials needed to construct the mortar platforms. The plan for the platforms called for granite blocks to form the ring at the upper surface of the platform, and for bolts that would secure

---

[7] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.
[8] Gillespie to Casey, July 8, 1893.
[9] Gillespie to Casey, July 8, 1893.

the bases of the mortar carriages.[10] Sealed proposals for the materials to construct eight platforms were opened on April 12, 1893, and the following proposals were accepted:

Waldo & Stout, Bridgeport, Conn.

192 aluminum bronze bolts, at 29 ¼ cents per pound.
192 phosphor-bronze washers, at 22 ½ cents per pound.
192 steel nuts (for above bolts), at 57 ¼ cents each.
128 wrought-iron anchor bolts, with hexagonal nuts, at 39 cents each.

Casey & Sherwood, New York City.

For eight sets of eight stones each, or 1063 cubic feet granite rings (which form the upper surface of the mortar platforms and the seat of the base ring of the mortar carriage), at $319 for one set, equivalent to $2.4007 per cubic foot.[11]

These materials were used in the construction of the two northern mortar pits. In November 1893, additional materials were ordered for the mortar pits at the southern end of the battery.

Construction Phase[12]

Construction of the Mortar Battery began with the excavation of sand from the site in November 1890.[13] Excavation of the site continued into the following year, and by the end of March 1891, Lt. Col. Gillespie reported to Chief Engineer Casey that the excavation was completed except for the southeast pit. By the close of the fiscal year, it was reported that excavations for the gun pits, passageways, and magazines had been completed, with about 30,000 cubic yards of sand having been removed. Lt. Col. Gillespie noted that "no masonry had been put in place but everything was in readiness for it and the machinery was set up and all other preparations made for the rapid and economical manufacture and deposit of concrete."[14]

[10] Gillespie to Casey, Sept. 28, 1893; File 1708, incl. 8; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[11] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[12] The following sections reference monthly reports documenting the construction of the mortar battery, as well as the Annual Reports from 1891-1893. The monthly reports dating from August 1891 through March 1894 were sent from Lt. J. G. Warren (Warren) to Col. Gillespie, and are compiled in a bound volume *Mortar Battery, Sandy Hook, New Jersey* (New York: United States Engineer Bureau), which is available at the New York City Public Library. Annual Reports for F.Y. 1892 and 1893 are included in this report as Appendices A and B).

[13] Gillespie to Casey, July 9, 1891; File # 3797; Annual Report for F.Y. 1891, Fort at Sandy Hook, N.J.; General Correspondence; Entry 96; RG 77; NAB.

[14] Gillespie to Casey, July 9, 1891.

Masonry

Though Lt. Col. Gillespie had hoped that concrete construction would start by April 1, 1891, the masonry work did not commence until July 13, 1891. One reason for the delay was the need to use of one of the hoisting engines intended for the Mortar Battery at Battery Potter until June 25, 1891.[15] Given the great undertaking of simultaneously constructing Battery Potter and the Mortar Battery, it is no wonder that initially one project took priority. However, once the concrete plant was in operation, the masonry work at the Mortar Battery progressed apace.

Masonry construction of the Mortar Battery was started at the north end of the battery. The retaining walls of northeast and northwest pits were constructed in July and August 1891, and 105 lineal feet of the northwest entrance was constructed up to reference 18.0. With the north end underway, construction of the retaining walls for the southeast and southwest pits, as well as the main and transverse galleries of the south end, was begun in September 1891.

The first change in the planned construction dated to October 1891, when due to unusually high tides the water level in the sand reached a higher point than what the Engineers had originally expected. To accommodate the high water level, and also to simplify the drainage systems for the battery, the Engineers decided to raise the battery 2 feet.

Masonry construction of the Mortar Battery continued into the winter months. Efforts during the months of November and December focused on the south end of the battery. During the month of November, the interior and exterior waterproofing process began. The waterproofing treatment for the Mortar Battery was the same process as that used at Battery Potter, and was performed at both sites by the Stone and Brick Waterproofing Company. The process entailed a preliminary hardening process, followed by the application of paraffin, which was postponed until spring.

Masonry work at the Mortar Battery was stopped during the last week in December, and it would not resume until April 11, 1892. Work during the winter months was confined to the clearing of the ditch around the battery and repairs to the concrete plant. In January, tracks were laid to a sand pit, also known as a borrow pit, northeast of the battery. The task of covering the Mortar Battery was started in February 1892 (see the subsequent section "Sand and Sod, Covering the Mortar Battery").

When concrete production resumed in April, the work focused on the east and west magazines of the battery. Construction through the remainder of the fiscal year completed the magazines, and made progress on the adjacent store rooms and main gallery.

By the end of July 1892, Site Engineer Lt. James G. Warren could report significant progress on the Mortar Battery. He noted that the interior masonry of the battery was practically complete (fig. 115). The blast slopes of the mortar pits (fig. 116) and above the entrance walls for each end had been carried higher (to reference 25.0), but were not complete. He further noted that the concrete floors of the mortar pits would not be put in place until the design of the mortar platforms had been finalized.

---

[15] Gillespie to Casey, June 1891; Letters Sent; Vol. I, p. 195; Entry 815; RG 77; NARA - Northeast Region (NY).

Progress on the Mortar Battery to this level meant that the waterproofing process could continue on the interior of the battery. The Stone and Brick Waterproofing Company spent the months of July and August treating the arches of the magazines, galleries, and passageways.

Work during the first half of 1892 was not confined to the masonry; the ditch around the battery had also been completely cleared and graded. Thus, the completion of the interior masonry and the preparation of the surrounding ditch allowed work to commence on counterscarp walls in July.

Masonry construction from August through December was confined to the counterscarp walls and galleries (fig. 117). By the end of September, Lt. Warren reported that 957 feet of wall had been completed, 79 feet had been partly completed, and 982 feet remained to be constructed.

The overall production at the Mortar Battery was increased during the latter half of 1892 by the addition of machinery from other works at Sandy Hook. In August, one mixer was moved from the plant at Battery Potter to the Mortar Battery. The mixer was overhauled and put in working condition on September 24, 1892. In addition, one double-drum hoisting engine and two derricks were moved from Battery Potter, and one single-drum hoisting engine was brought over from the wharf. The "plant in use" at the Mortar Battery as reported by Lt. Warren from August to October 1892 demonstrates the increase in machinery at the plant:

Plant in Use (August 1892):

Hoisting engines	2	Dump cars	7
Stationary engines	1	Flat cars	7
Concrete mixers	1	Horses	3
Derricks	3[16]		

Plant (October 1892):

Hoisting engines	4	Dump cars	14
Stationary engines	1	Flat cars	14
Concrete mixers	2	Horses	4
Derricks	5[17]		

Also between August and October, the daily average number of laborers at the site increased from 47.5 to 98.0, which was the highest number of laborers at the site during all of the construction. All of the added machinery and manpower meant an increase in production at the Mortar Battery. However, as Lt. Col. Gillespie explained in the F.Y. 1893 Annual Report, the lack of proper transportation for the concrete meant that the capacity of the plant did not expand concurrently (Appendix B). According to the October monthly report, 2,812 cubic yards of concrete were mixed and placed at the Mortar Battery, which was the largest amount so far. However, this only represented an increase of 880.85 cubic yards from August to October. This was still a significant amount of concrete output, and the increased production helped complete the counterscarp walls before the worst of the winter weather began.

[16] Warren to Gillespie, August 1892; *Mortar Battery*.
[17] Warren to Gillespie, Oct. 1892; *Mortar Battery*.

Construction of the counterscarp walls during this period included the galleries of the counterscarp designed to house the machine-gun defenses for the Mortar Battery. The original plans for the Mortar Battery included an outline of the counterscarp galleries situated at the northeast and southwest corners of the surrounding wall (fig. 111). Lt. Warren submitted revised plans for the galleries to Lt. Col. Gillespie on September 2, 1892 (fig. 118). Warren's letter noted that the galleries would be equipped with machine guns that could sweep the ditch surrounding the interior of the battery. The northeast gallery would protect the east and north sides of the ditch, and the southwest gallery would protect the south and west sides. The correspondence to Lt. Col. Gillespie provided an estimate for the construction of the galleries, as well as details pertaining to their construction (see the subsequent section "Original Appearance, Exterior Elements, Counterscarp Wall and Galleries").[18]

The plans for the counterscarp galleries were approved on September 29, 1892, with some minor changes. They included a plan for mounting the Gatling or machine guns of the galleries. Lt. Warren used the Maxim gun as his model, and designed a mount that would allow the gun to be moved in and out of the embrasure (fig. 119). The openings of the gun ports were to measure 10 inches by 9 ½ inches, and the throat of the embrasures was lined with wrought-iron plates.

Lt. Warren chose the Maxim gun because it was the most modern gun of this type. However, it appears that Gardner guns were used instead. In October 1892, after the plans for the counterscarp galleries had been approved, Lt. Col. Gillespie requested illustrations of the Gardner gun in order to design the embrasures and shield plates of the gallery gun ports.[19] Subsequent correspondence between Chief Engineer William Craighill and Chief of Ordnance Flagler in August 1895 noted that both the Mortar Battery and Battery Potter were to receive Gardner carriages and presumably Gardner guns.[20] Documentation of the specific Gatling guns emplaced at the counterscarp galleries was not uncovered, but the correspondence suggests that the Gardner gun was used at both the Mortar Battery and Battery Potter.

As previously mentioned, the counterscarp walls – including the north entry and the counterscarp galleries – were the sole focus of masonry construction in the fall and early winter of 1892. By the end of December, Lt. Warren reported that the northeast gallery was complete, including an application of whitewash to the interior walls and arches. The southwest gallery was also complete, except for the whitewash. Thus, an important part of the Mortar Battery's defenses was in place.

Once again, the winter months brought stormy weather and extremely cold temperatures. This precluded the manufacture and placement of concrete during the most inclement months. However, a large labor force (an average of 69 laborers per month from January

---

[18] Gillespie to Casey, Dec. 1, 1890; Letters Sent; Vol. III, pp. 39-41; Entry 815; RG 77; NARA - Northeast Region (NY).

[19] Gillespie to Casey, Oct. 13, 1892; Letters Sent; Vol. III, p. 102; Entry 815; RG 77; NARA - Northeast Region (NY).

[20] Chief Engineer Brig. Gen. William Craighill to Chief of Ordnance Flagler, August 16, 1895; File 11876, Box 258; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

through April) remained employed at the battery, placing sand (see the subsequent section "Sand and Sod, Covering the Mortar Battery").

A lull in the placement of sand during the month of April 1892 allowed the Engineers to work on the drainage system for the battery. Lt. Warren described the excavation and construction of part of the drainage system as follows:

> 8 inch pipe – 245 feet between the top entrances.
> 12 inch pipe – 75 feet from the foot of the slope at the southeast corner to the iron pipe under the counterscarp wall and thence outside the battery 400 feet or all but 100 feet of the 500 leading to the swamp southeast of the battery.[21]

Additional drainage was installed in May. During the month, 380 linear feet of 4-inch pipe was laid to provide drainage for the magazines.

The Engineers were also busy in April preparing for the resumption of masonry construction at the Mortar Battery. The plant was put in working condition and materials were ordered for eight mortar platforms, as previously described (see the previous section "Materials and Contracts").

Masonry construction at the Mortar Battery resumed at the north end of the battery in early May 1893 (fig. 120). Included in the production for the month were the blast slopes of the northern pits, the northern dynamo room, the main gallery, and the magazines. By the end of the month, a total of 26154.10 cubic yards of concrete had been mixed and placed at the Mortar Battery. With the construction of the main structure and counterscarp walls drawing to a close, one of the cubical concrete mixers was disassembled and prepared for shipment to Fort Hamilton.

Concrete construction continued through the summer of 1893, and by the end of August the masonry construction was nearly complete. The floor levels were within 3 inches of their finished level. To facilitate the final construction of the interior sections of the battery, a gap had been left in the counterscarp wall, and the front entrance had been left incomplete.

Preparations for the mortar platforms of the two northern mortar pits had begun in July 1893. Since the concrete portion of the battery was almost completed, constructing the foundations for the mortar platforms was the focus of the masonry work over the next few months (fig. 121). The construction of the foundation had to allow for the setting of the bolts that would hold the mortar carriages in place. To allow for setting and adjusting the bolts, empty cement barrels were inverted over the area where the bolts would be placed. The foundation was then poured around the barrel. When the concrete foundation had set, the heads of the barrels were removed to reveal the holes for the bolts (see the subsequent section "Mortar Platforms").[22]

---

[21] Warren to Gillespie, April 1892; *Mortar Battery*.

[22] 2nd Lt. Robert McGregor to Gillespie, March 5, 1894; File 1708, incl. 40; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

The months of October through December 1893 witnessed the continued masonry construction of the Mortar Battery. During the month of October, the gap in the west counterscarp wall was filled, and construction of the main entrance was continued. The concrete main entrance was completed in November, and in December a bluestone coping was set over the entrance. At the same time, the bulletproof doors for the entrance were constructed and ready to be hung, and the bulletproof doors for the counterscarp galleries were installed. Concrete construction of the interior portions of the battery included finishing the floors of the magazines, and also the masonry associated with the ammunition tracks and turntables (see the subsequent section "Armament"). By the end of December 1893, the masonry construction of the Mortar Battery was practically complete. The final masonry of the pits and the floors of the galleries along the service tracks were left undone while work was finalized on those items.

December 1893 was also significant because of a number of visitors to the Mortar Battery. The advanced condition of the battery and the fact that it was the first of its type made it important for officers of both the Corps of Engineers and the Ordnance Department to inspect the site. Lt. Warren reported that during the course of December, the Mortar Battery was visited by Lt. Col. Gillespie – no stranger to the project – as well as Lt. Col. P. C. Hains and Lt. Col. William Ludlow, both of the Corps of Engineers. Warren also noted that on December 14, Brig. Gen. D.W. Flagler, Chief of Ordnance, visited the Mortar Battery, accompanied by Major Clifton Comly and Captain Frank Heath, Ordnance Department. Lt. Col. Gillespie returned twice in January 1894 to keep abreast of developments in the project, and to shepherd it towards completion.

Work at the Mortar Battery concentrated on the assembly of the mortar carriages and mounting the mortars during the first half of 1894. By June 22, 1894, the north end of the battery was ready for testing, and by November 25, all of the mortars had been mounted and proof-fired (see the subsequent section "Armament").

Lt. Col. Gillespie submitted a final report on the construction of the Mortar Battery on May 7, 1895. Gillespie's report included a set of four drawings of Mortar Battery No. I, Sandy Hook, New Jersey (figs. 122-125), and the following breakdown of expenditures on the Mortar Battery:

Purchase and erection of plant for construction	$ 15,923.36
Construction of battery proper	228,498.54
Platforms for 16 carriages	25,330.74
Total cost without armament	$269,752.67
Assembling 12 carriages, and mounting mortars thereon	3,600.00
Balance on hand, May 1, 1895	699.33
Total	$ 274,052.00

Cost of Armament	
Sixteen spring-return carriages	$ 144,000.00
Sixteen cast-iron steel-hooped mortars	120,000.00
Total	$ 264,000.00[23]

Completion of the Mortar Battery at Sandy Hook marked the installation of the first Endicott System emplacement of this type.

Lighting the Mortar Battery

Prior to the official completion of the Mortar Battery in May 1895, Lt. Col. Gillespie submitted plans for lighting the interior of the battery. The lighting system included 12 incandescent-light fixtures in the main gallery, and six fixtures in the interior rooms, all with a 24-candle-power capacity. The fixtures were powered by an accumulator with a capacity of 100-ampere hours. The accumulator was charged from the dynamo at Battery Potter, and then brought to the Mortar Battery whenever electric lighting was required. This system was in place at the Mortar Battery by April 11, 1895.[24]

Sand and Sod, Covering the Mortar Battery

Lt. Col. Gillespie's 1890 estimate for the construction of the Mortar Battery included 153,210 cubic yards of sand fill beyond that acquired from the excavation of the site. The covering of the masonry structure of the battery with sand was an important part of the battery's defenses. The massive quantity of sand required for the project was taken from three borrow pits near the site.

In January 1892, Lt. Warren reported that 400 feet of track had been laid to the borrow pit northeast of the battery, and that a derrick was in position to begin placing sand at the south end of the battery (fig. 112).

The work of depositing sand on the battery began in March 1892, and it continued at a slow pace through the fiscal year. Initially the sand filling was done mostly by hand; the sand was shoveled into removable boxes with a capacity of about 1 cubic yard set on rail cars, which were then moved under a derrick that would raise the boxes and dump the sand where it was needed (fig. 126). The F.Y. 1892 Annual Report stated that 9,449 cubic yards of sand had been placed during the year – a relatively small amount, given the total estimate by Lt. Col. Gillespie.

It appears that the increase in labor in October 1892 previously mentioned was primarily designed to assist with the sand filling at the Mortar Battery. The amount of sand excavated and placed did increase during that month, but Lt. Warren noted that it was a slow process.

---

[23] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983), p. 179.

[24] Bearss, *The Sandy Hook Defenses*, p. 180.

Therefore, a steam-powered bucket grapple (or shovel) was ordered to augment the large labor force employed during the winter of 1892-93 for the excavation and placement of sand.

A Lancaster bucket grapple was in operation at the borrow pit by mid-November 1892, and it greatly increased productivity (fig. 127). The steam grapple was used to load rotary dump cars with a capacity of 3 cubic yards, which were then hauled up an incline by a steam-powered hoist, where they were dumped by hand. One steam-powered grapple was capable of moving 500 cubic yards of sand in eight hours. That capacity was not realized at the Mortar Battery, due to the lack of proper transportation for the sand. Sand excavation and placement per grapple at the site did not exceed 350 cubic yards per eight-hour period.[25] However, this was still a significant increase in the placement of sand, and a second steam shovel was procured in January 1893.

While the masonry work was stopped from January through April 1893, great progress was made on filling the interior portions of the battery with sand (fig. 128). By the end of March, 93,276 cubic yards of sand had been excavated and deposited on the battery. At that time, Lt. Warren estimated that it would take a total of 115,735 cubic yards of sand to complete the project. However, as he reported in the following month, the estimate had not allowed for the excessive settlement of the sand. This, combined with shifting sand due to high winds, resulted in a larger amount of sand required to adequately cover the Mortar Battery.

To combat the sand erosion, Lt. Warren deployed a small labor force to cut sod from the marsh south of the battery. The sod was used to cover the slopes of the mortar pits above the concrete blast slope. The sod thus placed would cover the revetment from reference 35.0 – the top of the concrete slope – to reference 50.0 – the top of the entire slope. It was further determined that the slopes adjoining the ditch of the battery could be covered with a native heather that could survive exposure to the sun and wind, in combination with cedar boughs. The slopes were also sown with oats. All of these efforts had one purpose: to combat the loss of sand so laboriously deposited to cover the Mortar Battery.

The sand fill and protection of the slopes continued along with the concrete construction during the summer, fall, and early winter of 1893. By the end of November, the placement of sod on the interior revetment slopes was complete; work on the exterior slopes continued into the winter. Lt. Warren reported in January 1894 that the sand covering of the portions of the battery within the counterscarp wall was complete, with the exception of a small area; the total sand excavated and placed to date was 147,494 cubic yards.

Of the reports reviewed, the last one from March 1894 noted that the sand filling had been temporarily discontinued until the mortar carriages had been brought into the battery. At that point, the total had reached 151,210 cubic yards, which was closer to Lt. Col. Gillespie's original estimate. The incomplete portion, along the south side of the counterscarp wall, was undoubtedly completed after the arrival and installation of the mortar carriages. The covering of the Mortar Battery with sand, and the subsequent cover of the sand with sod and heather, served as protection for the battery and as natural camouflage.

[25] Gillespie to Casey, July 8, 1893; File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

Mortar Platforms

Completion drawings for the Mortar Battery and historic photographs depict the construction of the mortar platforms. These drawings, combined with the monthly reports and correspondence, provide a good understanding of the construction methods employed at the Mortar Battery.

The construction of the mortar platforms was hampered by the high water level in the sand of the Mortar Battery. In order to construct the foundations for the mortar platforms, the Engineers had to drain the water from the sand by means of pumps. When the water level was low enough, the excavation of the pit and concrete work was done as quickly as possible. Correspondence from 2nd Lt. Robert McGregor (who replaced Lt. Warren as the site engineer in December 1893) to Lt. Col. Gillespie described the process employed by his predecessor for constructing the foundations of the mortar platforms (Appendix E).

The foundation of each platform began at reference 2.29. With the inverted cement barrels in place, the foundation was brought up to reference 6.0. The hold-down bolts that would secure the metal base ring of the platform were then set in the holes in the concrete foundation. Lt. McGregor's letter described this process in detail, and completion drawings, as well as a historic photograph of the site, depict the work (figs. 129 -130). In short, the bolts were set after the foundation was poured, in order to more accurately place each bolt. Then eight granite blocks were set on the concrete foundation to form a masonry ring. These granite blocks were predrilled to allow the bolts to pass through them and protrude beyond their top surfaces. Then a steel base ring was set on the granite circle. (This lower, base ring supported the rollers of the carriage, and so was also called the lower roller path.) The base ring was secured on top of the granite ring by means of the hold-down bolts, which were anchored in the concrete and extended through the granite ring. Once the ring was in place, the concrete around the perimeter of each platform was brought up to reference 10.0, and the upper, index ring for the mortar platform and carriage was set in place. The mortar carriage was then mounted on the base ring.

Two issues arose concerning the base rings during construction of the mortar platforms. The first was brought to the Chief Engineer's attention by Lt. Col. Gillespie on May 17, 1893, when he noted that each base ring was manufactured in a single piece that weighed about 17 tons and measured about 14 feet in diameter.[26] The large size of the rings would not allow the workers to bring them through the entrance of the battery. So, when the time came to deliver the base rings, a trestle was built to carry them over the counterscarp walls and to the upper slopes of the pits (fig. 131). From there the base rings were lowered into the pit via hoists. The first base rings to be delivered by this system were for the northeast pit in September 1893. The same system was used to place the mortar carriages in the mortar pits. However, this system was not flawless. On April 13, 1894, while lowering a carriage into the southwest pit, a 4-inch rope snapped, dropping and breaking the base ring of the carriage and causing considerable damage to the platform. The repairs included replacing one stone of the granite

[26] Gillespie to Casey, May 17, 1893; File 1708, incl. 3; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

ring and re-forging three of the hold-down bolts. The base ring could not be repaired, and a new base ring was requested from the Ordnance Department.[27]

The other problem with the base rings was discovered by Ordnance Officers of the Sandy Hook Proving Ground. The Ordnance Department tests of the mortar carriages showed that during repeated firing, the nuts of the hold-down bolts loosened. This matter was brought to the attention of Lt. Warren, who noted that once the mortar carriage was assembled, it was not possible to access the nuts without removing the entire movable part of the carriage. Warren therefore recommended that a steel "jam nut" three-quarters of an inch thick be installed under the standard nut to better secure the base ring of the mortar platform and carriage.[28] This solution was ultimately approved by the Board of Engineers in November 1893, with the added recommendation that the thread of the bolt be burred above the nut assembly.

These issues aside, the Engineers made steady progress on the construction of the mortar platforms. As stated in Lt. McGregor's letter, the excavation and foundation work for the northeast pit was completed in August 1893. Also received during that month were the stones for the granite rings of the same platforms. With the hold-down bolts, granite course, and base rings in place, the surrounding concrete was carried up to the 10-foot level, and all four platforms were ready to receive their carriages by the end of November. At the same time, foundation work progressed at the northwest pit, which was brought to the same condition during the month of December.

Meanwhile, progress was made constructing the mortar platforms of the southern mortar pits. By the end of November 1893, the pits at that end of the battery were ready for the stones of the granite rings and the hold-down bolts. However, delays in the assembly of the carriages in the northern pits, and requirements for laborers in other portions of the battery construction, delayed further work at the southern end until March the following year.

The Ordnance Department began delivering the mortar carriages to the Mortar Battery in June 1893. Once the mortar platforms of the northern end of the battery were complete, the assembly of the carriages commenced. Early in the assembly process, which began in January 1894, it was discovered that adjustments had to be made to the granite ring of the platform to allow the spring recoil cylinders of the carriage to fit on the platform. Lt. McGregor quickly solved this problem, and reported that the platforms would be ready for the Ordnance Department to resume assembly of the carriages as fast as they wanted (see the subsequent section "Mortar Carriages and Mortars"). When work resumed on the southern mortar platforms in March, the granite was cut after the hold-down bolts and stones were set in place.

[27] McGregor to Gillespie, April 24, 1894; File 1708, incl. 45; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

[28] Warren to Gillespie, Oct. 19, 1893; File 1708, incl. 17; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

Beginning with the northwest pit, the mortar carriages at the north end of the battery were assembled during February and March (see the subsequent section "Mortar Carriages and Mortars"). By the end of March, four of the eight pits were ready to receive their carriages. Work was completed on the platforms by mid-April, and the battery was near completion.

Mortar Battery – Armament

Mortar Carriages and Mortars

Eight mortar carriages for the north end of the Mortar Battery were ordered by the Chief of Engineers in March 1893. All of the mortar carriages were Model 1891, and were manufactured by the Builders Iron Foundry in Providence, Rhode Island. The first four carriages were delivered by the Ordnance Department on June 10, 1893, for assembly and installation in the northeast pit. The masonry walls and slopes of northeast pit had been the first completed, and the foundations for the mortar platforms were slated to be the first constructed. By the end of October, Lt. Warren reported that the Ordnance Department had four more carriages at the Proving Ground ready for delivery, and that two carriages for the southern end of the battery were on rail cars near the battery.

As previously discussed, progress continued on the masonry foundations for the mortar platforms and carriages through the fall and winter of 1893. The metal base ring was essentially the first component of the mortar carriage assembly. These were in place at the north end of the battery by the end of November. The first attempt at assembling the carriages of the north end pits in January 1894 encountered some complications. It was discovered that the diameter of the granite ring of the platform was too small to allow the spring recoil cylinders of the carriage to sit in the well of the platform. Lt. McGregor alerted Lt. Col. Gillespie to this problem in a letter dated January 24, 1894. In that correspondence, McGregor described the dilemma and offered the following solution:

> The lowest horizontal diameter of this cylinder is between three and four inches below the top surface of the stone, and it swings, in place, within ½ inch of the inside edge of the lower roller path. As the stone comes 1 ½ inches inside the lower roller path it will be necessary to cut away this projection to a depth of 4 inches around the entire circles, as shown in red on the accompanying tracing.[29]

Stone cutters were immediately put to work cutting away the excess granite of the stone rings, and they had completed this task at the northern end of the battery by February 15. This same process was completed at the south end of the battery as the mortar platforms were assembled.

[29] McGregor to Gillespie, Jan. 24, 1894; File 1708, incl. 33; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

During the final weeks of February and through March, the Ordnance Department worked on assembling the mortar carriages of the northwest pit. The Engineers were responsible for assembling the other 12 carriages for the Mortar Battery. In his March 1894 monthly report, Lt. McGregor noted that the first carriage was ready for its mortar on March 3.

All of the mortars emplaced at the Mortar Battery were 12-inch, breech-loading, rifled mortars, Model 1886, which had a cast-iron body enclosed in built-up steel hoops from the mortar's mid-section back to the breech.[30] They also were manufactured by the Builders Iron Foundry. The first mortar was delivered by the Ordnance Department and installed on March 10, 1894. Though the report does not specify in which pit this work was performed, it is assumed that the Engineers were working in the northeast pit, since this one was the first completed. The remaining three mortar carriages of that pit were ready for the mortars, but a defect was discovered in the trunnion beds. The report states that the two sides of the trunnion beds were not level. The problem was corrected by the Ordnance Department without significant delay.

The Ordnance Department delivered two additional mortars during the month of March, and by the end of June 1894, the northern pits were completed and ready for service. At the southern end of the battery, the southeast pit was near completion and serviceable in the event of war, and the carriages of the southwest pit were mostly assembled. By the fall of 1894, all 16 mortars were in place and serviceable (fig. 132).

Proof-Firing

The first test of a completed mortar emplacement was carried out on June 22, 1894, with Lt. Col. Gillespie and the Commanding Officer of the Sandy Hook Proving Ground in attendance (Appendix F). The Engineers chose the southeast gun of the northeast pit for that test, since it would subject the concrete structure and slope of the battery to the greatest pressure. Due to the close proximity of the mortar to the concrete wall and slope, Lt. Col. Gillespie and company feared there would be damage to the masonry. The mortars were raised to an elevation of 45 degrees, and the 630-pound shot was propelled by more than 60 pounds of brown prismatic gunpowder. Lt. Col. Gillespie's report to Chief Engineer Casey the following day detailed the proof-firing, and noted that the only damage sustained from the blast of the mortar was to the sod covering the upper slope. By all accounts, the first test was successful, and minimal damage was sustained by the masonry of the battery.[31]

Upon the completion of the first test, the Commanding Officer of the Proving Ground recommended that each mortar and carriage at the Mortar Battery be proof-tested. These tests would serve to proof the mortar, carriage, and platform of the emplacement, and would also provide valuable information regarding the accuracy of the mortars when fired in volleys from separate pits. The proof-firing of each mortar was completed on November 25, 1894.[32]

---

[30] SAHO Park Historian Thomas Hoffman.

[31] Gillespie to Casey, June 23, 1894; File 1708, incl. 47; General Correspondence and Record Cards, 1893-94; Entry 98; RG77; NAB.

[32] Bearss, *The Sandy Hook Defenses*, p. 178.

Ammunition Tracks

As with Battery Potter, the Mortar Battery required a system of railroad tracks to deliver ammunition from the wharf to the battery, and to move the ammunition within the battery. The completion drawings of the Mortar Battery depict the ammunition service tracks installed at the battery. The main line previously laid to facilitate the construction of the battery ran from the wharf to the site. The ammunition service line ran though the entrance of the battery to turntables positioned at the entrance to each end of the battery. From the turntable, the track led to the western pits at each end of the battery. The track continued into the transverse gallery and through to the eastern pit at each end of the battery. Turntables were also positioned at the junction of the transverse galleries (between each pair of mortar pits) and the main gallery that ran between the north and south ends of the battery. The tracks in the main gallery gave access to the magazines and storage rooms of the battery. Thus, the ammunition service tracks enabled the Engineers and later the Artillery Corps to efficiently transport ammunition from the wharf to the battery.

Construction of the portions of the ammunition track inside the battery was begun in November 1893. During the month, 120 linear feet of track were laid in the main gallery, and the turntables for the transverse galleries had arrived at the site. The turntables at the entrances to the north and south ends of the battery were positioned in the following month, as was the one at the north end transverse gallery. By January 1894, the main gallery was completed, and the line for a permanent track connecting the ammunition service track with the wharf line was laid out. Construction of the track continued as the battery neared completion, and it was ready to receive ammunition deliveries by June 1894.

To augment the ammunition delivery, an overhead trolley and hoist system was put in place in November 1895. The system consisted of an overhead rail in the main gallery, which ran along the arch of the barrel-vaulted ceiling and intersected the transverse galleries at both ends of the battery. The rail was installed in two sections and fastened with iron hangers spaced 5 feet apart. A block and tackle with a capacity of 1,000 pounds was attached to the rail at each end of the Mortar Battery. The overhead system was used for raising the mortar shells off the railroad cars and loading the ordnance onto the shot trucks for delivery to the mortars.[33]

[33] McGregor to Gillespie, March 18, 1895; File 7345; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

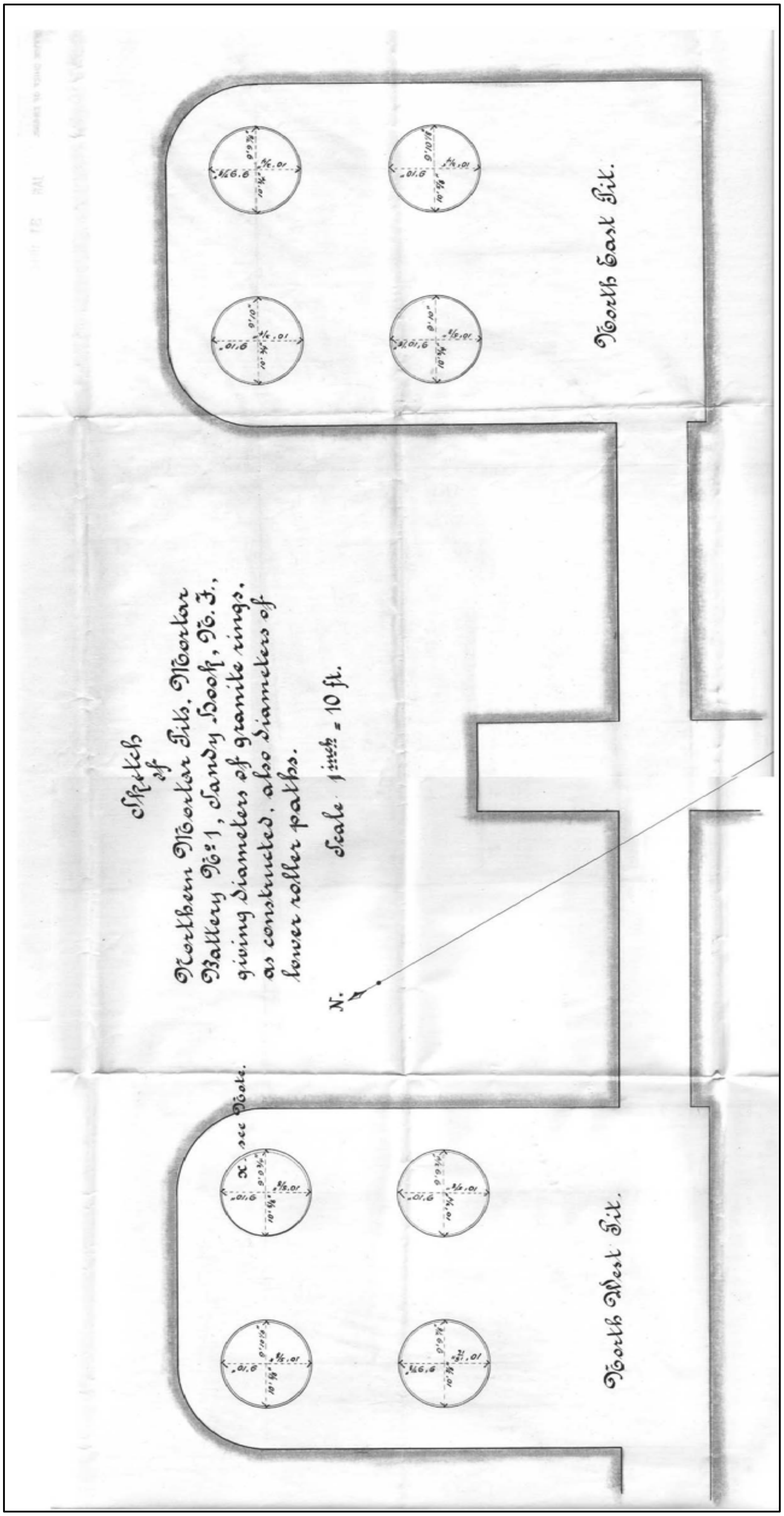


Figure 108. "Northern Mortar Pits, Mortar Battery No. 1, Sandy Hook, N.J."

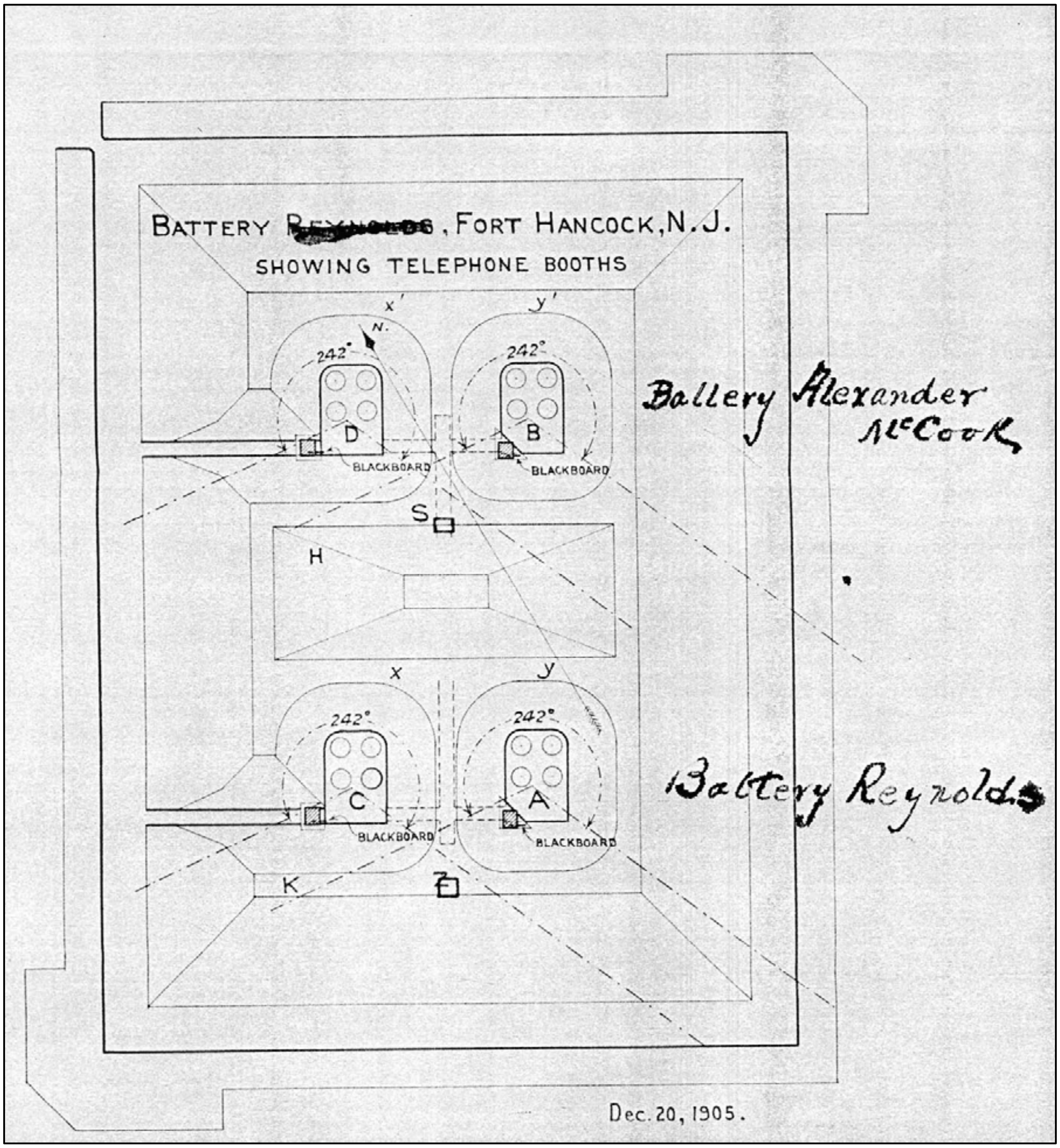


Figure 109. "Battery Reynolds, Fort Hancock, N.J. Showing Telephone Booths. Dec. 20, 1905." Battery McCook and Battery Reynolds added in handwritten script to identify re-designation of Mortar Batteries.

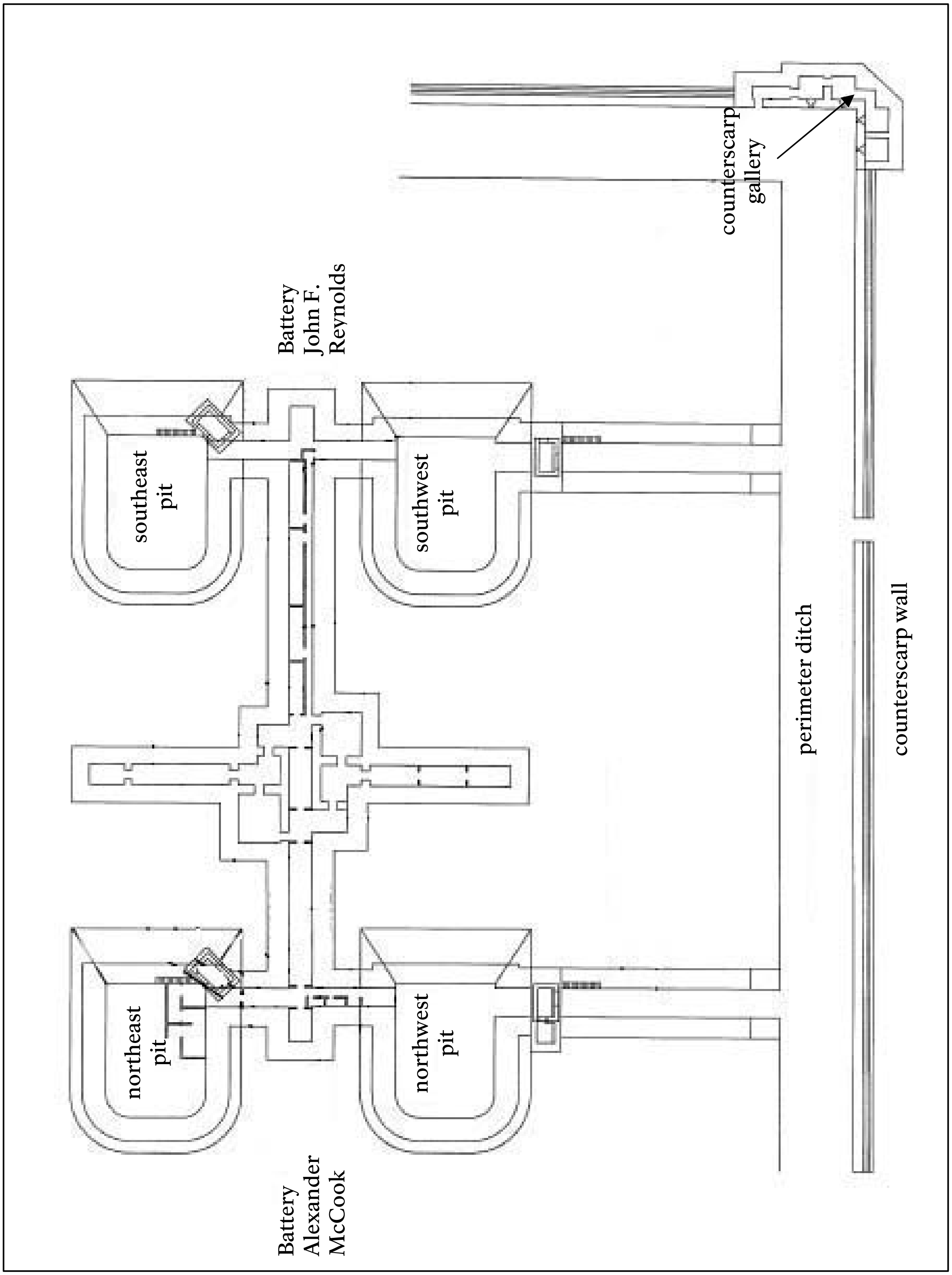


Figure 110. Mortar Battery (not to scale).

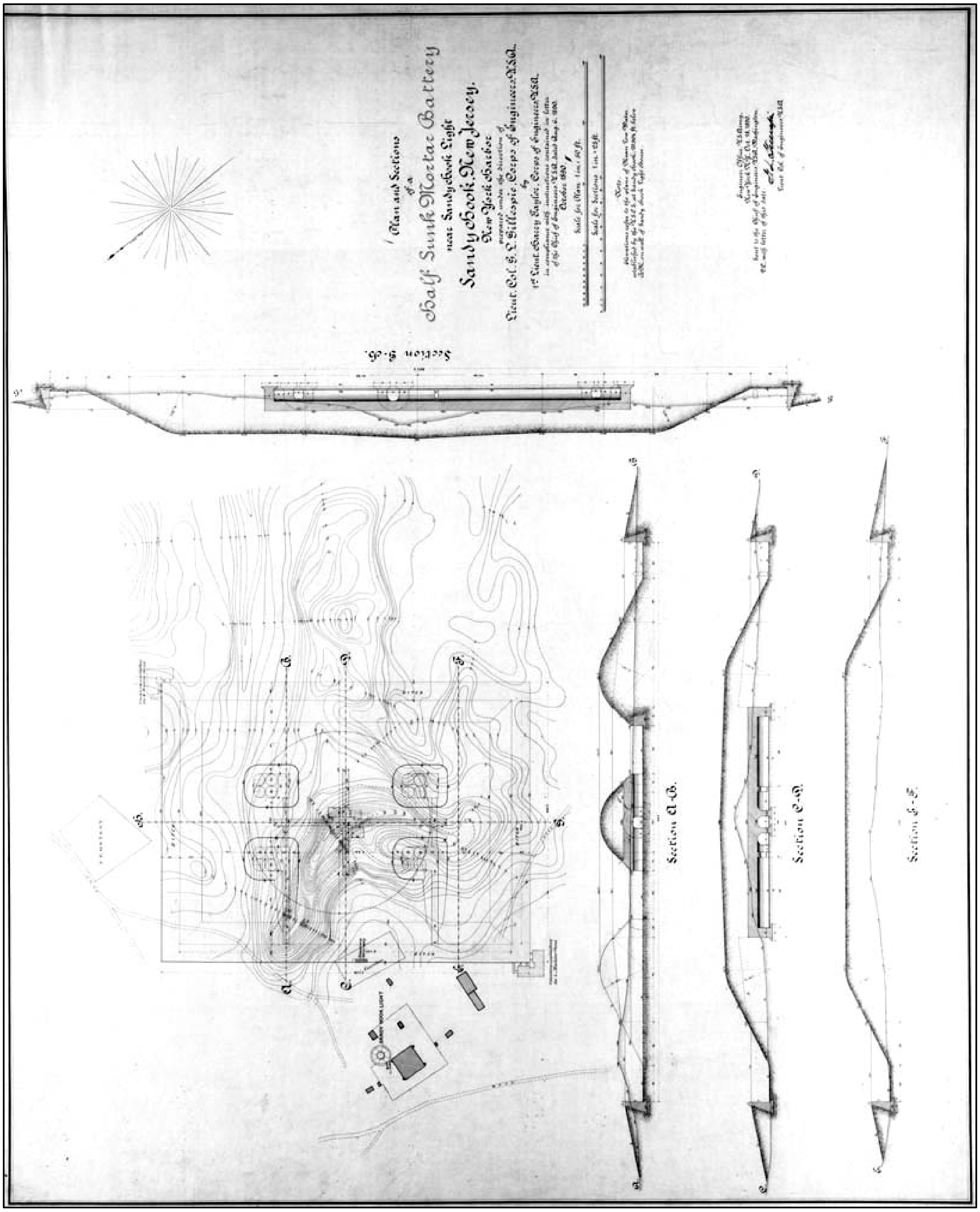


Figure 111. "Plans and Sections of a Half Sunk Mortar Battery near Sandy Hook Light, Sandy Hook, New Jersey, October 1890."

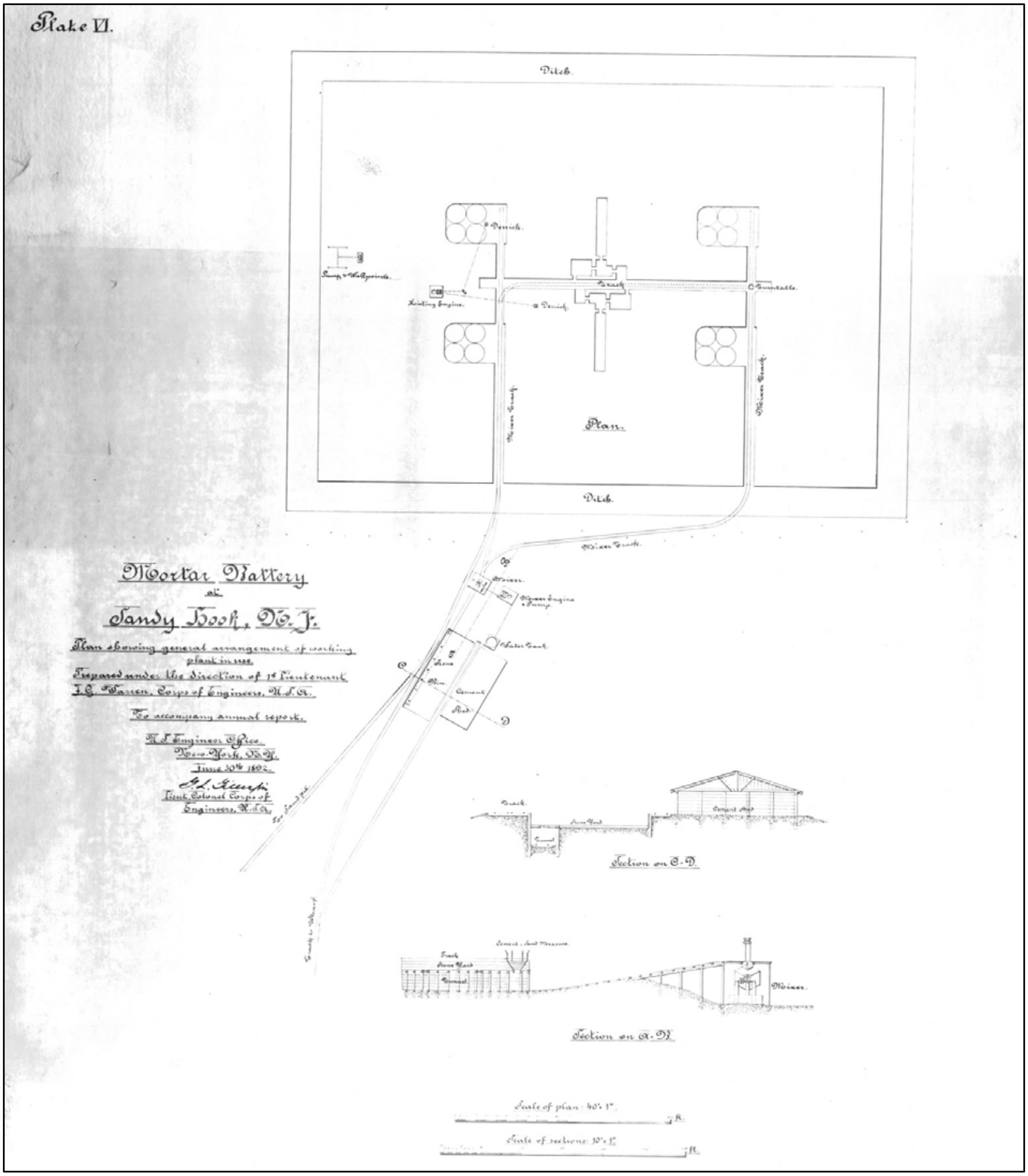


Figure 112. "Mortar Battery at Sandy Hook, N.J. Plan showing general arrangement of working plant in use, June 30, 1892."

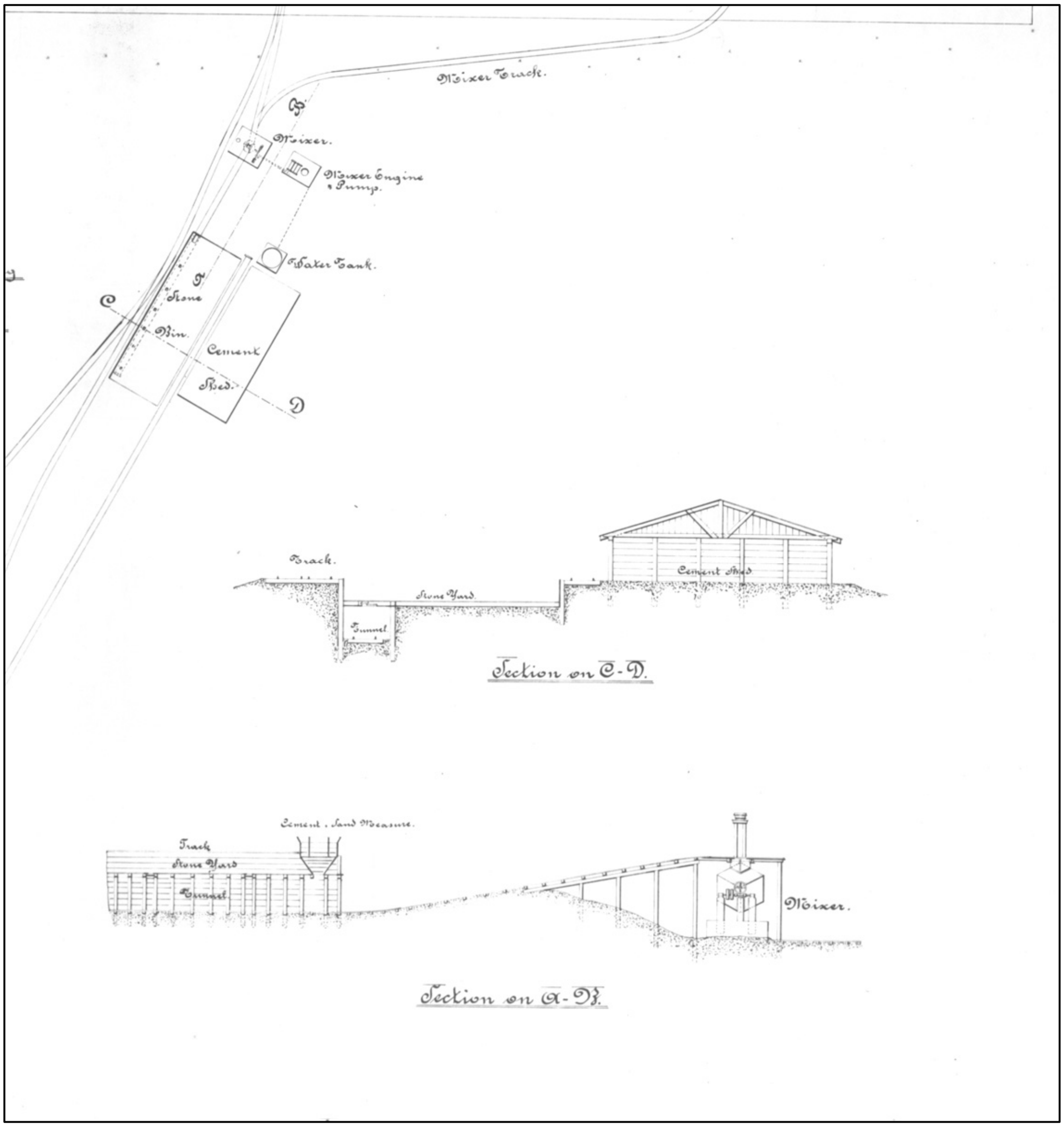


Figure 113. Detail of concrete plant from "Plans and Sections of a Half Sunk Mortar Battery near Sandy Hook Light, Sandy Hook, New Jersey, October 1890."

Figure 114. Concrete mixers in operation at Mortar Battery plant, Nov. 14, 1892.

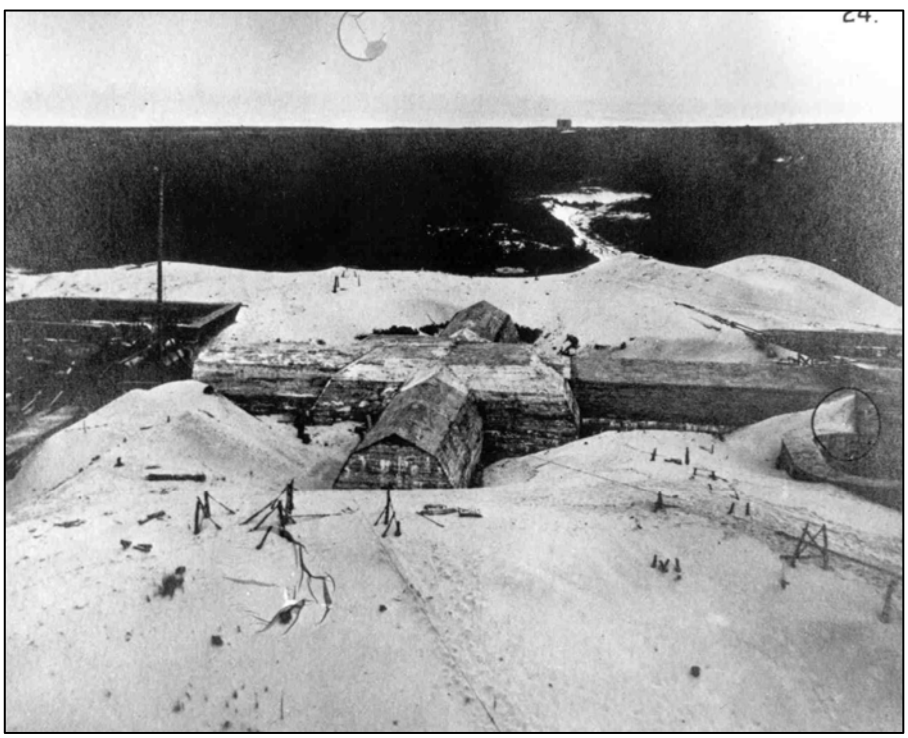


Figure 115. Mortar Battery, as seen from lighthouse, June 7, 1892.

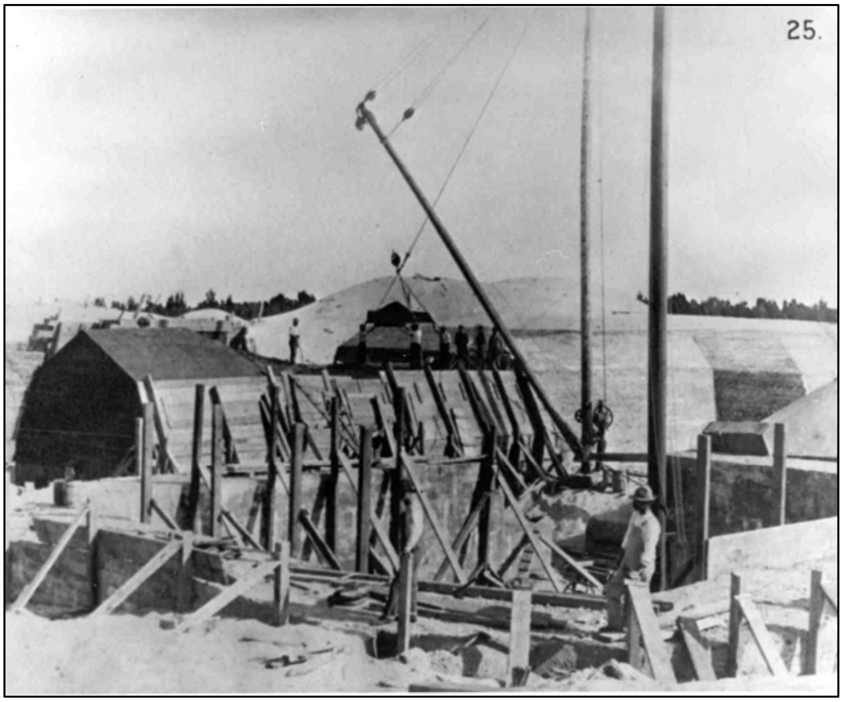


Figure 116. Northwest pit during construction, June 7, 1892.

Figure 117. Commencing construction of counterscarp wall, near north entrance, July 29, 1892.

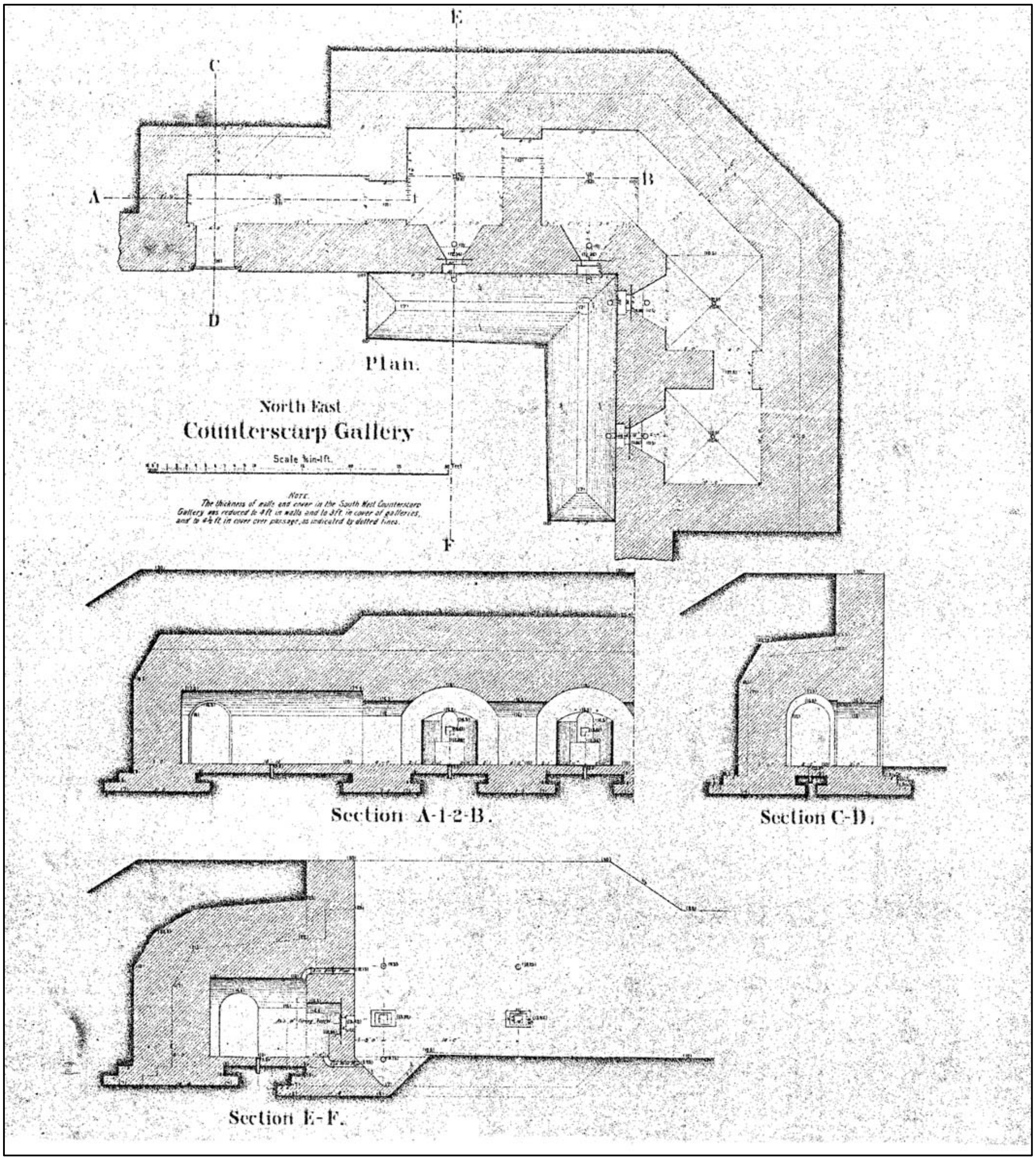


Figure 118. Mortar Battery: Detail of counterscarp gallery, from sheet no. 4 of four completion drawings, 1895.

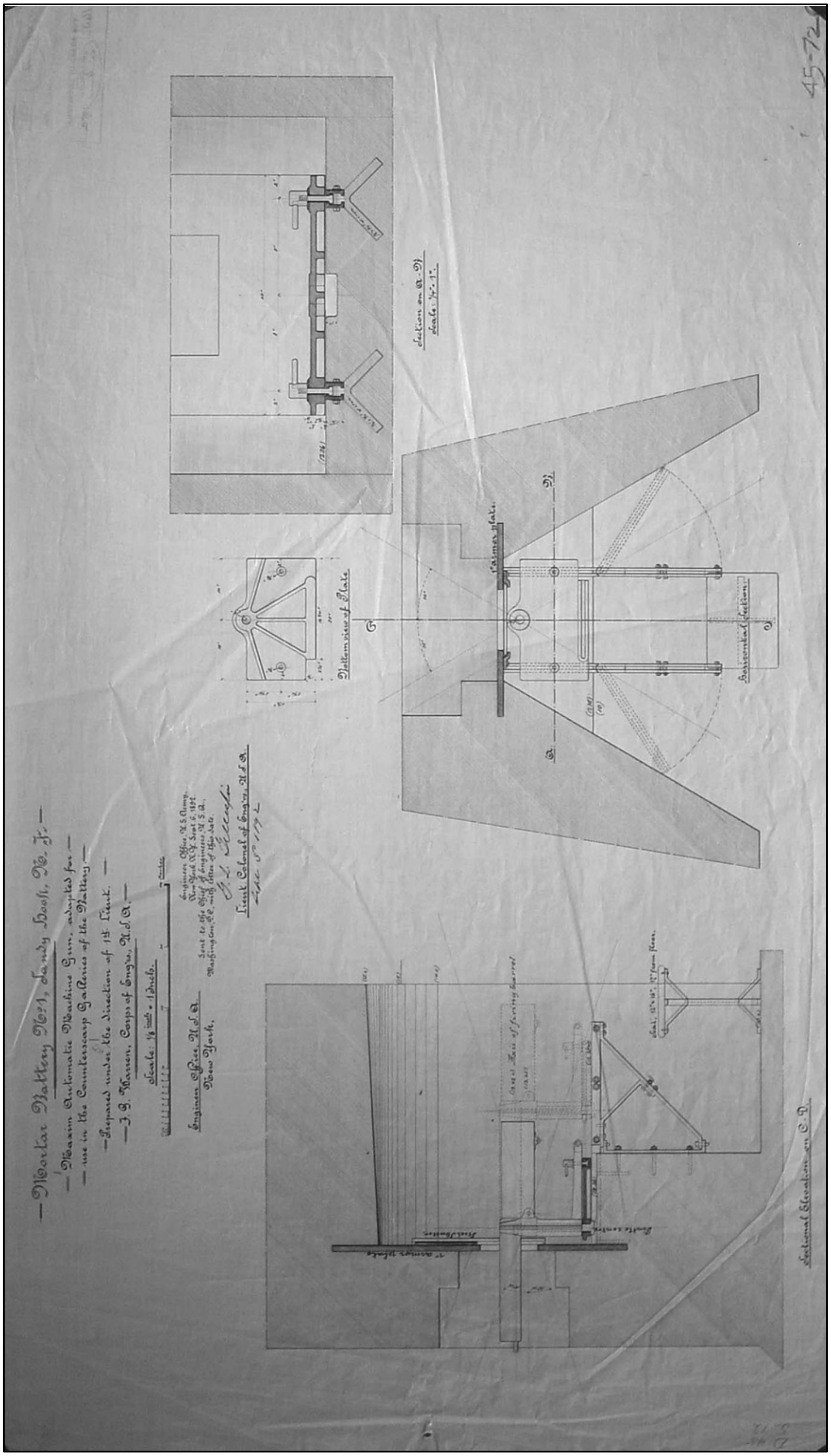


Figure 119. “Mortar Battery No. 1, Sandy Hook, N.J. Maxim Automatic Machine Gun adapted for use in the Counterscarp Galleries of the Battery, September 1892.”

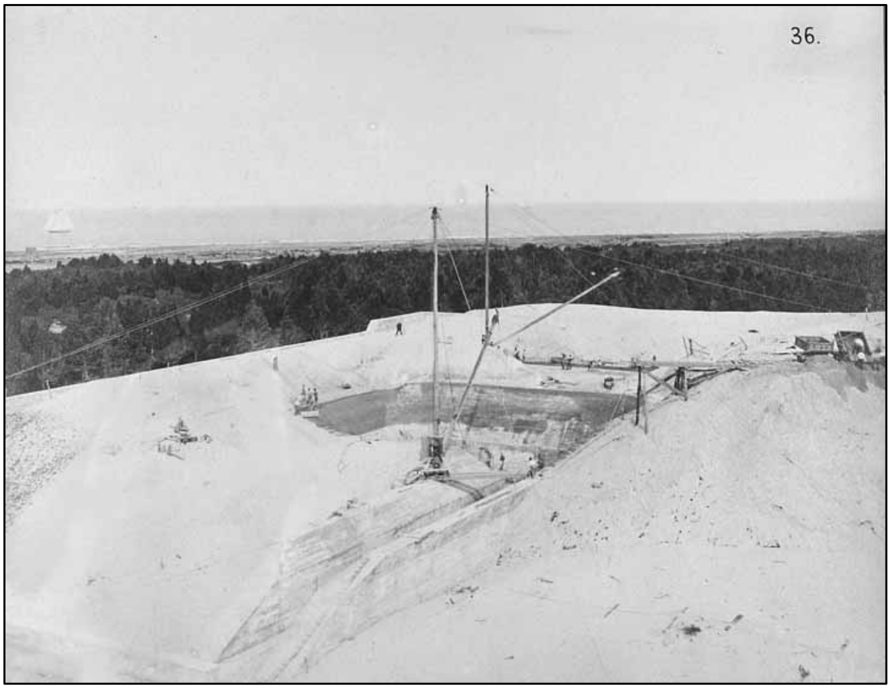


Figure 120. Construction of concrete slopes around the two northern pits, May 1, 1893.

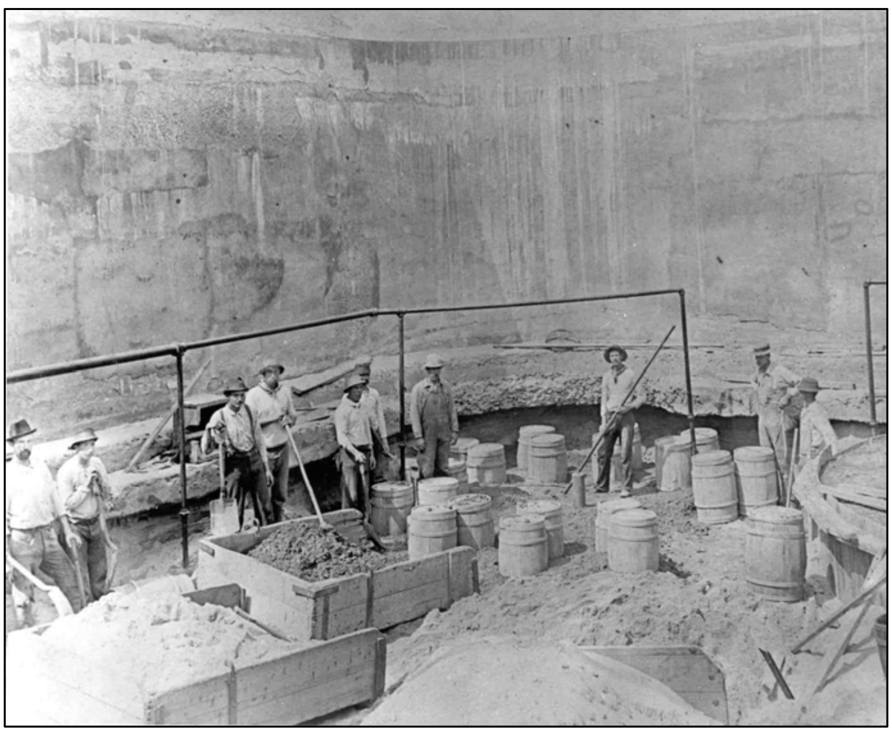


Figure 121. Mortar Battery, excavation and construction of foundations for mortar emplacements; note inverted cement barrels protecting bolt locations.

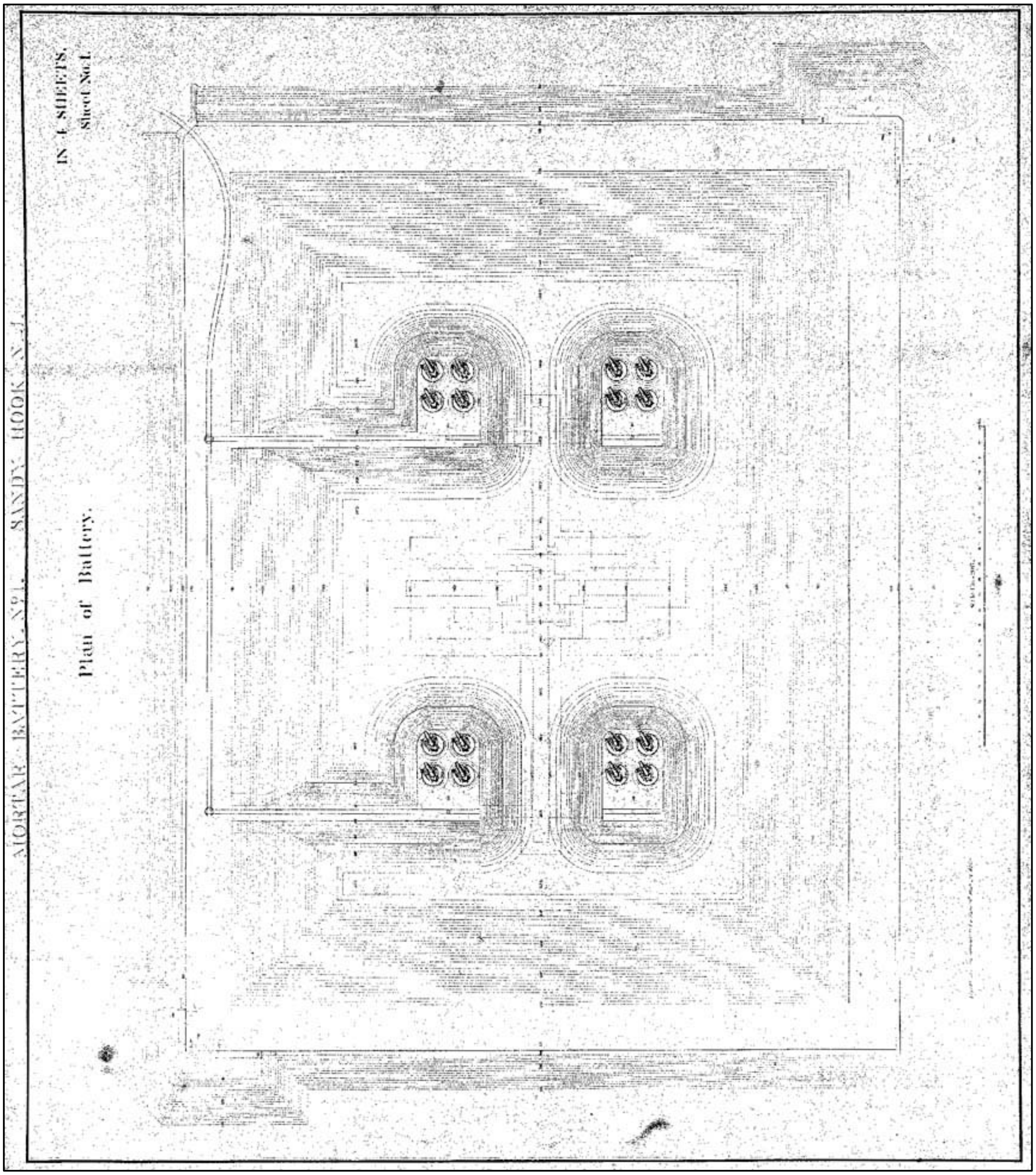


Figure 122. "Mortar Battery No. 1, Sandy Hook, N.J. Plan of Battery." Sheet no. 1 of 4, 1895.

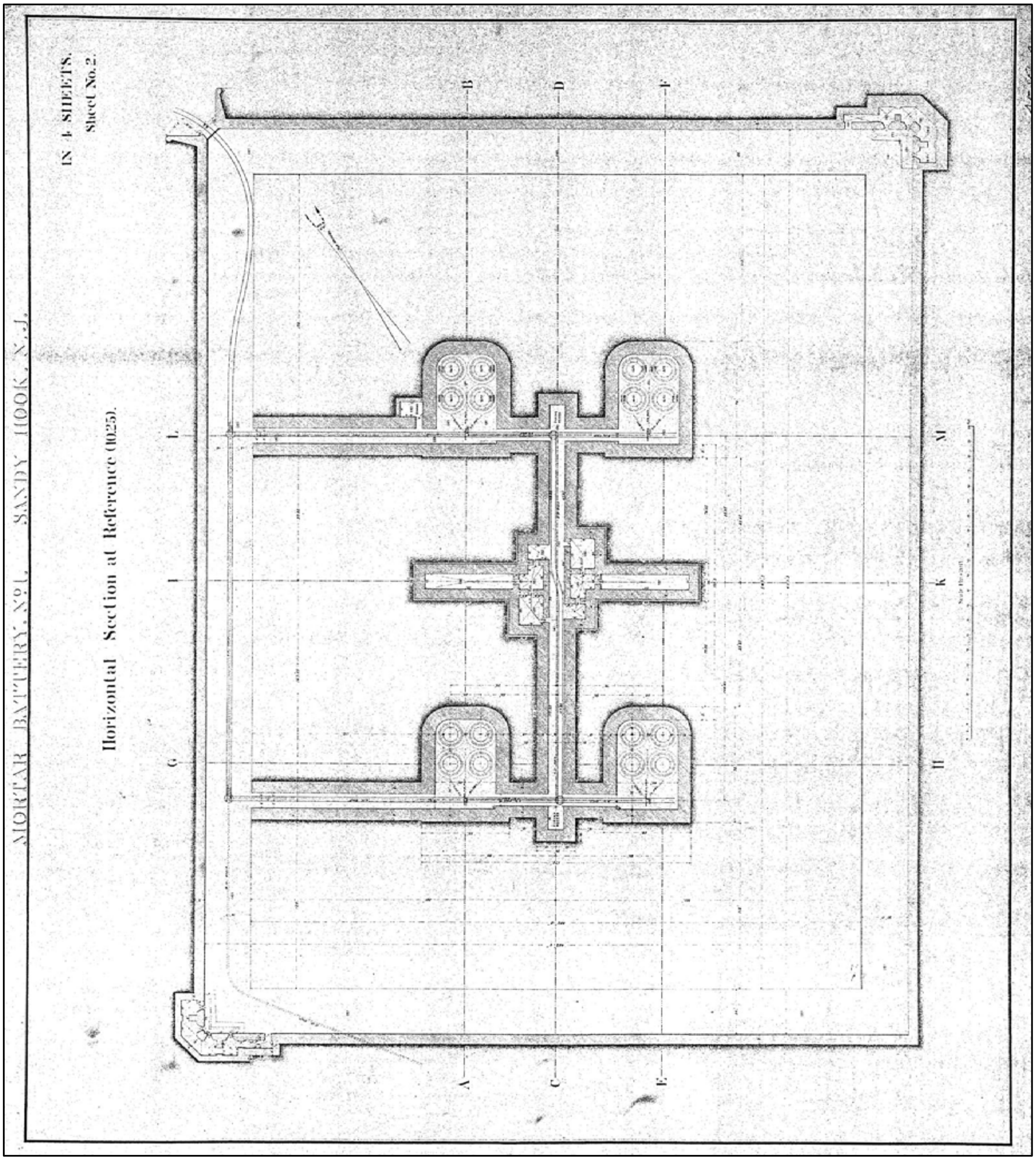


Figure 123. "Mortar Battery No. 1, Sandy Hook, N.J. Horizontal Section at Reference (10.25)." Sheet no. 2 of 4, 1895.

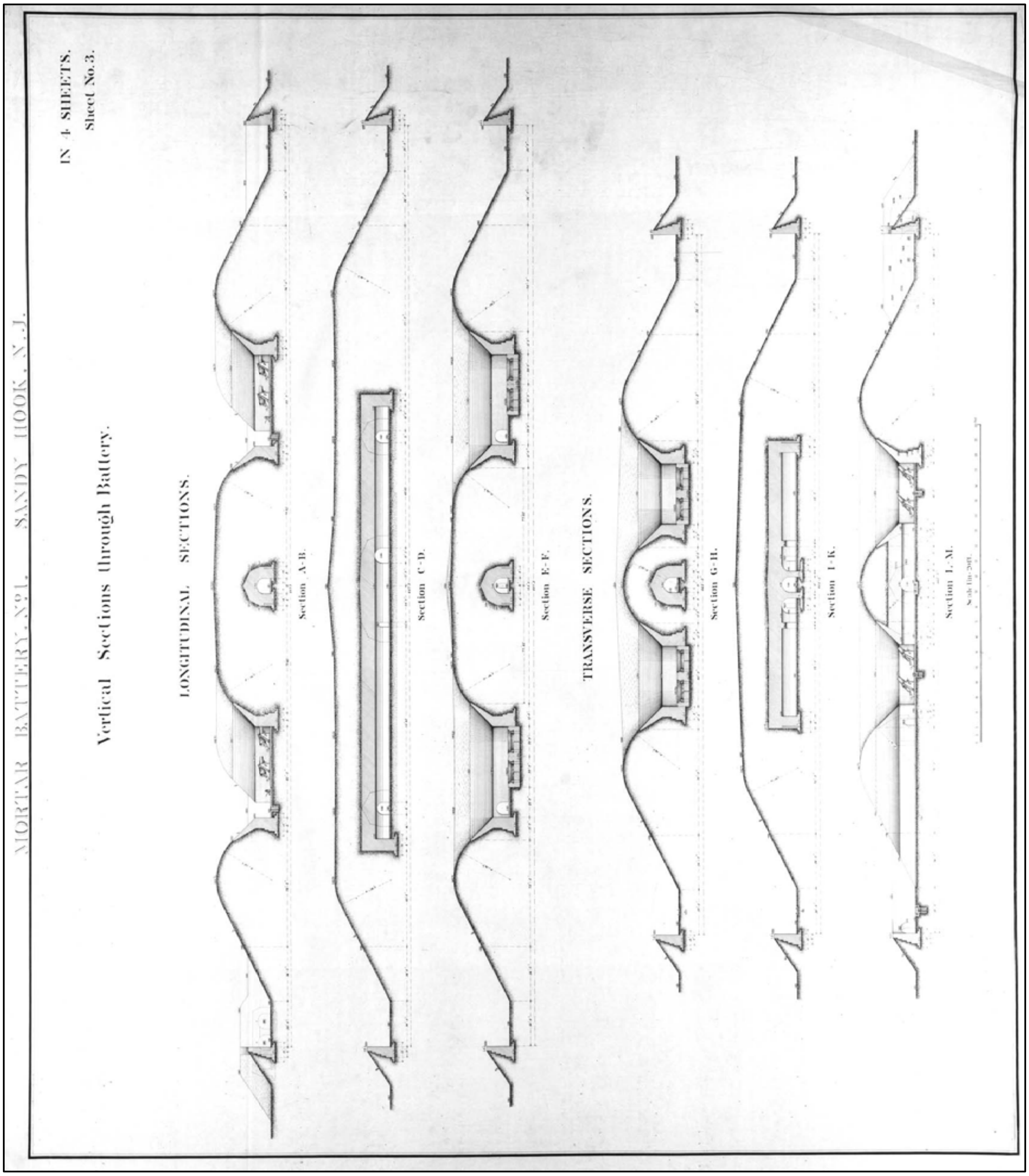


Figure 124. "Mortar Battery No. 1, Sandy Hook, N.J. Vertical Sections through Battery." Sheet no. 3 of 4, 1895.

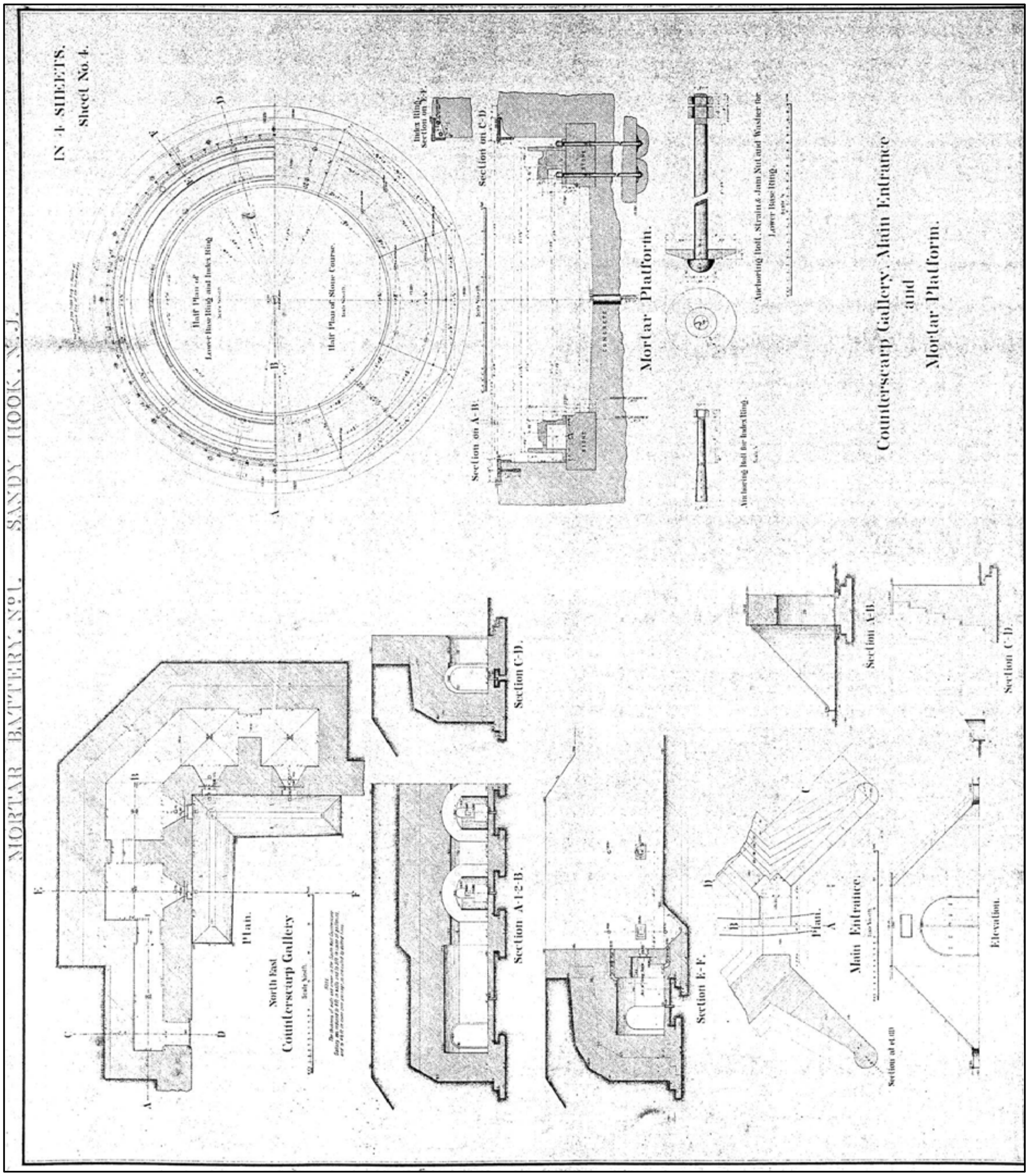


Figure 125. "Mortar Battery No. 1, Sandy Hook, N.J. Counterscarp Gallery, Main Entrance, and Mortar Platform." Sheet no. 4 of 4, 1895.

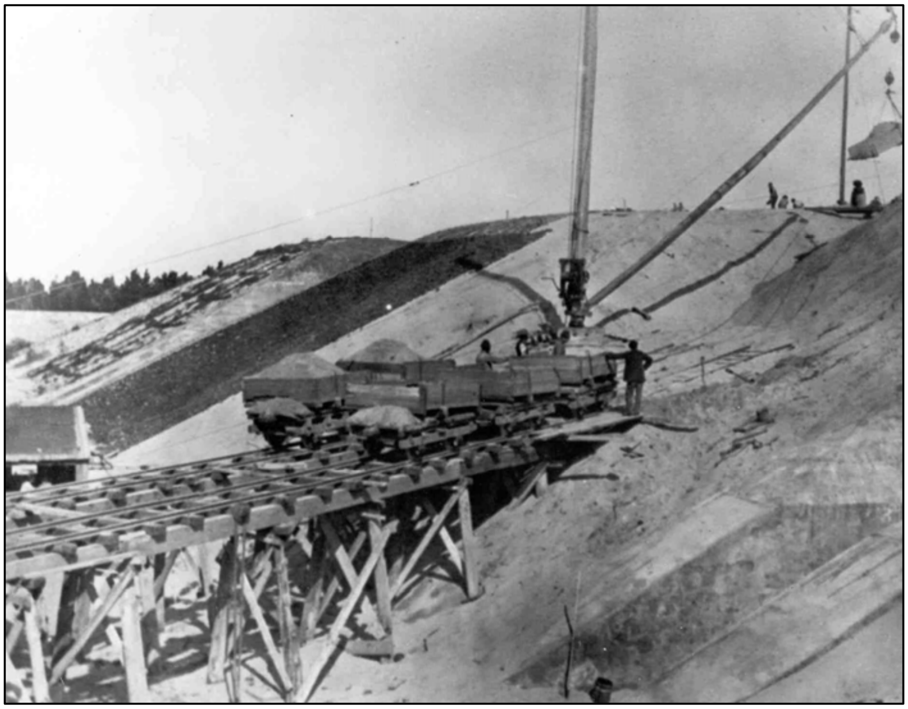


Figure 126. Mortar Battery, moving sand to the superior slope, ca. 1892.

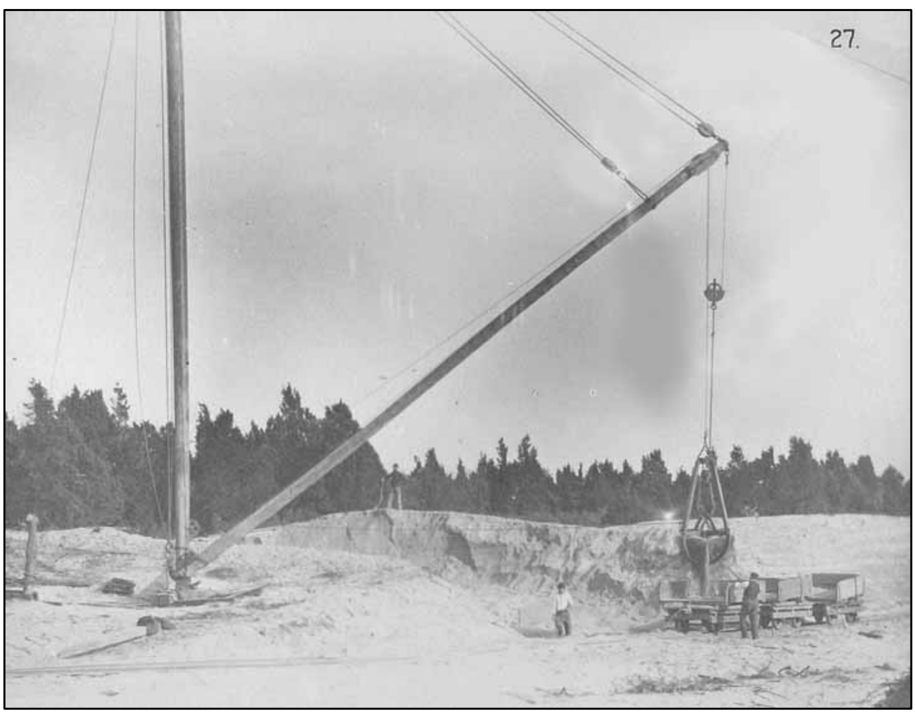


Figure 127. Lancaster bucket grapple at work in east borrow pit, November 11, 1892.

Figure 128. Mortar Battery, as seen from lighthouse, February 8, 1893; view shows covering of battery with sand.

Figure 129. Mortar Battery, construction of mortar platforms; view shows granite base ring and steel roller path.

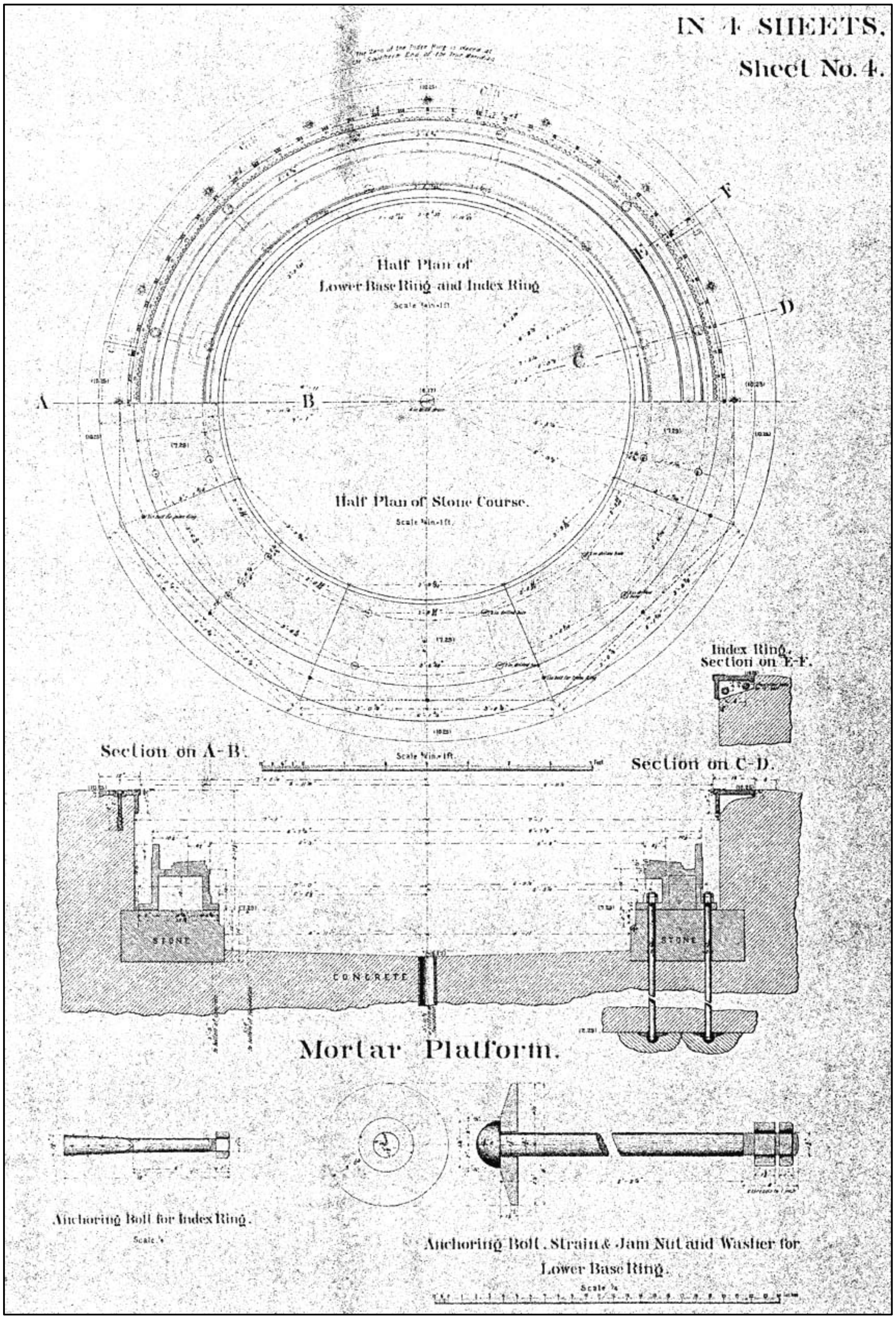


Figure 130. Detail of mortar platform, from sheet no. 4 of four completion drawings, 1895.

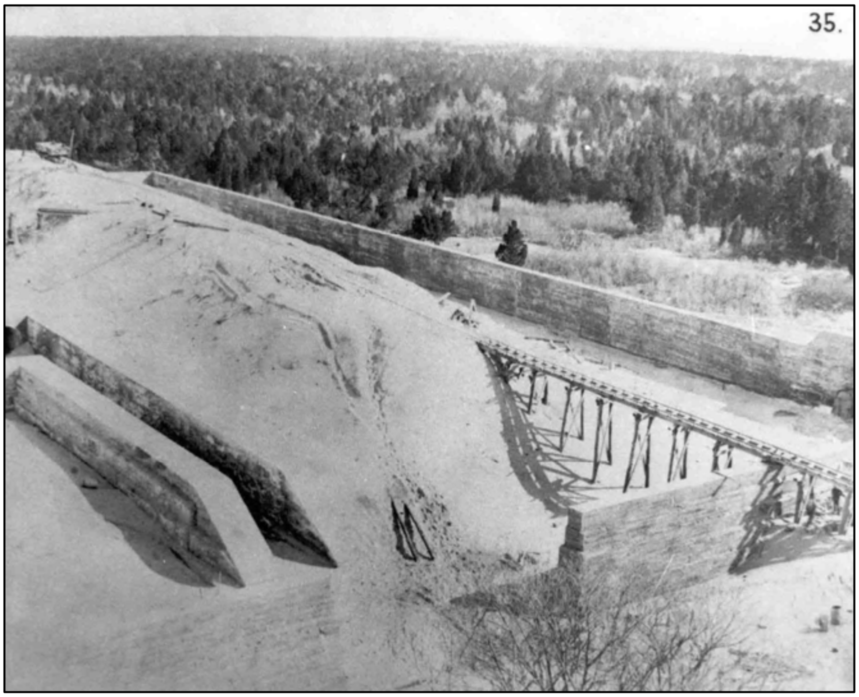


Figure 131. South end of Mortar Battery, as seen from lighthouse, March 13, 1893; view shows counterscarp wall and trestle over wall during construction.

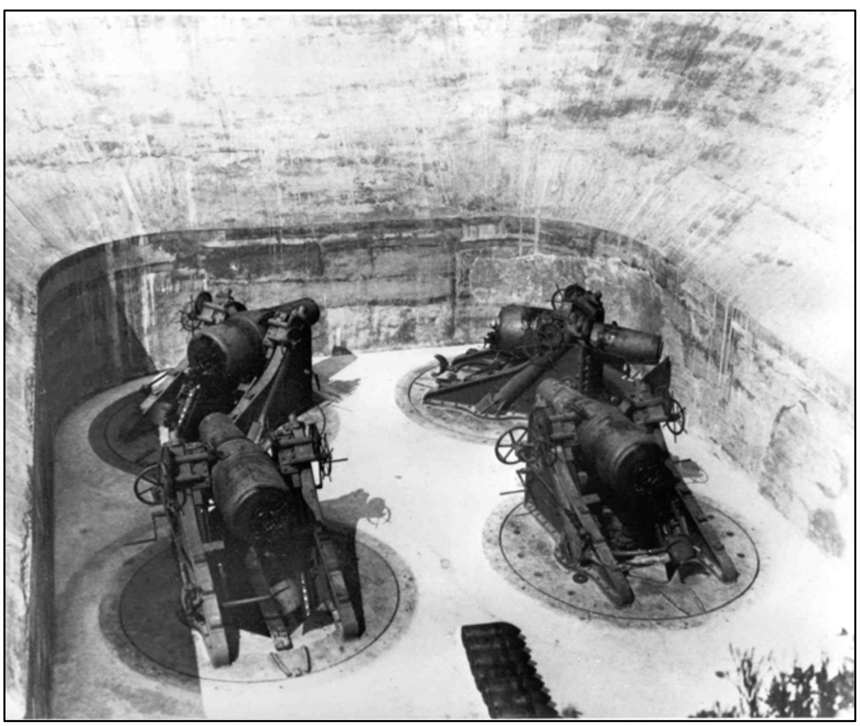


Figure 132. Mortar Battery, view of mortar pit showing mortars mounted on carriages, June 30, 1894.

ORIGINAL APPEARANCE

Introduction

The extant portions of the Mortar Battery provide some clues to the original appearance of the structure. However, alterations and the forces of nature have obliterated portions of the original battery. The following section relies on written and graphic documentation from the time of construction of the Mortar Battery, and on later photographs and drawings. Plans of the Mortar Battery with room numbers are provided as references to the mortar pits, galleries, and interior rooms of the battery (figs. 133-135). The numbered plans include partitions that were constructed in the 1920s and 1940s. The set of four completion drawings should be referred to for a sense of the original configuration of the battery (figs. 122 – 125). The description of the original appearance is meant to augment the information discussed in the previous section on construction.

The Mortar Battery was constructed with four mortar pits containing 16 mortars when fully armed. The interior of the battery was planned with two ends, each end containing two pits, with a structure for the magazines and storage positioned between the two ends. The interior portion of the Mortar Battery was surrounded by a perimeter ditch, which in turn was enclosed by the counterscarp wall.

Mortar Battery – Exterior Elements

Entrance

The main entrance to the Mortar Battery was constructed between December 1892 and November 1893, and was situated in the northwest corner of the counterscarp wall. Upon completion of the battery, an arched doorway in that location was the only means of accessing the ditch of the battery, and from there the entrances to the north and south pits of the battery. The doorway measured 10 feet wide by 10 feet high, and was equipped with double doors. Completion drawings of the Mortar Battery depict the entry doors with four gun loops (fig. 125). Thus, the main entrance formed the first defense for the battery.

The entrance was flanked by splayed retaining walls that held back the sand covering the perimeter of the counterscarp wall. The splayed walls sloped from the top of the counterscarp wall at reference 25.0 down to a semicircular pad at reference 4.0. The retaining wall was constructed with concrete in the same manner as the counterscarp, and was finished with bluestone coping.

Counterscarp Wall and Galleries

The counterscarp walls and galleries were constructed as the Mortar Battery's primary defense. The counterscarp walls enclosed the battery on all sides, and had one entrance in the northwest corner. The galleries were located in the southwest and northeast corners of the counterscarp, and were designed to provide defense for the ditch of the battery.

Sectional plans of the Mortar Battery show that the exterior portion of the wall was constructed in a stepped manner, and that the interior was flat. The foundation of the concrete counterscarp wall was a 13-foot-wide footing set at reference 7.0, approximately 3 feet below the level of the interior ditch. The wall was 7 feet thick at the base (reference 10.0). It was stepped in 1 foot for every 3 feet of rise, which made the wall 3 feet thick at the top (reference 25.0). Upon the completion of the battery, the exterior portions of the counterscarp wall were covered with a sand embankment.

The counterscarp galleries were situated in opposite corners of the counterscarp in order to provide machine gun cover on all sides of the ditch surrounding the interior portions of the Mortar Battery. The height of the counterscarp at both of those corners rose 5 feet from reference 25.0 to reference 30.0. Lt. Warren's letter to Lt. Col. Gillespie dated September 2, 1892, noted that the gallery to the northeast would require additional cover, since it would be exposed to fire coming from the rear as well as the ditch. Accordingly, his estimate for the northeast gallery included twice as much concrete as the southwest gallery. The lieutenant's letter described the plan of the galleries as follows:

> In general plan the galleries consist of segmented arches with ten feet span and three feet rise, supported upon bench walls five feet in height, arranged as relieving arches, their soffits perpendicular to the counterscarp wall so as to prevent the destruction of the galleries by fire coming down the ditch. Communication is had between the arches by a four-foot arched passageway in the bench walls and between the two sets of casemates by a similar arched room designed for magazine purposes. Access to the gallery is had by a four-foot door and passage communicating with the ditch and so arranged as to be screened from fire coming down the ditch.[1]

Lt. Warren also noted that the portion of the ditch in front of the galleries would be lower than the rest of the perimeter ditch, to protect the gun-port embrasures and simplify the drainage. Drawings of the northeast gallery show a concrete-lined ditch at the corner of the gallery in front of the embrasures. The completion drawings of the Mortar Battery depict the counterscarp galleries almost exactly as described by Lt. Warren (fig. 118).

---

[1] Lt. J.G. Warren to Lt. Col. George L. Gillespie, Sept. 2, 1892; Letters Sent; Vol. III, p. 40; Entry 815; RG 77; NARA - Northeast Region (NY).

Perimeter Ditch

The Mortar Battery was constructed with a defensive ditch. The counterscarp wall previously described formed the outside wall of the ditch, and the scarp formed the inside wall of the ditch. The ditch surrounded the interior portions of the battery on all sides, and was constructed as part of the battery's defense. The ditch measured 462 feet long on the north and south sides of the battery, and 607.3 feet long on the east and west sides of the battery. The ditch was 30 feet wide, and the ground level of the ditch was at reference 10.0. Entrance galleries to the north and south mortar pits were accessed from the west ditch.

Sand Cover

As previously mentioned, the outside wall of the counterscarp was covered with sand upon the completion of the battery. The sand embankment was at a 2:3 grade, and Lt. Col. Gillespie had estimated that it would take 16,225 cubic yards of sand to fill the glacis.[2]

The interior portions of the Mortar Battery were buried under more than 150,000 cubic yards of sand, leaving only the mortar pits and the entrances at each end of the battery open.[3] The sand covering the battery started at grade (reference 10.0) on the inside of the perimeter ditch. The sand embankment sloped up from that at a 1:2 grade, and leveled off at reference 45.7. From that level, the sand gently sloped up to reference 50.0 at its highest point. At each pit and along the entrance galleries, the sand cover sloped down toward the concrete slopes of the structure, and abutted the concrete at reference 35.0. As previously described, the sand served as a natural defense for the battery, and was covered with native plant material in an effort to hold it in place.

Mortar Battery – Interior Elements

North End

This area is depicted in figure 133.

[2] Gillespie to Brig. Gen. Thomas L. Casey, Chief of Engineers, Oct. 18, 1890; Letters Sent; Vol. I, p. 16; Entry 815; RG 77; NARA - Northeast Region (NY).
[3] Warren to Gillespie, March 1894; *Mortar Battery, Sandy Hook, New Jersey* (New York: United States Engineer Bureau).

Entrance Gallery

The entrance gallery (Room 101) of the north-end pits was 10 feet wide and 121 feet in length from the ditch to the northwest mortar pit. At the west end of the entrance, the vertical concrete walls sloped up from grade to reference 20.0. At that point, the vertical wall transitioned to a 45-degree slope that was constructed up to reference 35.0, and which continued into the west mortar pit. The sand cover of the battery sloped from reference 35.0 to the top of the battery (see the subsequent section "Sand Cover").

The dynamo room (room 102), which housed the electrical plant for the battery, was located on the north side of the entrance gallery. The room was 10 feet wide by 14 feet long, with concrete floors, walls, and arched ceilings.

Mortar Pits

The entrance gallery opened into the northwest mortar pit (room 103). All four mortar pits of the battery were the same size, measuring 40 feet wide by 60 feet long. The vertical concrete walls of the mortar pit were constructed up to reference 20.0 approximately 10 feet above the floor level of the pit. From that point, the concrete blast slope extended up to reference 35.0, where it abutted the sand slope.

The northwest mortar pit was equipped with four mortars grouped toward the Atlantic Ocean, or northeast end of the pit. The mortar platforms were spaced 20 feet on center, with 10 feet from the center to the side and front walls, and 30 feet to the back wall. However, the mortars were not centered on the platforms. Lt. Col. Gillespie explained to Chief Engineer Casey that when the battery was designed, it was expected that the centers of the mortar carriage would line up with the centers of the platform. However, the type of carriage used at the battery was designed with trunnions that extended 3 feet 3 ½ inches beyond the center of the platform, which brought the muzzle of the mortar closer to the wall of the pit. When the mortar was fired at a 45-degree angle, the muzzle was only 18 inches from the crest of the wall.[4]

An arched doorway in the east wall of the northwest pit led to the transverse gallery of the north end, which in turn led to the interior of the Mortar Battery and the northeast pit. The northeast pit (room 111) was planned and constructed in the same manner as the northwest pit. The one exception was that the doorway from the transverse gallery on the west wall was the only point of entry.

---

[4] Gillespie to Casey, June 23, 1894; File 1708, incl. 47; General Correspondence and Record Cards, 1893-94; Entry 98; RG 77; NAB.

Galleries

The transverse gallery (room 108) connecting the northwest and northeast pits was 8 feet wide, 80 feet long, and 9 feet high. The gallery was constructed with concrete walls 8 feet thick that transitioned to an arched ceiling that started 4 feet above the floor level. The arch formed a barrel-vaulted ceiling for the length of the gallery, except at its midpoint, where the main, longitudinal gallery of the battery intersected it.

At this intersection, an alcove (room 107) was constructed in the north or outside wall. The alcove measured 10 feet wide by 8 feet long, and was labeled a "Firing Recess" on the completion drawings.

The longitudinal main gallery (rooms 112, 119, and 126) of the Mortar Battery connected the north and south ends of the battery, and provided access to the magazines and storage rooms. The longitudinal gallery was 10 feet wide and 237 feet 3 ½ inches long, measuring from the north transverse gallery to the south transverse gallery. Like the transverse gallery, the concrete walls of the gallery were 8 feet thick, with a barrel- arched ceiling 9 feet high.

Magazines and Storage Rooms

The magazines and storage rooms were situated at the center of the battery, and were accessed from the main longitudinal gallery (fig. 134). A group of four rooms extended out on either side of the gallery. The rooms on the west side (rooms 113 – 118) serviced the north end of the battery, and the ones on the east side (rooms 120 – 124) serviced the south end.

Each group of rooms consisted of three storage rooms and a large magazine. All of the adjoining walls of these rooms were 4 feet thick, and the exterior walls were 8 feet thick. The interior height of all the rooms and galleries of the Mortar Battery was at reference 19.0, which was 9 feet above the finished floor level.

On the west side of the longitudinal gallery, the north room (room 113) measured 10 feet wide by 14 feet long. The full width of the room was directly open to the gallery, and a doorway in the south wall led to the next store room. The doorway measured 3 feet wide by 6 ½ feet high.

The next room was an L-shaped room (room 114) that connected to the magazine to the west, and to a storage room to the south. Room 114 measured 10 feet wide by 16 feet long. It had three arched doorways, each measuring 3 feet wide by 6 ½ feet high. A doorway on the west wall led to the magazine (now Rooms 115-117), and the doorway on the south wall led to the storage room (room 118).

The original magazine was 10 feet wide by 58 feet long, with concrete walls that extended up to a barrel-vaulted ceiling. The south storage room measured 16 feet wide by 20 feet long, and had a vaulted ceiling.

The storage rooms and magazine complex on the east side of the longitudinal gallery were the same size, but were laid out from south to north in order to better service the south end of the battery.

South End

This area is depicted in figure 135.

The south end of the Mortar Battery was laid out in the same manner as the north end. The only structural difference was the absence of the dynamo room off the entrance gallery. The transverse gallery followed the same configuration, and had a "firing recess" along the south wall opposite the longitudinal gallery. The longitudinal gallery at the south end of the Mortar Battery was longer than at the north end, but was otherwise constructed in the same manner. The length of the south gallery to the center of the battery was 142.65 feet, versus the 94.65-foot length of the north gallery. This was due to the orientation of the mortar pits and the design, which placed the interior portions of the battery roughly equidistant from the closest pit walls.

As previously mentioned, the storage rooms that serviced the south end of the battery were oriented in the opposite direction as those for the north end. Otherwise, the mortar pits were constructed to the same specifications, and the interior portions were similar.

ALTERATIONS

Upgrades and Maintenance, 1895-1901

Some minor repairs were performed at the Mortar Battery during the first fiscal year after its completion. One of those was the repair of the blast slopes of the mortar pits. Sections of the sod on the slopes had to be replaced due to damage sustained when the mortars were fired. The doors of the battery were also repaired in fiscal year 1896.[5]

Although the Mortar Battery had been completed during F.Y. 1895, it was noted that the battery remained unmanned at the beginning of F.Y. 1896.[6] The Mortar Battery was maintained by the Engineer Department during the first three years of its existence, and was turned over to the Artillery Corps in March 1898.[7]

Lt. Col. Gillespie estimated F.Y. 1898 projects for the Mortar Battery to include repair of the slopes, painting the hoists and trolley, and keeping in repair the batteries and electrical system.[8] During the fiscal year, the electrical wiring was removed from the wooden conduits and placed in iron pipes. The painting and slope repairs were completed as proposed by Gillespie.

F.Y. 1898 work began with the replacement by the Ordnance Department of eight of the index rings of the mortar platforms. This work included new paving under the index rings. The first eight were replaced by the end of August 1898. Upon the successful completion of that project, new index rings and paving materials were ordered for the remaining eight platforms, which were installed by the Ordnance Department during the summer of 1899.[9]

The condition of the interior slopes of the Mortar Battery continued to be a problem. The post commander of Fort Hancock, Major Burbank, wrote the Adjutant General on March 28, 1900, requesting a solution to the instability of the slopes. Major Burbank had witnessed first-hand the "dislodgement of a quantity of turf revetment of the slope in front of the mortar used" after one of the mortars in the northeast pit was tested by the Ordnance Department. The major commented on the steep pitch of the slopes, and noted that upon inspecting the other mortar pits, he was concerned that more turf would be lost and large

---

[5] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983), p. 181.

[6] 2nd Lt. Robert McGregor to Gillespie, July 23, 1895; File 11776; General Correspondence 1894 - 1923; Entry 103; RG 77; NAB.

[7] Bearss, *The Sandy Hook Defenses*, p. 181.

[8] Gillespie to Brig. Gen. William Craighill, Chief of Engineers, Oct. 27, 1896; File 13121; box 278; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

[9] Bearss, *The Sandy Hook Defenses*, p. 182.

amounts of material would be deposited in the pits.[10] Past experience and Major Burbank's request resulted in the regrading of the interior slopes to a slope of 1:2. The grading and replacement of the sod cover was completed by the end of F.Y. 1900.[11] This solution may have stabilized the interior slopes of the battery, but in May 1901 Burbank – now a colonel – reported that large amounts of sand were drifting into the emplacements, onto the guns, and into the gears of the armament at the Mortar Battery. Col. Burbank suggested covering the batteries with cinders to reduce the sand erosion. After some experimentation, Major William Marshall agreed that a cover of 3 to 4 inches of wet cinders appeared to stabilize the sand slopes, and this material was applied to the sand slopes of the Mortar Battery before the end of 1901.[12]

Another recurring problem at the Mortar Battery resurfaced in 1900. Apparently the drainage system was not sufficient for the mortar pits, and the condition was brought to Marshall's attention in August. Upon inspecting the battery, Marshall proposed that wells 3 feet in diameter be dug through the foundations of the mortar pits, which would require about 4 feet of excavation. Marshall recommended that the Chief Engineer make an allotment of $280 for the proposed work.[13]

In F.Y. 1901, the electric lighting system was upgraded with the addition of a new accumulator, armored distribution wires, and moisture-proof fixtures.[14]

Naming the Mortar Battery

Mortar Battery No. 1 was designated Battery John Reynolds by General Order No. 78, issued by the War Department on May 25, 1903. Major General John F. Reynolds had graduated from the U.S. Military Academy at West Point in 1841; he served with the Artillery in the Mexican War, and at the outbreak of the Civil War was commissioned a lieutenant colonel, 14th Infantry of the Union Army. Reynolds was rapidly promoted, and by the fall of 1862 was a major general commanding the 1st Corps, Army of the Potomac. He was killed at the battle of Gettysburg on July 1, 1863, while leading his troops. The designation of the Mortar Battery in his honor was a tribute to his service and gallantry.

The Mortar Battery was divided into two distinct batteries in 1906. By General Order of the War Department, the north end of the Battery Reynolds was designated Battery Alexander McCook. Alexander McCook was one of the "Fighting McCooks" – a family from Ohio known for having 15 members serving in the Union Army during the Civil War. Like General Reynolds, Alexander McCook was a graduate of West Point and a veteran of the Civil War.

---

[10] Major J.B. Burbank, Office of the Post Commander, Fort Hancock, N.J., to Adjutant General, Dept. of the East, N.Y.C., March 28, 1900; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Vol. I, p. 139; Entry 814; RG 77; NARA - Northeast Region (NY).

[11] Bearss, *The Sandy Hook Defenses*, p. 182.

[12] Bearss, *The Sandy Hook Defenses*, p. 216.

[13] Major William Marshall to Brig. Gen. John M. Wilson, Chief of Engineers, Sept. 22, 1900; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Vol. I, p. 139; Entry 814; RG 77; NARA - Northeast Region (NY).

[14] Bearss, *The Sandy Hook Defenses*, p. 181.

Alexander McCook spent his entire career in the service of the U.S. Army, and retired as a major general in 1895.

The division of the Mortar Battery apparently caused some confusion as to the division and designation of the mortar pits. On March 7, 1906, now-Lt. Col. Marshall sent a letter and blueprint of the Mortar Battery to the District Commander, Southern Artillery District of N.Y., clarifying the renaming of the battery (fig. 109).

Battery Telephone Booths and Battery Commander Stations

Observation of the activity at each mortar pit and communication between the pits and the range and position-finding systems was important. To assist in that process, four telephone booths – one in each pit – were constructed at the Mortar Battery in 1905. Lt. Col. Marshall transmitted to Lt. Hurlbut, his assistant at Sandy Hook, blueprints of the telephone booths on April 29, 1905. Marshall also informed Assistant Engineer Hurlbut that $4,800 had been allotted for the construction of the four telephone booths.[15]

Two plans of the telephone booths depict the overall design and plan of the two booths for the west pits (fig. 136) and the east pits (fig. 137). Though the plans are not dated, they appear to be from the period of construction, and the booths as depicted correspond with the extant structures. In addition, the plan dated December 20, 1905, shows the position of the telephone booths at Battery Reynolds (fig. 109).

Each booth was perched above its pit, in the southwest corner. The booths of the northwest and southwest pits were located at the end of the entrance gallery, and were supported by an arched concrete bridge at the height of the breast wall. The booths in the northeast and southeast pits were situated just above the entrance to the transverse gallery, and were supported by an arch spanning the corner of the pit (figs. 138-139). Each booth was rectangular and constructed of reinforced concrete. Small windows in the northeast corner of each booth gave the occupants a view of the pit below. The window openings were constructed with embrasures, presumably to protect the observers. The booths were accessed from the ground level via concrete steps with iron railings.

It is interesting to note that the plans for the telephone booths depict a blackboard mounted on the southeast side of each booth. As shown, the blackboards were divided into four rows that were marked from top to bottom with "Elev[ation], Azimuth, Charge, Project[ile]." The firing information on elevation, azimuth, charge, and projectile was relayed from the battery's plotting room to the telephone booth. Personnel in the telephone booth used the blackboards to communicate firing data to the personnel manning the mortars below.

[15] Lt. Col. Marshall to Lt. Hurlbut, April 29, 1905; folder 116, enclosure 1, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

Work on the telephone booths was carried out in the summer and fall of 1905, and the booths were near completion when the December 20th plan was drawn. Assistant Engineer Hurlbut notified Lt. Col. Marshall on January 12, 1906, that the telephone booths were complete, the electrical conduit was being laid, and all that remained was the installation of the electric lamps.[16]

Another component of the observation and communication system at the Mortar Battery was the battery commander stations. Lt. Col. Marshall forwarded tracings of the battery commander stations to Chief Engineer Mackenzie on February 15, 1906 (figs. 140-141). Battery commander stations were planned for both Battery Alexander and Battery Reynolds. The stations were constructed at the crest of the hill covering the battery, and faced northeast with a view of the battery pits and the Atlantic Ocean.

The battery commander stations were constructed with 8-inch-thick, reinforced-concrete walls that were set 2 feet 8 inches into the ground, and which sat on a footing 16 inches wide by 10 inches thick. The roof was also constructed of 8-inch-thick reinforced concrete. It had a slight pitch and was equipped with gutters and copper leaders for drainage. A steel door was located at the back of the building on the southwest elevation, and a band of narrow windows stretched across the northeast elevation. The grade on the northeast elevation was gradually raised up to the level of the observation windows to form a berm along that side of the station.

The interior of the battery commander stations measured 6 feet wide by 10 feet long, with a ceiling height of 7 feet. The floor of the station was a 6-inch-thick slab of concrete. Like the fire-control stations at Battery Potter, the battery commander stations were constructed with a band of windows along the northeast elevation that wrapped around the side elevations. The observation windows were set about 4 feet above the floor level, and measured approximately 2 feet 3 inches wide by 11 ¾ inches high. A concrete pedestal for optical azimuth instruments was situated at the center of the windows, and was set with its center 16 inches from the front wall. The pedestal was supported by a 2-foot-square pier that extended 3 feet 6 inches below the floor level. The horizontal axes of the instruments were set at reference 52.0 for Battery McCook and reference 56.0 for Battery Reynolds. Each battery commander station had direct communication with the telephone booths at their respective ends of the battery.

Work on the battery commander stations was completed by November 8, 1907, when Lt. Col. Marshall wrote Chief Engineer Mackenzie that they were ready for transfer to the Artillery Corps. Marshall made his final inspection of the stations on December 12 and turned them over to the Fort Hancock commander.[17]

---

[16] Hurlbut to Marshall, Jan. 12, 1906; folder 116, enclosure 3, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[17] Marshall to Brig. Gen. Alexander Mackenzie, Chief of Engineers, Nov. 8, 1907; File 35510, incl. 887; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.

Mortar Battery Tower and Station

Historic photographs depict a tower inside the west counterscarp wall of the Mortar Battery (figs. 142 and 159). The tower is listed as a "Meteorological Station" on a ca.-1910 map (fig. 15) and a plan of Battery Reynolds dated September 1910 (fig. 145). The Fort Record Book for Fort Hancock documented that the meteorological station at the Mortar Battery originally served as the battery commander's station for Battery Reynolds (prior to the division of the battery). The station was completed by the Engineers on May 30, 1901, and transferred to the Artillery Corps on September 3 that same year. The post record book indicates that the meteorological station was installed by November 1907, which was confirmed by the 1910 plans.[18] It seems likely that the role of the station was changed after the construction of the battery commander stations on top of the Mortar Battery. The meteorological station was further documented by the "Report of Completed Works" in July 1921. That report noted that the station was inside the Mortar Battery, and was a wood structure on a steel tower. The report further documents that the station measured 15 feet square and was surrounded by a 3-foot walkway (fig. 143).[19] The tower and station later served as the "Command Post & Observation Post for Group 2" during World War II (fig. 163), but only the concrete base of the tower remains today.

Trolley System Improvements

Efforts were made to improve the 1895 trolley system at the Mortar Battery beginning in January 1907. Assistant Engineer Hurlbut's initial plan recommended the extension of the trolley into the mortar pits, and the addition of a parallel trolley in the main gallery. The improved system would allow a marked efficiency in the ammunition delivery for each pit. Hurlbut's plans for the improved trolley system were forwarded to the New York District Engineer Lt. Col. Marshall on January 31, accompanied by an estimate of $2,000 for the project.[20] Col. Marshall approved of the plans, and recommended that additional passages for powder carriers be tunneled out from the magazines to the transverse galleries. Marshall sent his proposal to Chief Engineer Mackenzie on February 28, 1907, with an estimated project amount of $9,000.[21] The proposed improvements were approved by Chief Engineer Mackenzie, and the requested funds for the project were allotted in March 1907.[22]

---

[18] Fort Record Book, Fort Hancock, New Jersey, October 1924, p. 84.

[19] "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J., July 1, 1921"; RG 392; NARA - Northeast Region (NY).

[20] Hurlbut to Marshall, Jan. 31, 1907; folder 9, enclosure 5, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[21] Marshall to Mackenzie, Feb. 28, 1907; folder 9, enclosure 1, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[22] Abbott (for Mackenzie) to Marshall, March 27, 1907; folder 9, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

As the Engineer on site, Lt. Hurlbut had a different opinion about the best way to proceed. He felt that tunneling through the concrete and sand for the passages recommended by Lt. Col. Marshall would be dangerous and would require skilled labor. Hurlbut suggested an alternate plan that involved widening the transverse galleries at both ends of the Mortar Battery, and the longitudinal gallery that connected Reynolds and McCook.[23]

Assistant Engineer Hurlbut's proposal included widening the transverse galleries by 2 feet on the outside wall, which would create 10-foot-wide galleries. The widening was to include expanding the arch of the ceiling and thus slightly raising the ceilings, as well as rounding the corners leading into the longitudinal gallery. The longitudinal gallery was to be widened by 2 feet 6 inches on each side, creating a 15-foot-wide corridor between the transverse gallery and the magazines (a section of the longitudinal gallery at the middle of the Mortar Battery remained 10 feet wide). The wider galleries allowed for the passage of both the ammunition and the powder along the corridors without the necessity of additional tunneling.[24]

Hurlbut communicated his plan to Marshall on March 22, 1907. The proposal included a comparison of the estimated costs for constructing the powder passages proposed by Marshall, and the alternative of widening the galleries. The estimate for the tunneling included expert laborers for that purpose, and was $5,000 more than the $9,500 estimate for widening the longitudinal galleries. Both estimates included widening the transverse galleries and the cost of a new trolley system and electric lights.[25]

Lt. Col. Marshall was duly impressed by Hurlbut's solution, and approved of the plan to widen the longitudinal gallery. He forwarded tracings of the proposed modifications to Chief Engineer Mackenzie on April 24, 1907 (fig. 144). Marshall explained that the tunneling would be too dangerous; widening the existing galleries would provide an equally efficient manner for moving the powder, and would also allow room for the new ammunition trolley system. The modifications to the Mortar Battery were approved by Brig. Gen. Mackenzie on May 2, 1907.[26]

The Coast Artillery Corps had to suspend their practice at Batteries Reynolds and McCook during the modifications to the Mortar Battery. At the time, the 55th Company, Coast Artillery was assigned to Battery McCook. In March 1907, Capt. P.R. Ward, Coast Artillery, requested that the 55th be reassigned to Battery Richardson. The Adjutant General approved the move in April, and scheduled the transfer to take place after the next practice.[27] The Chief of Engineers notified Lt. Col. Marshall that the assignment change for the 55th was

---

23 Bearss, *The Sandy Hook Defenses*, p. 186.

24 "Fort Hancock, N.J., Proposed Modification of Batteries Reynolds & McCook," drawn under the direction of Lt. Col. Wm. Marshall, Corps of Engineers, USA, April 1907, by J.C. Letts, Draftsman. Drawer 45, Sheet 88-17; RG 77; NACP. Copy at Gateway NRA, Sandy Hook Unit (GATE-10864).

25 Hurlbut to Marshall, March 22, 1907; folder 9, enclosure 7, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

26 Marshall to Mackenzie, April 24, 1907; endorsed by Mackenzie May 2, 1907; folder 9, enclosure 16, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

27 Bearss, *The Sandy Hook Defenses*, p. 188.

postponed until the target practice was completed.[28] Once the Coast Artillery Company had relocated, the project was begun.

Assistant Engineer Hurlbut estimated that widening the galleries would require removing an approximately 93.4 cubic yards of concrete in each transverse gallery, and approximately 291 cubic yards in the longitudinal gallery. The process involved drilling holes in the concrete and then blasting away the concrete. Once the galleries had been widened, the walls and ceiling would be grouted with a Portland cement concrete, which Hurlbut estimated would take 130 barrels of cement for the transverse galleries and 150 barrels for the longitudinal gallery.[29] The drilling and blasting process was time-consuming, and was still incomplete in February 1908.

The widening of the transverse galleries required some alterations to the doors leading from the mortar pits to the gallery. The existing double doors would need to have material added to them to make them wider. This, said Hurlbut, would make the doors too heavy for their hinges. Hurlbut proposed that a two-foot-wide steel plate be riveted to each door, and that the doors should be hung from a trolley on brackets that could be salvaged from the old trolley system. Lt. Col. Solomon W. Roessler, who had replaced Lt. Col. Marshall when the latter was appointed as Chief of Engineers, approved Hurlbut's modifications to the doors.[30]

Though the project was moving along, in August 1908 Lt. Col. Roessler notified the Chief of Engineers that it would require an additional $2,000 to complete. Chief Engineer Marshall approved the expenditure, and allotted the funds from the appropriation for "Modernizing Older Emplacements."[31]

The modifications to Battery McCook were completed by August 19, 1908, except for the doors. At that point, Col. Roessler informed Lt. Col. Henry L. Harris, District Commander, South Artillery District, that the Coast Artillery could resume practice at Battery McCook.[32] Assistant Engineer Hurlbut was directed to turn the battery over to the Coast Artillery, and practice resumed at Battery McCook.

Problems with the grout in sections of Battery Reynolds' longitudinal gallery delayed the return of that battery to the Coast Artillery. In November Hurlbut found some hollow spaces in the grouting of the new arch. He determined that the problem was caused during the application of the concrete grout, which he presumed had seeped into the more porous Rosendale concrete when the second application of grout was forced into the forms. The solution to the problem was to place expansion bolts every 3 feet on both sides of the center arch in the longitudinal gallery and patch the concrete. The plan was approved by Lt. Col.

[28] Mackenzie to Marshall, April 12, 1907; folder 9, enclosure 13, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[29] Hurlbut to Marshall, March 29, 1907; folder 9, enclosure 11, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[30] Bearss, *The Sandy Hook Defenses*, p. 188.

[31] Lt. Col. Solomon W. Roessler to Marshall, August 5, 1908, with reply from Marshall; folder 9, enclosures 29 & 30, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[32] Roessler to Col. H.L. Harris, District Commander, South Artillery District, Fort Hancock, New Jersey, August 19, 1908; folder 9, enclosure 35, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

Roessler, and the work was completed by January 1, 1909. Battery Reynolds was subsequently turned over to the Coast Artillery Corps.[33]

Maintenance of Drainage and Electrical Systems

During fiscal year 1911, Lt. Col. Roessler prepared plans of both Battery Reynolds and Battery McCook that showed the layout of each battery and detailed the drainage and electrical systems (figs. 145-146). The plans were prepared for the Coast Artillery Corps, and included the following instructions for the care of the Mortar Batteries:

INSTRUCTIONS FOR GARRISON

1. Floors and pavements are graded to fall towards strainers at drain inlets. Arrows indicate direction of flow in drains. Inlets in magazine, storerooms and long gallery drain into the underlying sand.
2. All drains shall be carefully inspected and cleaned at least once a week. Occasionally the pipes should be flushed by means of hose run from hydrants.
3. The rooms and passages must be swept and all rubbish removed at least once a week; care must be taken that the holes in strainers are kept open and free from dirt; sweeping must be removed to such a place that they will not be carried into the drains by wind or water.
4. Immediately after each rain the earth slopes shall be carefully inspected; any slight tendency to gully or slough shall be at once remedied; any serious gullying shall at once be reported in writing to the District Engineer.
5. No person shall be allowed to walk upon the earth slopes, except when necessary to inspect or repair them.
6. All doors should be opened from daylight until 2 P.M. on clear days when there is a good breeze and temperature is above 60°.
7. Lights (*) are controlled from switch-boxes, located as shown on plan. Conductors are partly in conduits and partly in exposed armored cable.[34]

As noted in the instructions, the Coast Artillery Company garrisoned at each battery was responsible for the maintenance of the drainage and electrical systems, and for reporting any deficiencies to the Engineers.

---

[33] Bearss, *The Sandy Hook Defenses,* p. 189.

[34] "Plan Showing Drainage and Electrical Systems, Battery Reynolds, Fort Hancock, N.J., September 1910." Approved by Roessler Sept. 9, 1910; Chief of Engineers Wm. H. Bixby Sept. 14, 1910; and Acting Secretary of War Robert Shaw Oliver Sept. 17, 1910; Sheet 88-20, Drawer 45; RG 77; NACP. Also see "Plan Showing Drainage and Electrical Systems, Battery McCook, Fort Hancock, N.J., February 1911"; Sheet 88-21, Drawer 45; RG 77; NACP. Copies at Gateway NRA, Sandy Hook.

Installation of Ventilator Shafts

Item # 6 of the previously cited instructions noted that the doors to the batteries should be left open on clear breezy days. That was indicative of the poor ventilation of the interior rooms of the Mortar Battery. The magazines were especially affected by the lack of air, and were rarely free of moisture or condensation. Assistant Engineer Hurlbut forwarded an estimate for the installation of two ventilator shafts for the Mortar Battery, one at the end of each magazine, to Lt. Col. Roessler on October 18, 1911.[35]

Hurlbut's plan proposed digging a 6-foot-square shaft down through approximately 22 feet of sand to the top surface of each magazine. This shaft would be positioned over the thick concrete end wall of the magazine. At the bottom of the shaft, a hole 20 inches in diameter would be drilled 8 feet farther, down through the magazine ceiling and into the end wall. Then, a 20-inch-square shaft would be cut through the end wall of the magazine, extending 2 feet to intersect with the 20-inch hole at a right angle. The 6-foot-square shaft would be lined with vitrified-tile sewer pipe 20 inches in diameter and capped with a galvanized iron globe ventilator. Concrete would be poured in around the sewer pipe to help secure it in place. Hurlbut estimated that each ventilator would cost $494.89 for a total of $989.78, which he rounded up to $1,000 in his request to Lt. Col. Roessler.[36]

Lt. Col. Roessler forwarded the request to Chief Engineer Bixby and included a plan entitled "Ventilating Flues for Magazines, Batteries Reynolds and McCook." The plans depicted the construction of the 6-foot-square shaft and the position of the drilling apparatus, as well as a section view of the completed ventilator flue (fig. 147). On October 30, 1911, Brig. Gen. Bixby approved the project and allocated funds from the "Preservation and Repair of Fortifications" Act of March 4, 1911.[37]

Work was begun on the ventilator shafts as soon as the season's target practice was completed. The workmen had connected the ventilator shafts with the magazines by mid-May 1912, and then cut the 20-inch-square shaft from the inside of the magazine to the shaft. The ventilators were completed on June 18, 1912.[38]

---

[35] Hurlbut to Roessler, Oct. 18, 1911; folder 9, enclosure 45, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[36] Hurlbut to Roessler, Oct. 18, 1911; folder 9, enclosures 45 & 46, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[37] Roessler to Bixby, Oct. 23, 1911, with endorsement by Bixby, Oct. 30, 1911; folder 9, enclosure 46, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[38] Bearss, *The Sandy Hook Defenses*, p. 192.

Disarming the Mortar Battery

A plan of the Mortar Battery records the serial numbers of mortars and carriages that were in place in 1915 (fig. 148). During World War I, the complex of Fort Hancock defenses was expanded by the addition of a battery in Navesink emplaced with four mortars. In order to arm the Navesink battery, four mortars were transferred from Reynolds and McCook. On July 29, 1917, Assistant Engineer G.W. Kuehule notified the District Engineer in New York City that the following 12-inch mortars and spring-return carriage were being dismounted at the Mortar Battery and transferred to Navesink: Battery Reynolds - Pit A #3, Mortar #20 and Carriage #4; Pit B #1, Mortar #21 and Carriage #25. Battery McCook - Pit A #3, Mortar #18 and Carriage #12; Pit B #1, Mortar #58 and Carriage #9 (fig. 149).[39]

With the end of World War I, Fort Hancock and the country experienced a rapid demobilization of armed forces. From December 1918 through June 1919, the forces assigned to the Sandy Hook defenses were reduced from 24 officers and 1,535 enlisted men to 15 officers and 386 enlisted men. The number of troops assigned to Fort Hancock was also reduced, and by June 1919 the command had been reduced to "caretaker status."[40] During this same period, it was determined that Batteries Reynolds and McCook were obsolete, and that their 12-inch mortars and carriages were surplus to the nation's defenses. Consequently, all of the remaining mortars and carriages of Batteries Reynolds and McCook were salvaged and sold to civilians during the winter and spring of 1920.[41]

Switchboard Room

The Mortar Battery emplacement was not abandoned by the Army. By January 1921 discussions had begun to use some of the galleries of Battery McCook as a protected switchboard room. In April of that year, the Chief of Engineers allotted $20,000 for the construction of a protected switchboard room in the north end of the longitudinal gallery of Battery McCook, room 112 (fig. 133).[42]

Plans for the switchboard room submitted on August 16, 1922, depicted the alterations to the transverse and longitudinal galleries of Battery McCook (fig. 150). At each end of the transverse gallery, new doorways were constructed with double swinging doors leading to the mortar pits. The doorways were installed just inside of the hanging steel doors, and plans

[39] Asst. Engineer G.W. Kuehule to District Engineer Officer, 2nd District, NYC, July 29, 1917; folder 9, enclosure 63, box 34; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[40] Bearss, *Historic Resource Study, Fort Hancock, 1895-1948, Gateway National Recreation Area, New York/New Jersey* (Denver: U.S. Department of the Interior, National Park Service, May 1981), pp. 397-404.

[41] Fort Record Book, October 1924, p. 106.

[42] Bearss, *The Sandy Hook Defenses,* p. 195. Also see Record Card No. 347, Record Cards for Correspondence Relating to Fortification Projects 1907 -1930; Entry 801; RG 77; NARA - Northeast Region (NY).

indicated that the doorway to the northeast pit was constructed with "grating" and "grating doors." The "grating" of the doorways and doors was made of steel bars,[43] and it is seen in later photographs of the battery.

The interior of the transverse gallery was designated the "Corridor," and ventilation pipes and utility cables were hung from the arched ceiling. At the intersection of the transverse and longitudinal galleries, partition walls were constructed leading to both the longitudinal gallery and the alcove or "firing recess" on the east side of the transverse gallery. The walls, which are extant, were constructed with tile blocks with a single-width doorway centered in the wall. The partitioned room on the east side of the transverse gallery was designated the "Storage Battery Room." The storage batteries provided the power for the switchboards. The plans noted that the floors and walls of the room were finished with two coats of "acid proof paint."[44]

As previously described, a partition wall was constructed at the north end of the longitudinal gallery where it intersected the transverse gallery. Another partition wall was constructed at the junction of the longitudinal gallery and the storage rooms, near the center of the battery. The partitioned area formed a room that measured 15 feet wide and 35 feet 1 inch long. This room was designated the "Switchboard Room" (figs. 150 -151). The plans noted that the floor of the room was covered with "¼ inch cork carpet," and that the walls were finished with two coats of "cement white." Five switchboard panels were installed in the room to service the fire-control system at Fort Hancock. The vertical panels stood approximately 7 feet tall, and were installed over an open trench in the floor of the room. The open trench was cut into the concrete floor of the room; it carried the utility cables to a covered trench in the transverse gallery and then to the storage battery room.[45]

The protected switchboard room was constructed and equipped by the end of August 1922. The switchboard room was transferred to the post commander by the District Engineer on September 2, 1922.[46]

Harbor Defense Command Post (HDCP) and World War II

The establishment of the HDCP at Sandy Hook in the late 1930s also led to some alterations at the Mortar Battery. The command center for the Harbor Defenses was located in the interior rooms of the Mortar Battery, which became known as the "catacombs of Fort Hancock" and later "The Bombproof."[47] At the same time, the Mortar Battery continued to serve as the fire-control switchboard room, and was also used as part of the Sandy Hook

---

[43] "Fort Hancock, N.J., Fire Control-Switch Board and Storage Battery Rooms, Aug. 16, 1922." Drawer 45, Sheet 118-58; RG 77; NACP.
[44] "Fire Control-Switch Board and Storage Battery Rooms, Aug. 16, 1922."
[45] "Fire Control-Switch Board and Storage Battery Rooms, Aug. 16, 1922."
[46] Bearss, *The Sandy Hook Defenses*, p. 195.
[47] Interview with Ed Biedermann, Technical Sergeant stationed at Fort Hancock 1940 – 1945; July 4, 1981.

telephone communications.[48] The adaptation of the Mortar Battery from a defense emplacement to a communications and command post that supported the defensive efforts at Sandy Hook changed the character of the structure.

During this same period, sections of the Mortar Battery's counterscarp were demolished. The southeast, northwest, and northeast angles, and the counterscarp defenses at the northeast corner, were removed in 1938. A new entrance was cut through the southwest wall near the entrance gallery to Battery Reynolds (fig. 152).[49] This new entrance was used by the troops that manned the HDCP at the Mortar Battery.[50]

Though the switchboard room was in the same location, historic photographs and Sergeant Biedermann's account indicated that the equipment in the room was upgraded circa 1941 (fig. 154). The photograph appears to be the same view as the 1922 photograph (compare figs. 151 and 155), but the switchboard panels are seen on the east side of the room, and personnel are seated along the west wall in the area where the original switchboard was located. Mr. Biedermann stated that one of his first duties at the Mortar Battery was to install equipment in the switchboard room. When he started his duty there, there were two flush panels, and he assisted in the installation of more boards. His account suggests that the panels installed in 1922 had been removed, and that new panels were installed when he started his tour in 1940. The upgrade of the switchboard room was confirmed by a Signal Corps inspection report dated July 17, 1941, that documented five switchboards in the room, as well as other equipment.[51] Mr. Biedermann said that after the beginning of World War II, 18 men from the 245th Coast Artillery Company were stationed in the fire-control room.[52]

The use of the battery as the HDCP led to further alterations to the interior galleries, storage rooms, and magazines. A ca.-1944 floor plan of the Mortar Battery depicted the addition of partitions and the layout of the rooms, and included a room schedule (fig. 153; see figs. 133-135 for room number references). The room schedule indicated that the commanding general of the post had an office and room in the west magazine (rooms 116 and 117). The other rooms west of the longitudinal gallery were used as "S-1/intelligence" (room 114), the Executive Officer's office (room 115), and the Sgt. Major's office (room 118). The switchboard room remained in the longitudinal gallery of Battery McCook (room 112), and there was also a radio room (room 124), a chart room (room 122), and a message center (room128), among others. Latrines for the enlisted men and the officers were also added to the transverse gallery of Battery McCook (rooms 105a, 105b, and 106).

The ca.-1944 plan depicts an air lock at each end of the battery. The north air lock (room 104) at Battery McCook was located at the west end of the transverse gallery, while the south air lock (room 130) for Battery Reynolds was located at the intersection of the transverse and longitudinal galleries. The air locks were installed as part of the gas-proofing of the HDCP at the Mortar Battery. The north air lock took up the entire width of the transverse gallery, and was 5 feet 10 inches deep. The west partition wall was a 12-inch-thick brick wall, and the east wall was a 6-inch-thick brick wall. The air lock was entered via a doorway in the west wall,

---

[48] Bearss, *The Sandy Hook Defenses,* p. 195. Also interview with Ed Biedermann.
[49] Bearss, T*he Sandy Hook Defenses,* p. 195.
[50] Interview with Ed Biedermann.
[51] Bearss, *The Sandy Hook Defenses,* p. 195.
[52] Interview with Ed Biedermann.

and a doorway on the east wall led to the interior corridor. The south air lock was a rectangular room constructed at the corner of the transverse and longitudinal galleries. It was constructed with 12-inch-thick brick walls, and the interior measured 5 feet 6 inches wide by 7 feet 2 inches long. The air lock was entered through a doorway on the west wall of the room, and a doorway on the north wall led to the interior corridor. Both rooms were equipped with ventilation systems that included a fan unit and ventilation pipes. The rooms were built with gas-proof doors, and were constructed to be airtight.[53]

Drawings of the gas-proofing, labeled "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds" were prepared in 1942 and certified complete in June 1944 (figs. 156-157). Detail plans depicted the piping and ventilation systems for the battery and the door details. The gas-proof doors were installed in the air-lock rooms, which were commonly known as the "de-gassers." Upon entering the battery, the process as described by Sergeant Biedermann was that personnel would ring a bell for the outside door to be opened. The personnel would enter the air lock, and once the door was closed, fans would come on to de-gas the chamber and its occupants. After about 30 seconds, the personnel would then enter through the next gas-proof door into the corridors and rooms of the HDCP. Mr. Biedermann noted that the communications staff, of which he was one, would park their cars in the northwest pit of Battery McCook and enter through the north air lock (fig. 158). The other HDCP staff entered the battery by the lighthouse (the new entrance in the southwest wall) and then through the south air lock. Mr. Biedermann further noted that after the bombing at Pearl Harbor, an armed guard was stationed outside the air-lock rooms. A World War II-era photograph shows a guard station at the entrance gallery to the southwest mortar pit (fig. 159).[54]

The ventilation system associated with the gas-proofing primarily consisted of large intake and exhaust ducts and a generator that ran the system. The generator room was located at the east end of the north transverse gallery, and extended into the northeast mortar pit of the Mortar Battery (fig. 160). The generator room was equipped with a large generator and two compressors. The ventilating instructions for the generator room included the following explanation of operation: "Generator fan will draw cool outside air into the generator room through the intake duct and exhaust it through the radiator, exhaust duct, corridor and opening "D" to the outside."[55] The ductwork for the system was hung from the ceiling, and it ran throughout the interior rooms of the battery.[56]

As indicated by the ca.-1944 plans, the HDCP used some of the battery's rooms as they were, and altered others by constructing partitions. The south end of the longitudinal gallery that was formerly part of Battery Reynolds was divided into four rooms (fig. 153; see fig. 135 for room number references). The room schedule notes that these were used for enlisted men,

---

[53] "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Gas Proof Detail Doors, certified June 6, 1944." Copy at Gateway NRA, Sandy Hook.

[54] Interview with Ed Biedermann.

[55] "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Generator Room Ventilation System, March 1944." Copy at Gateway NRA, Sandy Hook (GATE mortarbattery3).

[56] "Generator Room Ventilation System, March 1944."

message center, Navy liaison, and S-4 (transportation).[57] The plans indicate that the room used for the enlisted men (room 129) had been constructed before the HDCP moved into the battery. The plan notation "6-inch hollow tile partition installed by others"[58] suggests that the wall was already in place. Proceeding down the corridor, the partitions of the other rooms were built with 2 by 4 framing and plywood paneling. The change in materials further indicates that the enlisted men's room was constructed during a separate alteration. The room may have been part of the alterations to the battery in 1922, but the documents from that period did not indicate that any changes were made to the longitudinal gallery of Battery Reynolds.

As previously described, the generator room extended into the northeast pit of the battery. The walls that were added in the former mortar pit were constructed of reinforced concrete. Southeast of the generator room, additional walls were built for an L-shaped corridor and a boiler room. The plans indicated that the boiler room housed an oil-fired boiler (extant pieces of which can be found in the northeast pit).[59] Mr. Biedermann recalled that the switchboard room had been equipped with hot-water radiators attached to the walls prior to switching to a hot-air system.[60] The boiler may have been used with either one or both of those systems.

Concurrent with other alterations for the HDCP, the Mortar Battery was soundproofed. The soundproofing was achieved by the application of asbestos sprayed on the arched ceilings of the galleries, storage rooms, and magazines. Drawings of the soundproofing indicate that a 1-inch-thick asbestos layer was sprayed above the spring line of the arched walls. The plans noted that the material was "K & M Sprayed Limpet Asbestos." The application generally avoided the cables and ducts, but did include the exterior of the large ceiling duct in the switchboard room.[61]

A "Report of Completed Works" documented that the modifications to the Mortar Battery in 1943 cost $41,625.27. An additional $200 was spent on the ventilating system for the generator room in 1944. The report also notes that the battery was "concealed by camouflage netting and paint."[62] This was in addition to the Mortar Battery's existing natural cover. The netting camouflage is seen in period photographs of the Mortar Battery (e.g., figs. 152 and 161-162), and was apparently in place during the battery's use as the HDCP.

---

[57] Interview with Ed Biedermann. Mr. Biedermann stated that S-4 referred to the transportation personnel.

[58] "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Gasproofing General Layout, certified June 6, 1944." Copy at Gateway NRA, Sandy Hook.

[59] "Generator Room Ventilation System, March 1944."

[60] Interview with Ed Biedermann.

[61] "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Soundproofing Details, certified May 16, 1944." Copy at Gateway NRA, Sandy Hook.

[62] "Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921, corrected May, 1944"; RG 392; NARA - Northeast Region (NY).

Antiaircraft Defenses at the Mortar Battery

The Mortar Battery was one of four locations chosen for antiaircraft installations in the 1920s. Circa 1922 Battery B was mounted on the superior slope of the battery, armed with two 3-inch antiaircraft guns, Model 1917 (fig. 164).[63] The battery was chosen because its interior offered space for ammunition storage and shelter for personnel.

When the antiaircraft defenses at Sandy Hook were revised in 1937, an additional gun and mount was added to the superior slope of the Mortar Battery. This additional armament was moved from one of the disarmed antiaircraft batteries elsewhere at Sandy Hook. The antiaircraft defenses on the Mortar Battery were redesignated Gun Battery No. 2.[64] A World War II-era Corps of Engineers plan of Sandy Hook depicts three "A.A.C. Guns" on the superior slope of the Mortar Battery (fig. 163). Mr. Biedermann confirmed that there were 3-inch anti-aircraft guns on top of the Mortar Battery, and he stated that the guns practiced firing at targets towed by airplanes.[65] The observation post for the antiaircraft defenses was also installed at the Mortar Battery, and the antiaircraft group command post and message center were installed in an interior room, or "bombproof," of the battery.[66]

In addition to the antiaircraft guns, an antiaircraft machine-gun platoon – armed with four .50-caliber machine guns – was stationed at the Mortar Battery as part of the revised antiaircraft defenses at Sandy Hook.[67] The machine guns were mounted on concrete platforms on top of the battery. One of the machine-gun emplacements is depicted in the background of the photograph of training for the 3-inch gun (fig. 164).

After World War II

After World War II, the number of troops stationed at Fort Hancock was once again reduced. The deactivation of the New York Harbor Defense Program in 1950 meant the end of the associated activities at the Mortar Battery. The documents reviewed did not indicate whether the switchboard room remained active, but the closing of Fort Hancock in 1950 most likely signified the end of that function, as well.

The Mortar Battery does not appear to have undergone any significant alterations during the remainder of Fort Hancock's years as a U.S. military reservation. Reactivation of Fort Hancock during the Korean War did not appear to include further use of the Mortar Battery. Fort Hancock was once again active during the Cold War, for the deployment of Nike missile defenses. During the 1960s, the interior galleries and storage rooms of the Mortar Battery functioned as the post's fallout shelter. The electrical and generator systems remained operative at that time, and the Army set up beds, chairs, and tables there, and stocked the

[63] Bearss, *The Sandy Hook Defenses*, p. 368.
[64] Bearss, *The Sandy Hook Defenses*, p. 369.
[65] Interview with Ed Biedermann.
[66] Bearss, *The Sandy Hook Defenses*, p. 195.
[67] Bearss, *The Sandy Hook Defenses*, p. 369.

rooms with emergency rations and tins of drinking water.[68] However, by the time Fort Hancock was deactivated in 1974 and turned over to the Department of the Interior, the Mortar Battery was vacant.

National Park Service

The goal of the National Park Service as stewards of the Mortar Battery has been to preserve the structure. Initial efforts in 1977 included a plan to partially restore Batteries Reynolds and McCook, along with other significant batteries.[69] The General Management Plan (GMP) and GMP Amendment for Gateway NRA called for the rehabilitation of the Mortar Battery in accordance with *The Secretary of the Interior's Standards for Rehabilitation*.[70]

Early efforts at Sandy Hook Unit, Gateway NRA, to interpret the Mortar Battery included opening some of the mortar pits to visitors, posting interpretive signs, and establishing a walkway on the top of the battery that was lined with a post-and-cable safety railing in the late 1970s. The trail along the top of the battery was closed ca. 1990 due to increased erosion caused by visitor-made trails off the established pathways. The southwest mortar pit is currently open to the public, and the interpretive signs have been updated.

The park included the Mortar Battery in the project "Stabilization of Historic Concrete Batteries at Fort Hancock." This project included core testing of the masonry of the battery, and culminated in a 1990 report with recommendations for stabilization. The report noted "that in spite of the poor quality of concrete, both lower walls and upper slopes could still be functional today."[71] This was attributed to the low density, and subsequent low structural loading, of the concrete, as well as the relative thickness of the concrete walls and slopes. The report did note that the reinforced-concrete structures of the battery commander stations and the telephone booths are subject to different factors, and may not be as durable as the battery structure.[72]

The recommendations of the 1990 report stressed the importance of removing the invasive vegetation from the mortar pits. The report also recommended keeping one pit open to the public, and backfilling the other three in an effort to stop vegetative growth and the freeze-thaw cycle in the exposed concrete. Since then, the park has made efforts to remove vegetation from the northwest mortar pit, but the southeast and northeast pits are still overgrown.

---

[68] Thomas Hoffman, Park Historian.

[69] Jack E. Stark, NARO Regional Director, to Superintendent, Gateway NRA, July 7, 1977. Copy at Northeast Region Offices, 115 John Street, Lowell, MA.

[70] *General Management Plan Amendment: Development Concept Plan and Interpretation Prospectus: Sandy Hook Unit, Gateway National Recreation Area, New York/New Jersey* (U.S. Department of the Interior, National Park Service, January 1990), p. 9.

[71] Todd Rutenbeck, *Stabilization Investigations, Historic Concrete Batteries, Fort Hancock, Sandy Hook Unit, Gateway NRA, New Jersey* (Denver, CO: Bureau of Reclamation, June 1990), p. 17.

[72] Rutenbeck, *Stabilization Investigations*, p. 18.

The park is currently in the process of planning the preservation and rehabilitation of three Endicott System batteries, which includes the Mortar Battery. The NPS Project Management Information System (PMIS) states that the repairs on the Mortar Battery Potter will focus on removing vegetation and stabilizing the concrete in all four mortar pits, and will reestablish the walkway on top of the battery to again allow visitor access to that area. The work will also address visitor safety concerns outside and inside the battery.[73] The preservation of the Mortar Battery will enhance the park's interpretation of the history of Fort Hancock and the coastal defenses of the United States.

[73] Project Information Management System (PMIS) 57952. NPS website (http://165.83.198.10/pmis_search_projectdetail.cfm).

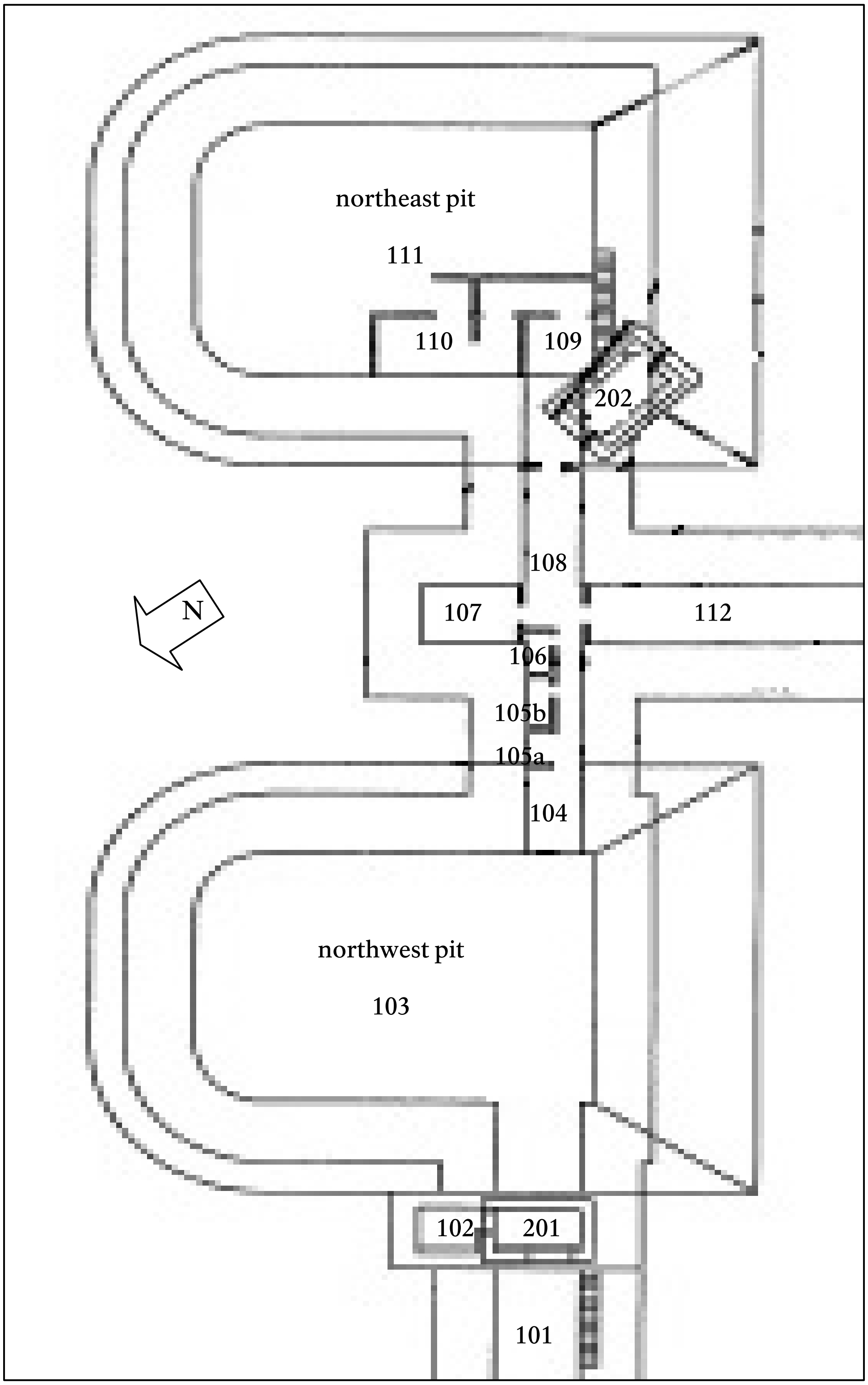


Figure 133. Mortar Battery, north end (Battery McCook). Not to scale.

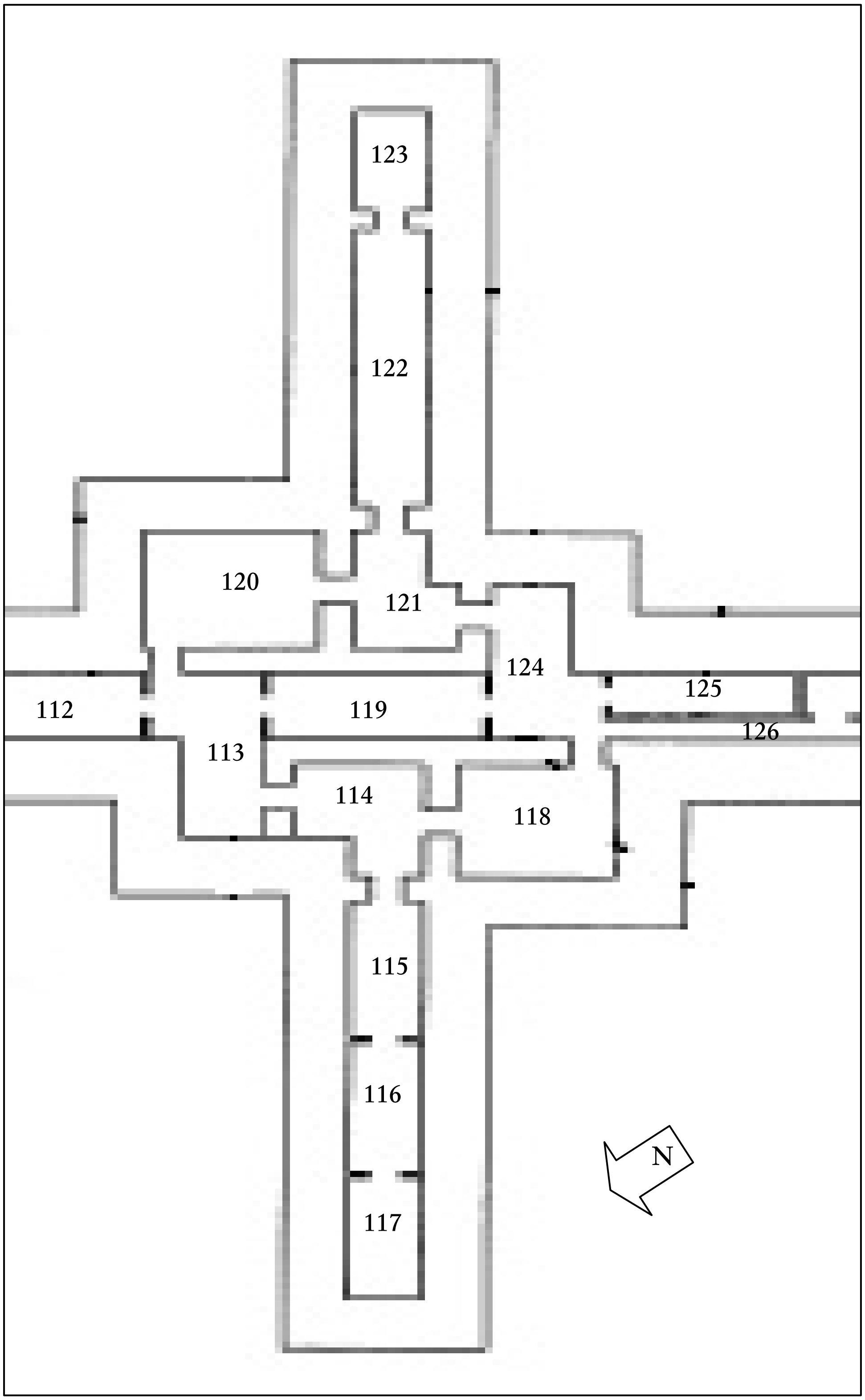


Figure 134. Mortar Battery, interior. Not to scale.

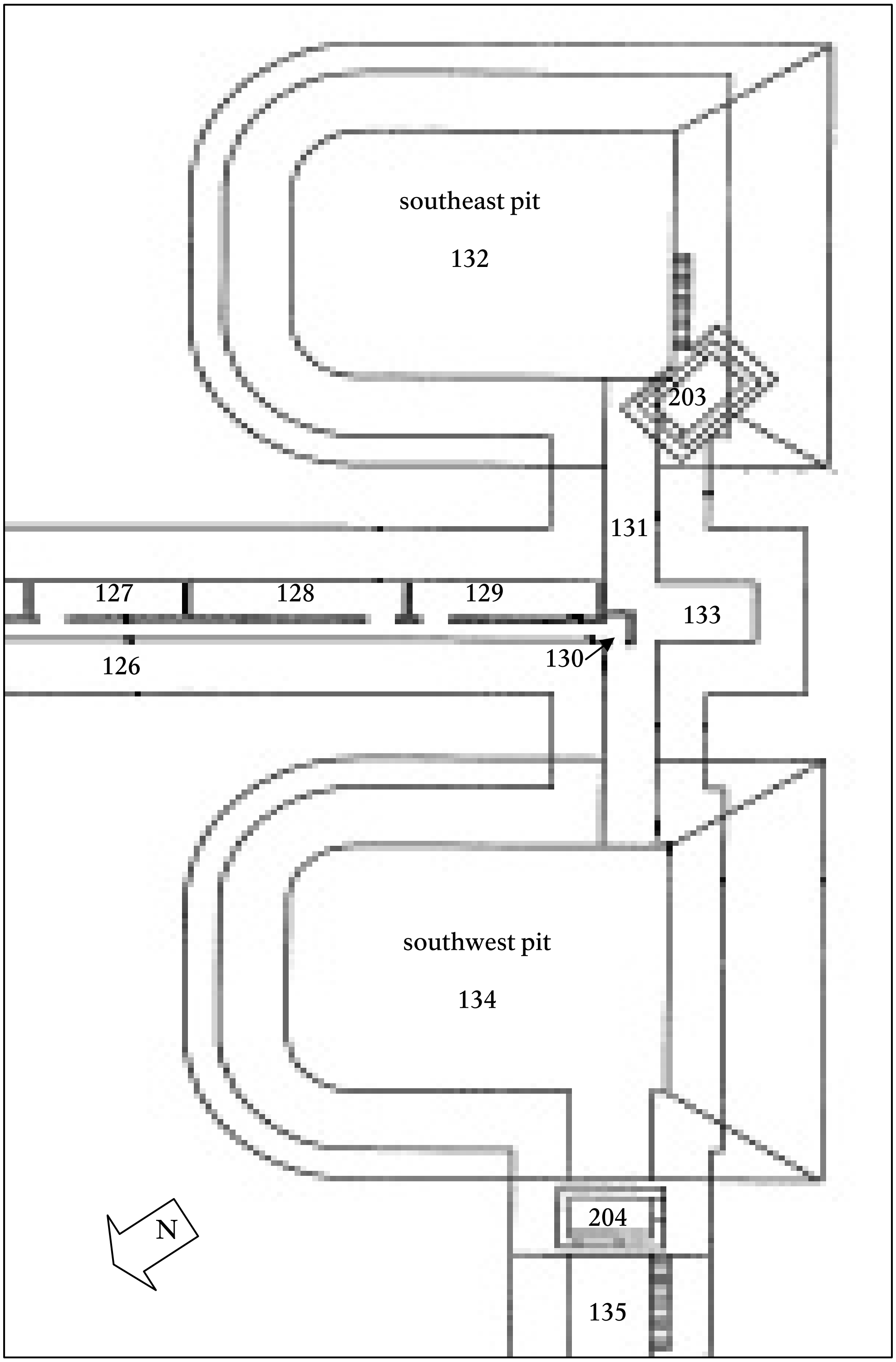


Figure 135. Mortar Battery, south end (Battery Reynolds). Not to scale.

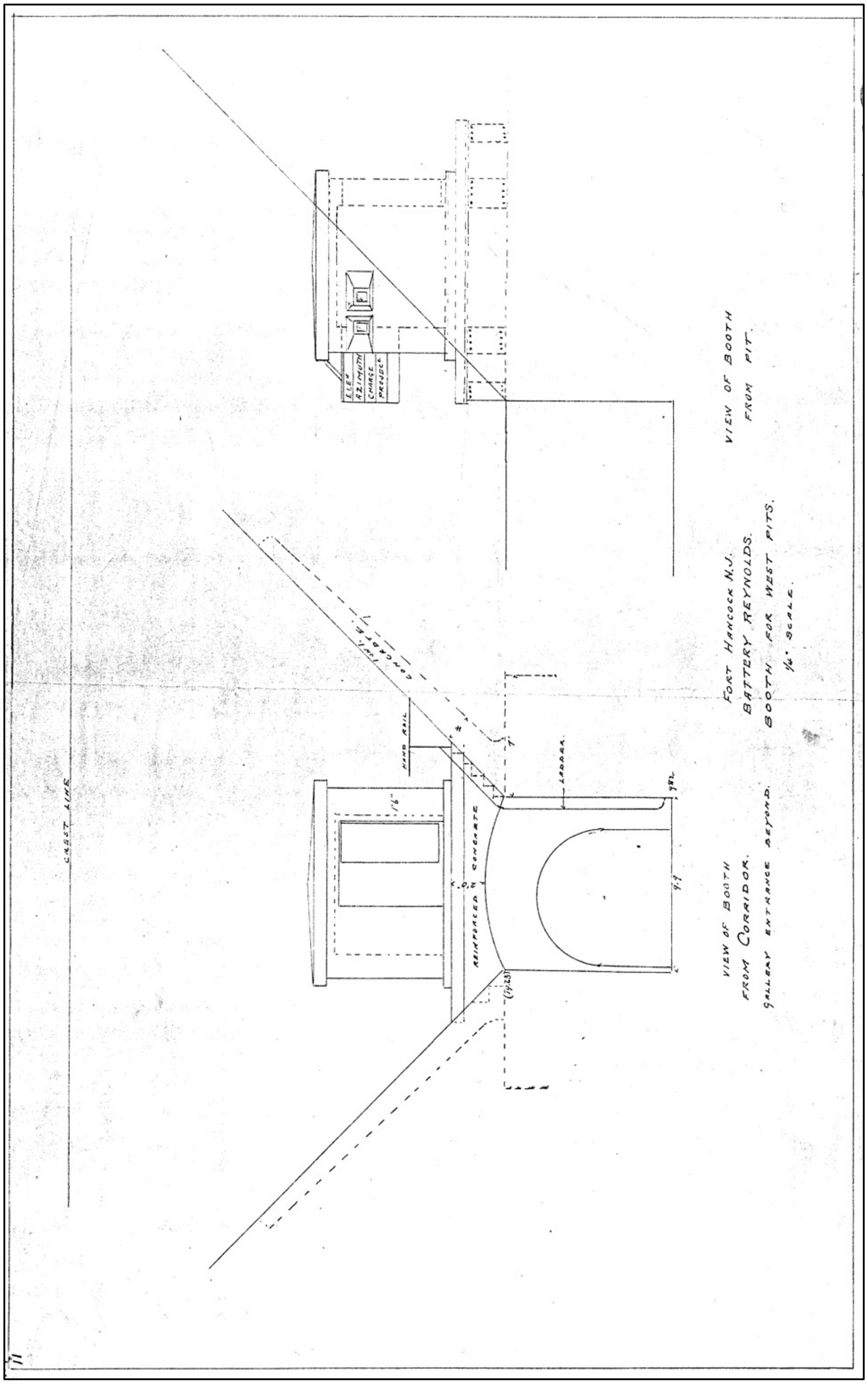


Figure 136. "Fort Hancock Battery Reynolds Booth for West Pits." Ca.-1905 plans for Mortar Battery telephone booths for northwest and southwest pits.

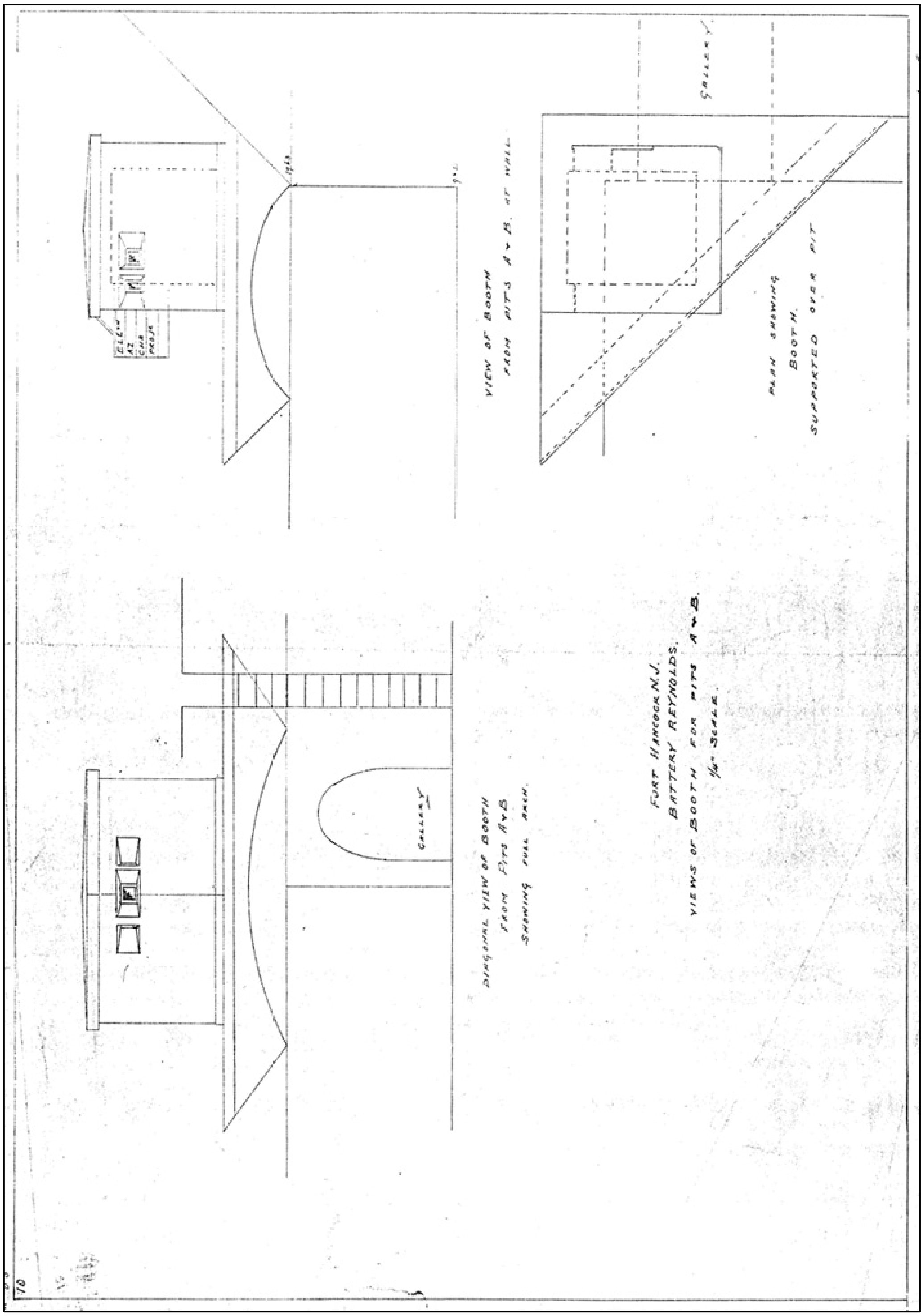


Figure 137. "Fort Hancock Battery Reynolds Booth for Pits A & B." Ca.-1905 plans for Mortar Battery telephone booths for northeast and southeast pits.

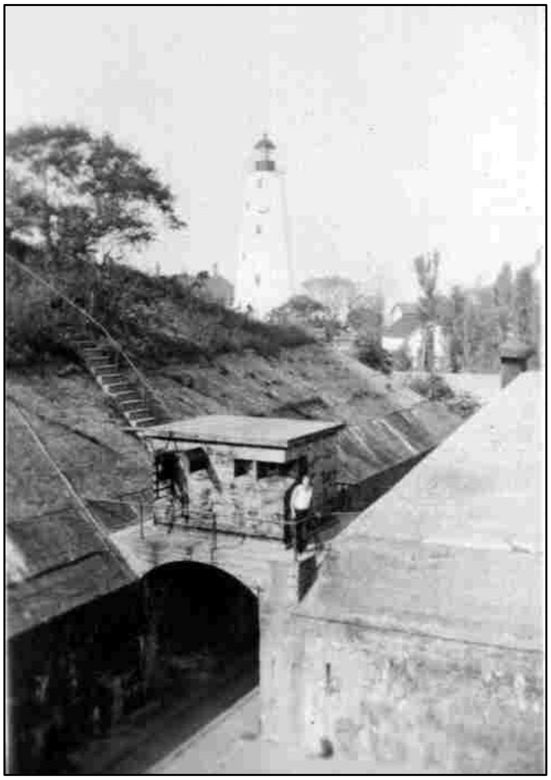


Figure 138. Mortar Battery, telephone booth in northwest mortar pit, ca. 1920.

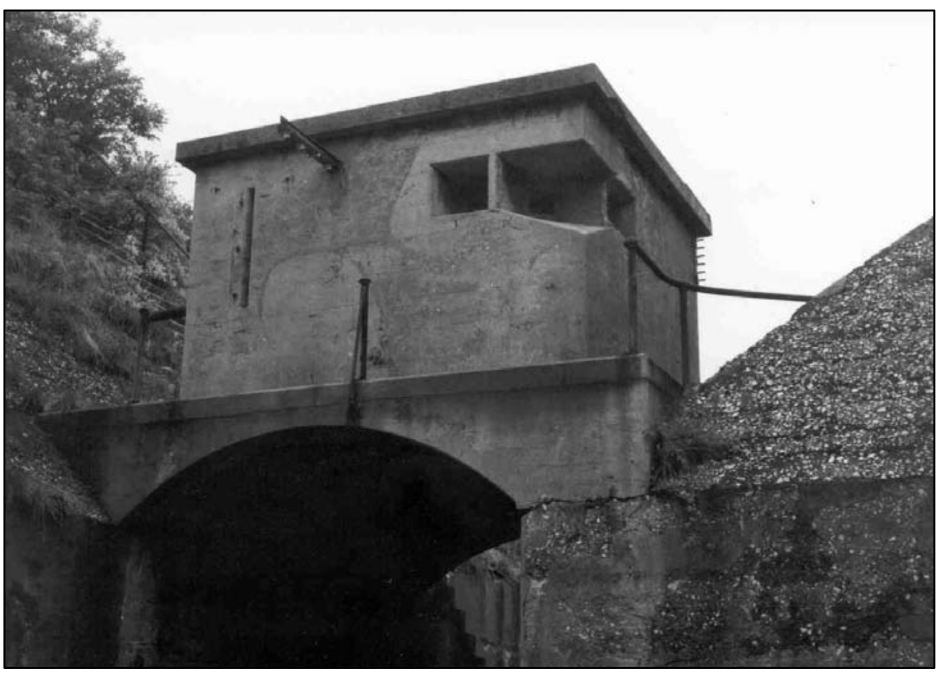


Figure 139. Mortar Battery, telephone booth in northwest mortar pit.

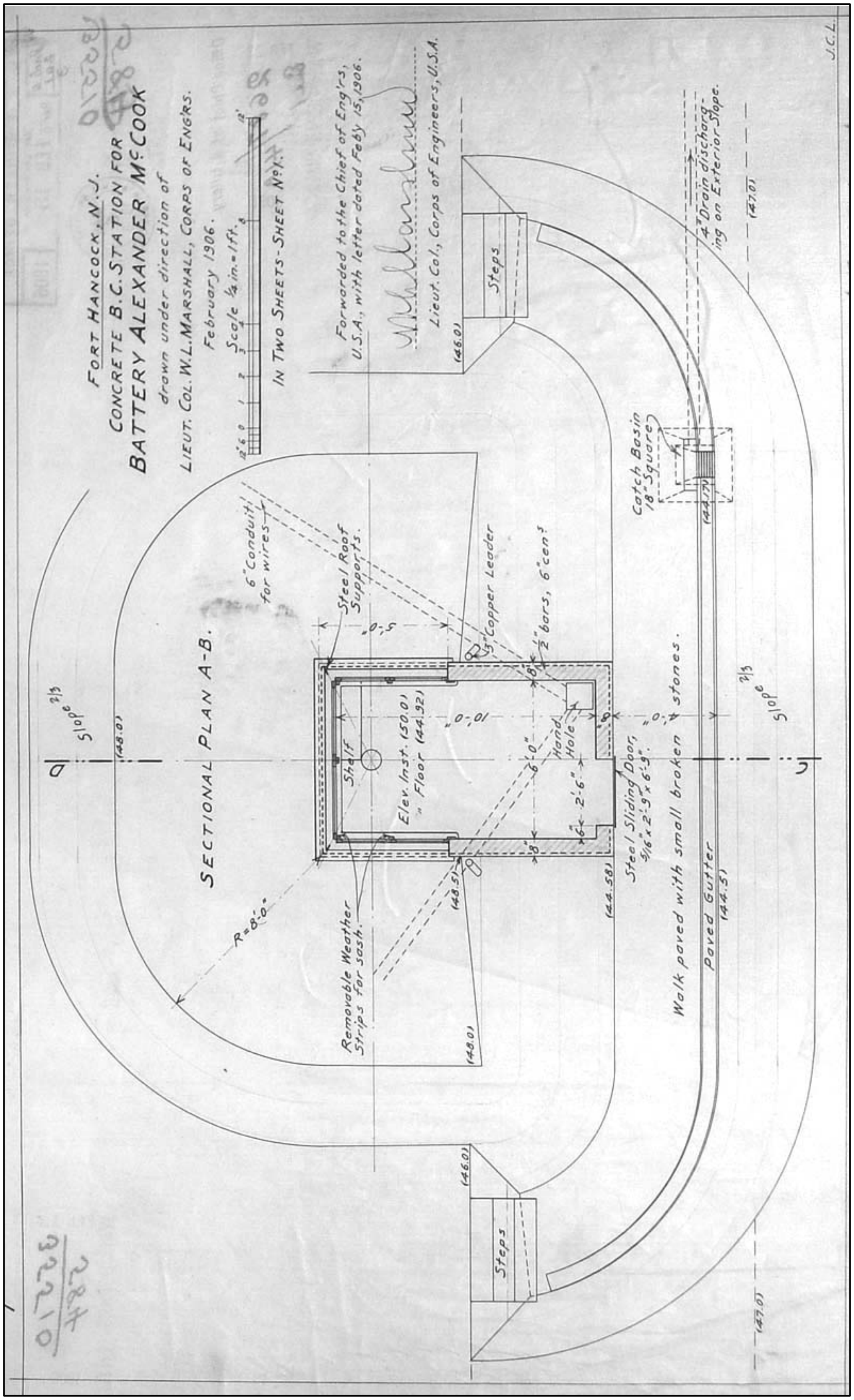


Figure 140. "Fort Hancock, N.J., Concrete B.C. Station for Battery Alexander McCook, February 1906."

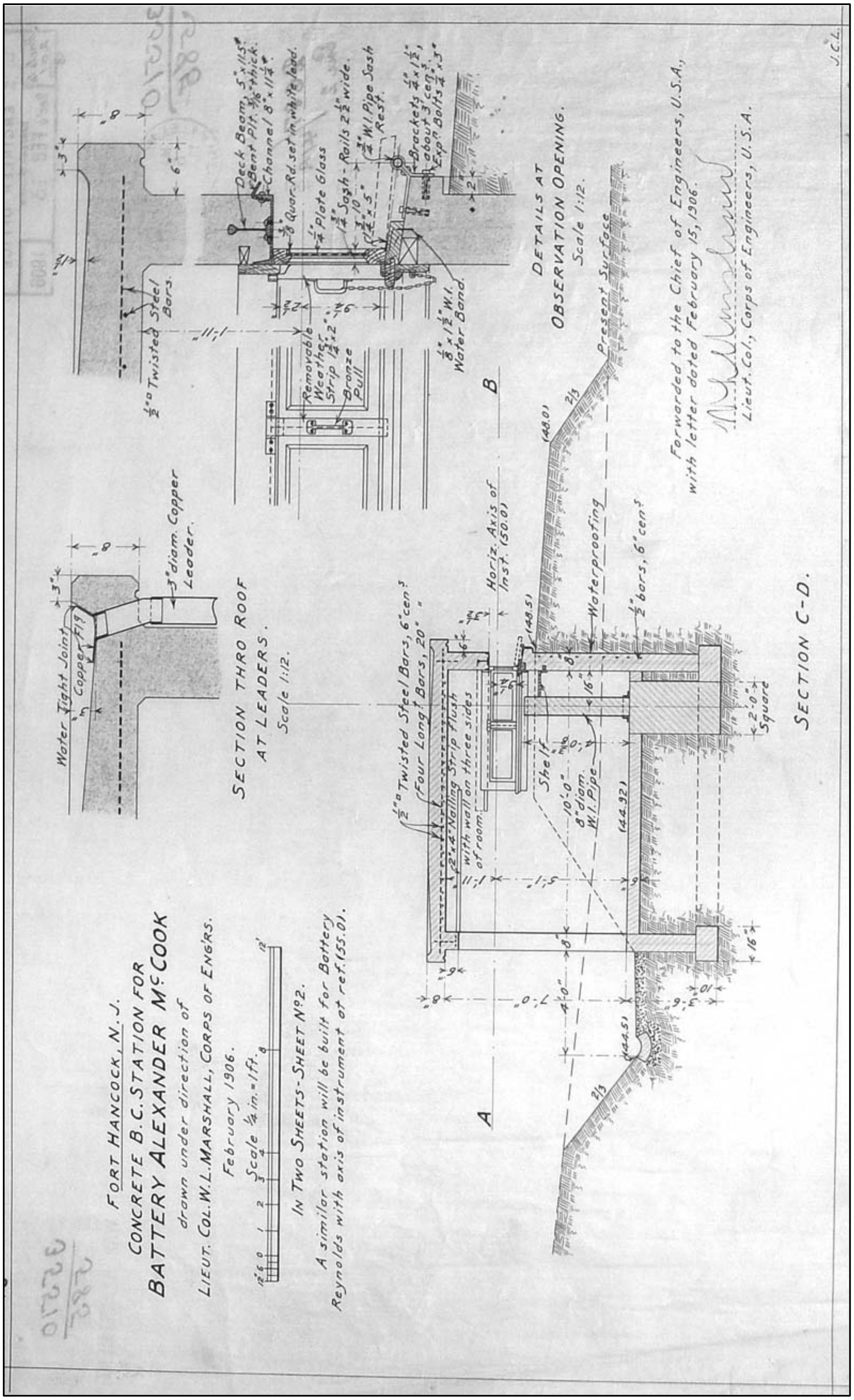


Figure 141. "Fort Hancock, N.J., Concrete B.C. Station for Battery Alexander McCook, February 1906." Note says: "A similar station will be built for Battery Reynolds. . . ."

Figure 142. Detail of aerial photograph of Fort Hancock, ca. 1930: view of Mortar Battery, showing tower and station inside west counterscarp wall.

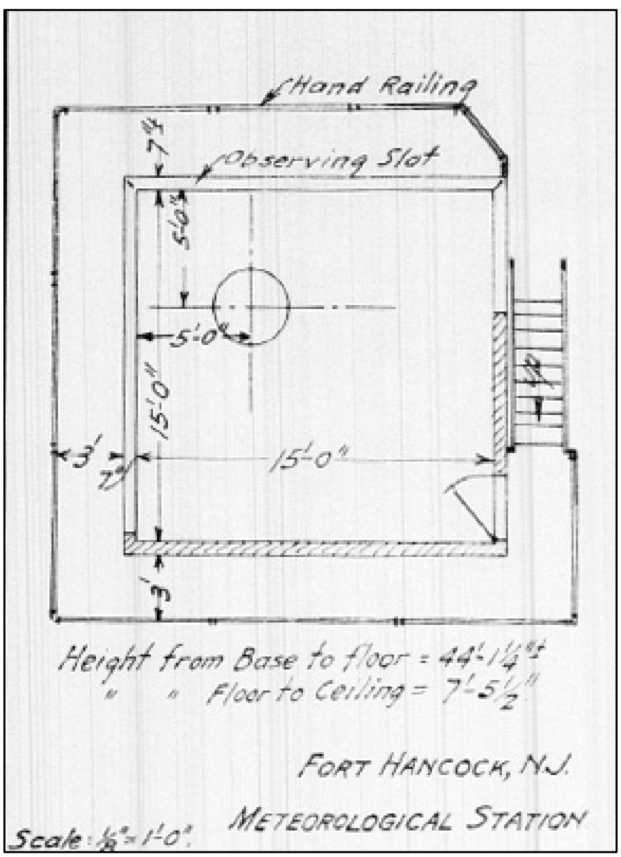


Figure 143. Plan of meteorological station inside west counterscarp wall of Mortar Battery, July 1, 1921.

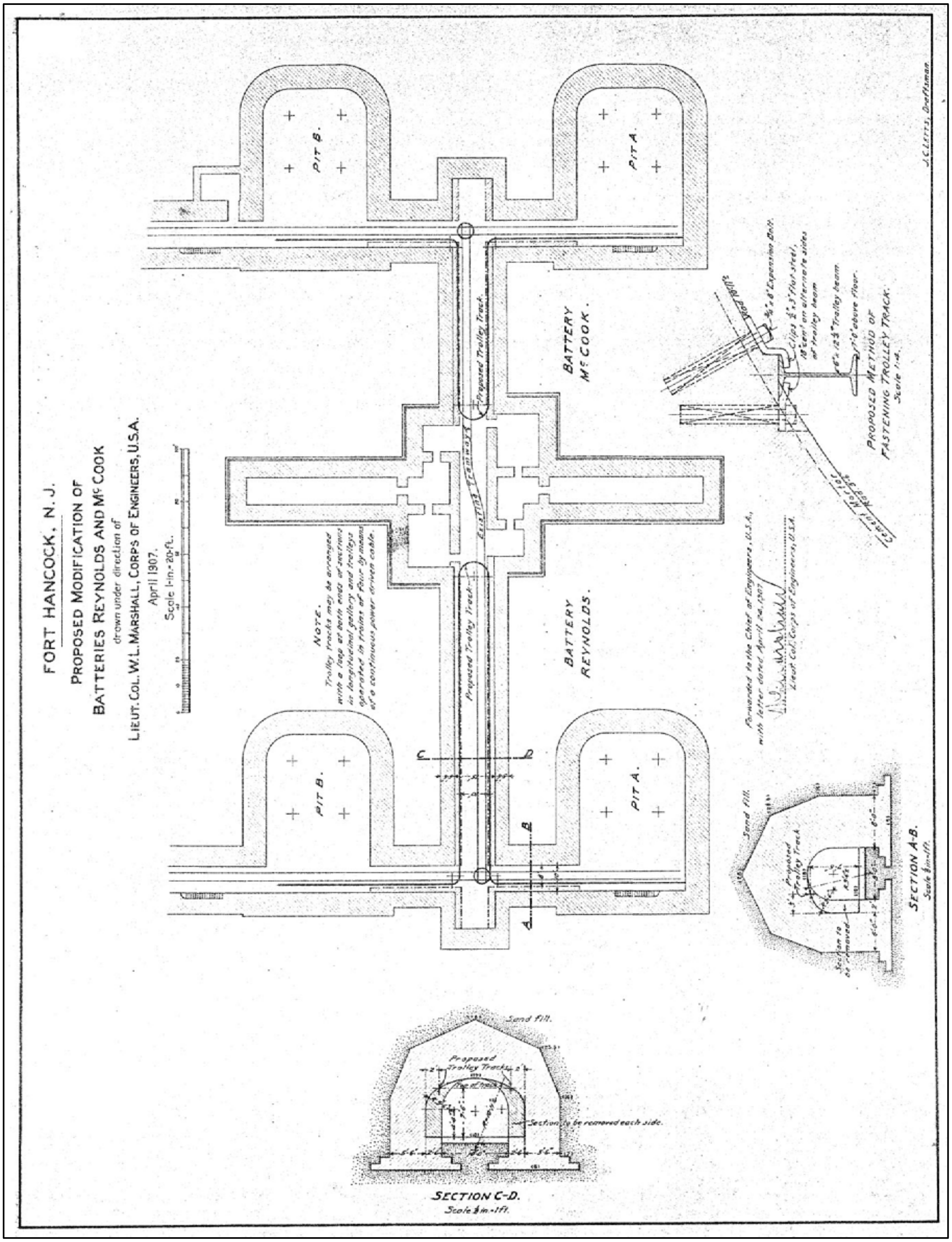


Figure 144. "Fort Hancock, N.J., Proposed Modification of Batteries Reynolds and McCook, April 1907." Alterations for the improved trolley system.

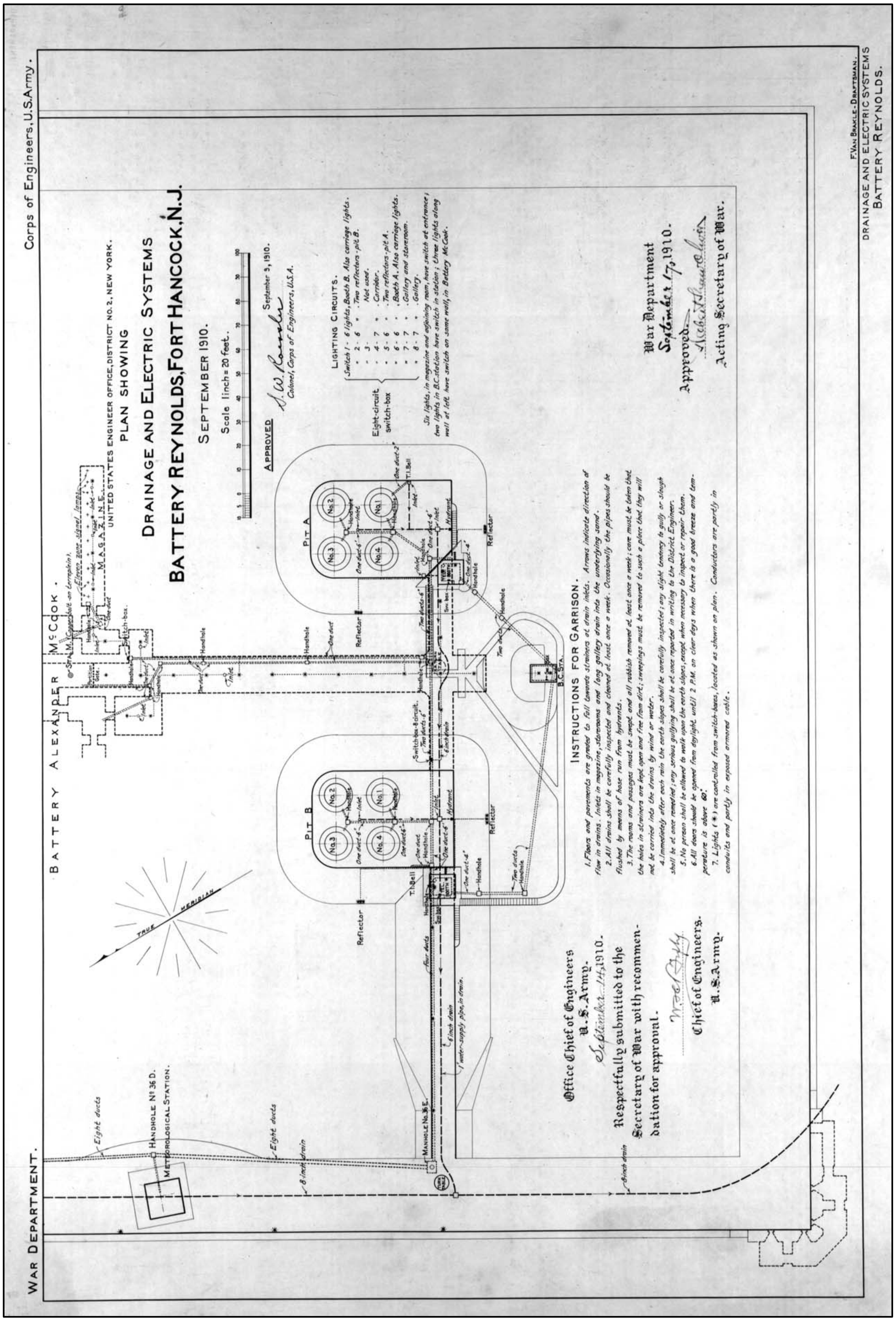


Figure 145. "Plan Showing Drainage and Electrical Systems, Battery Reynolds, Fort Hancock, N.J., Sept. 1910."

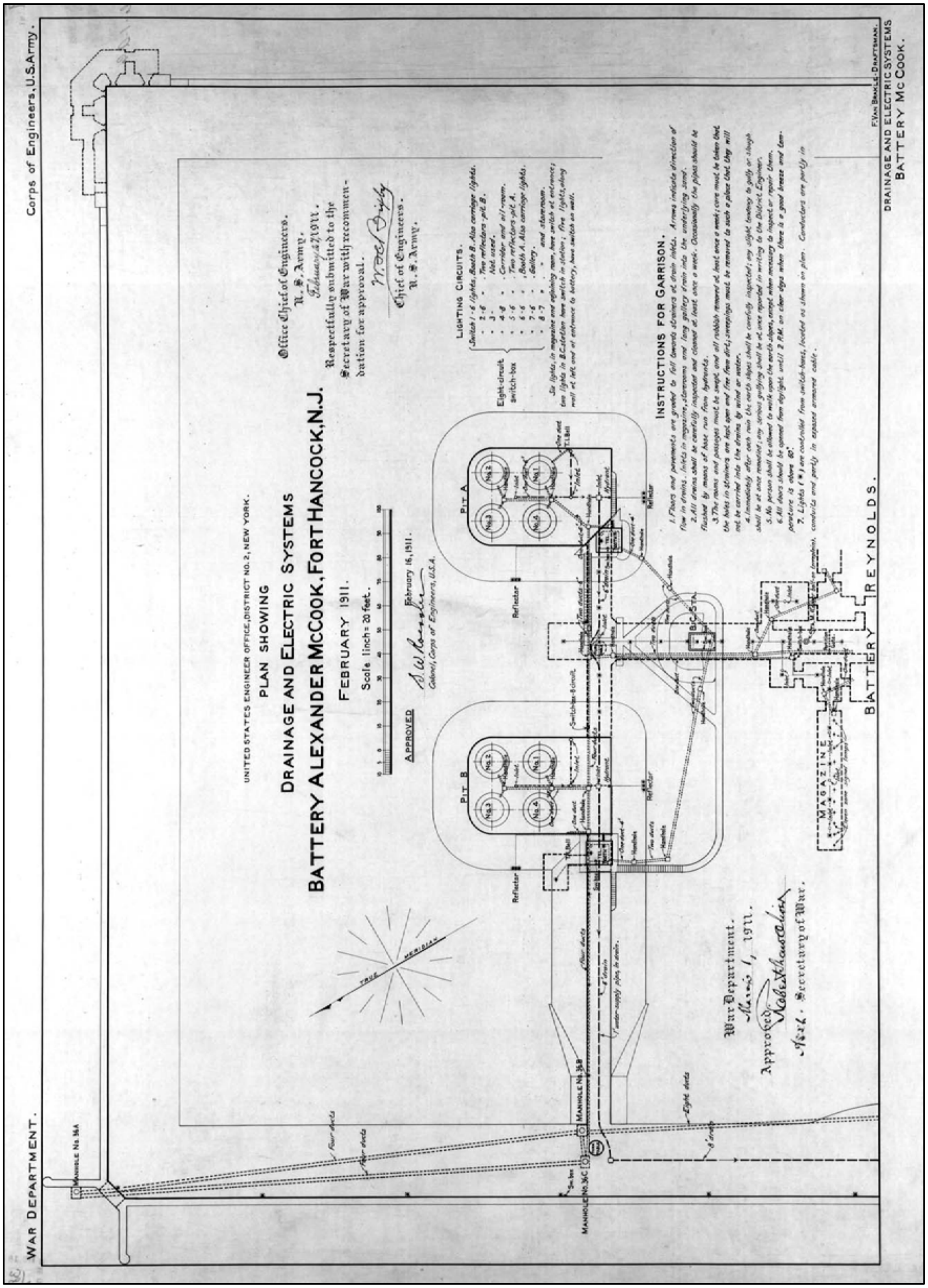


Figure 146. "Plan Showing Drainage and Electrical Systems, Battery Alexander McCook, Fort Hancock, N.J., Sept. 1910."

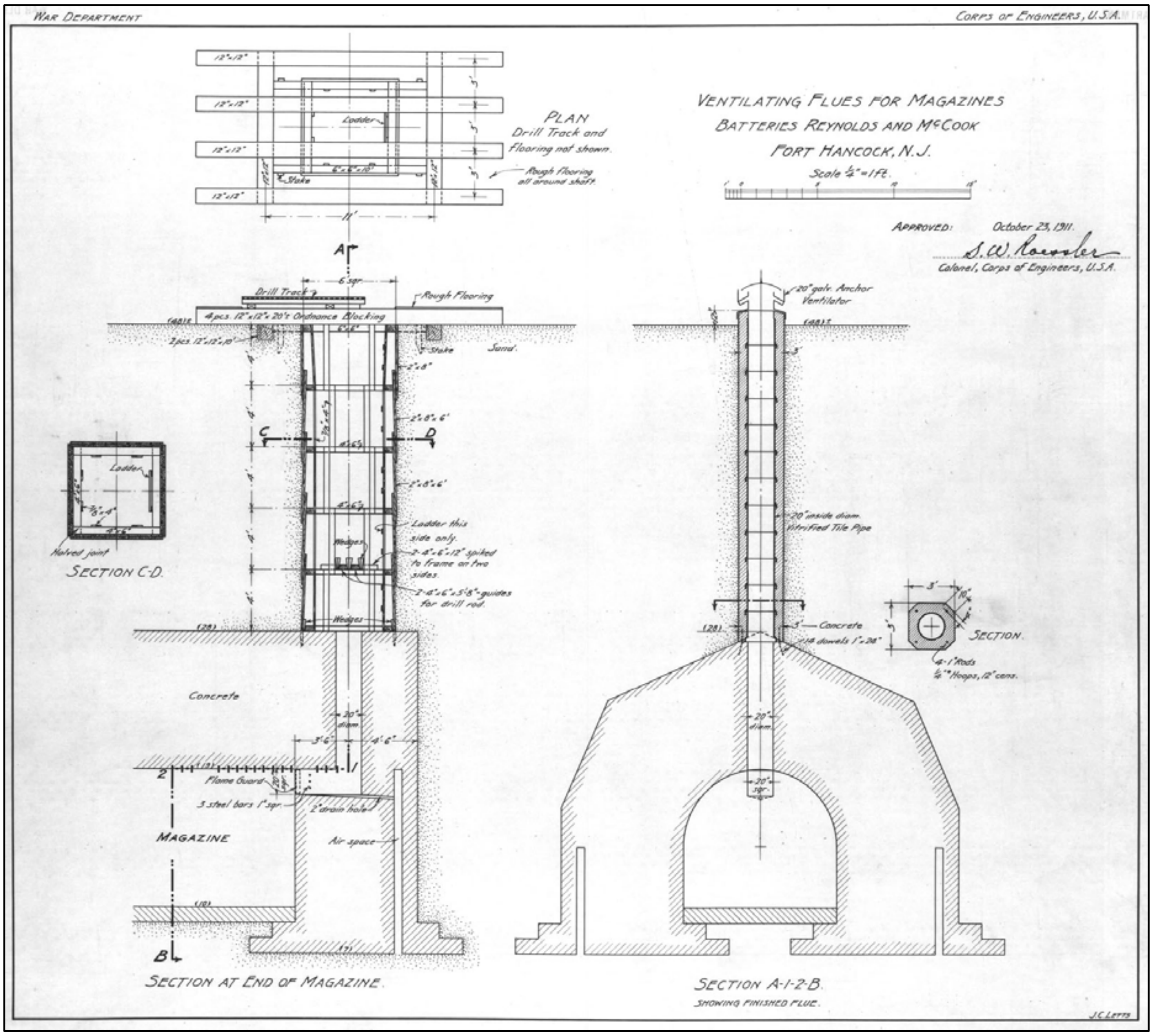


Figure 147. "Ventilating flues for Magazines, Batteries Reynolds and McCook, Fort Hancock, N.J., Oct. 1911."

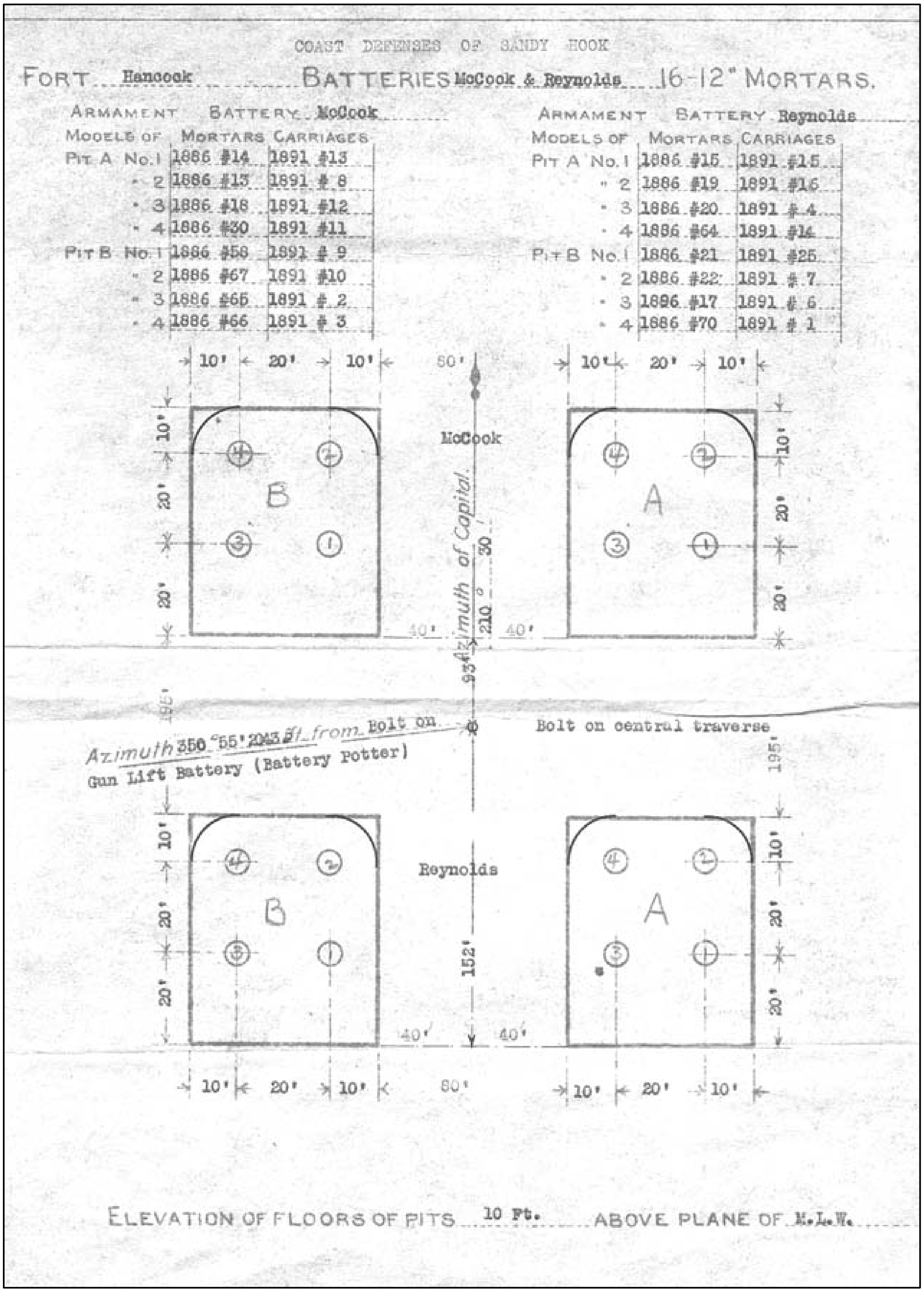


Figure 148. "Coastal Defenses of Sandy Hook, Fort Hancock, Batteries Reynolds and McCook, 16- 12-inch mortars." Plan of the Mortar Battery with serial numbers of guns and carriages, 1915.

Figure 149. Mortar Battery, balloon aerial view, circa 1919. Note that each mortar pit has only three mortars per pit; the fourth set of guns and carriages for each had been moved to the Navesink battery.

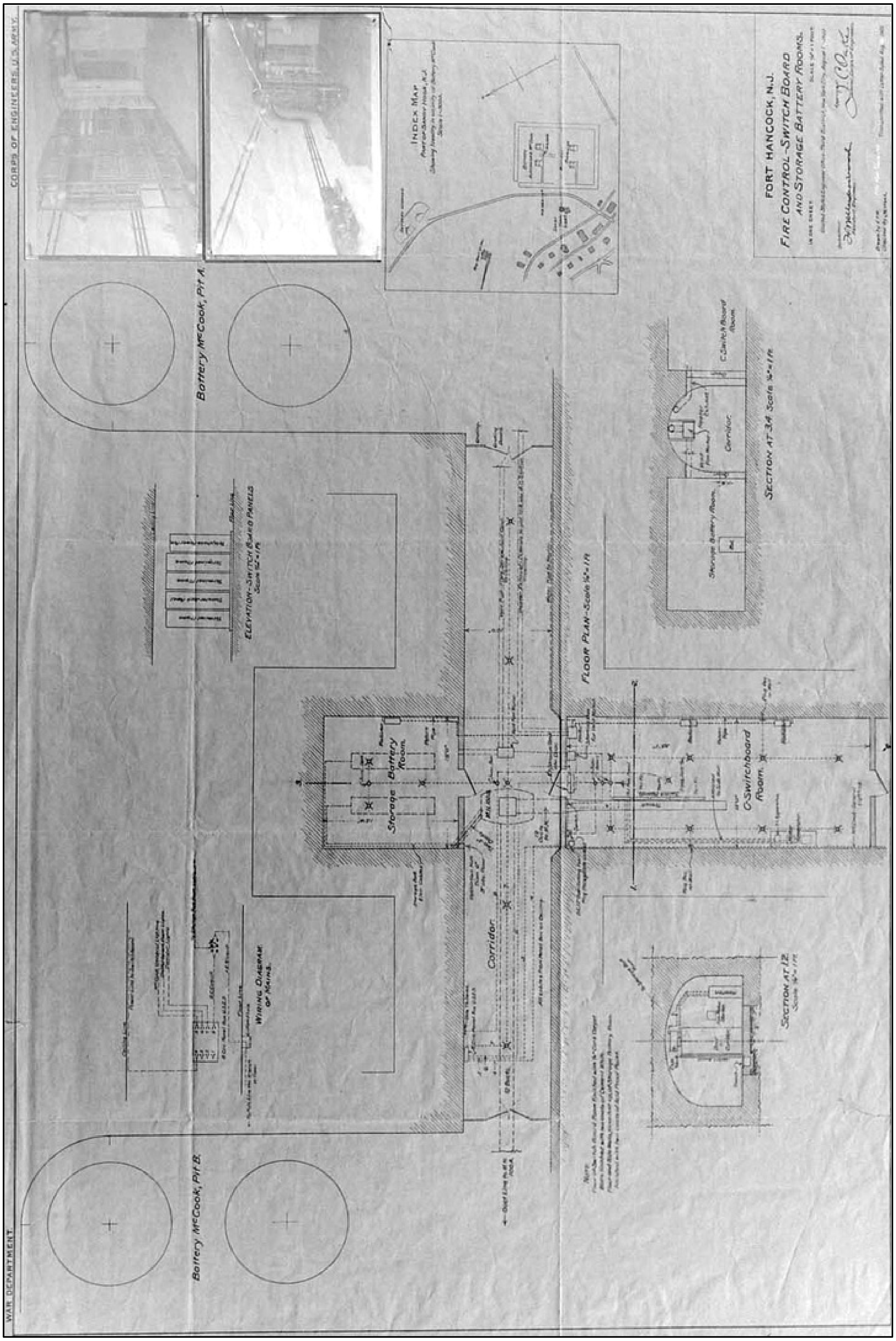


Figure 150. "Fort Hancock, N.J. Fire Control Switchboard and Storage Battery Rooms. August 16, 1922."

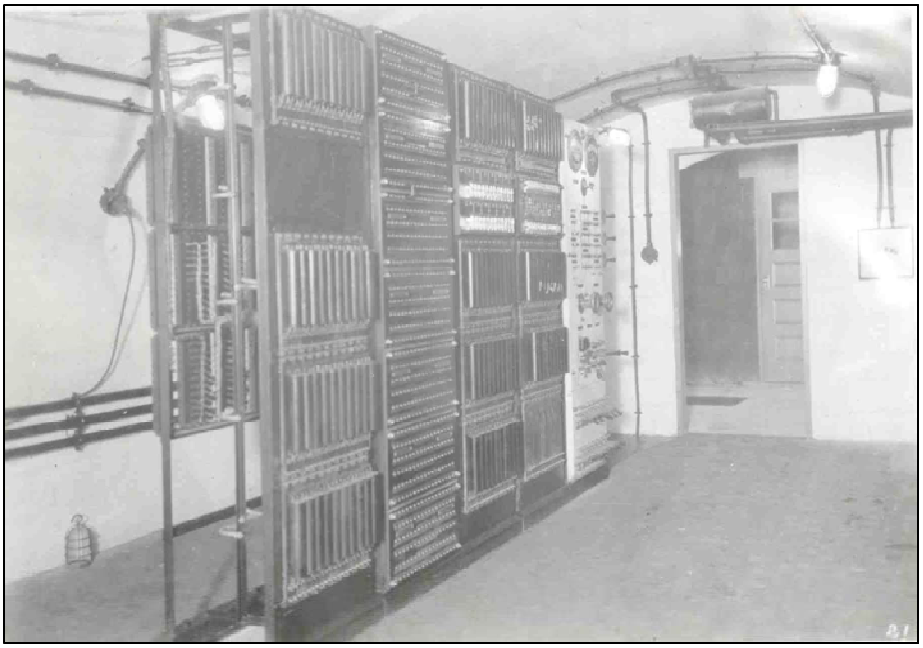


Figure 151. Mortar Battery, interior of switchboard room, ca. 1922.

Figure 152. Mortar Battery, opening in counterscarp wall, ca. 1944.

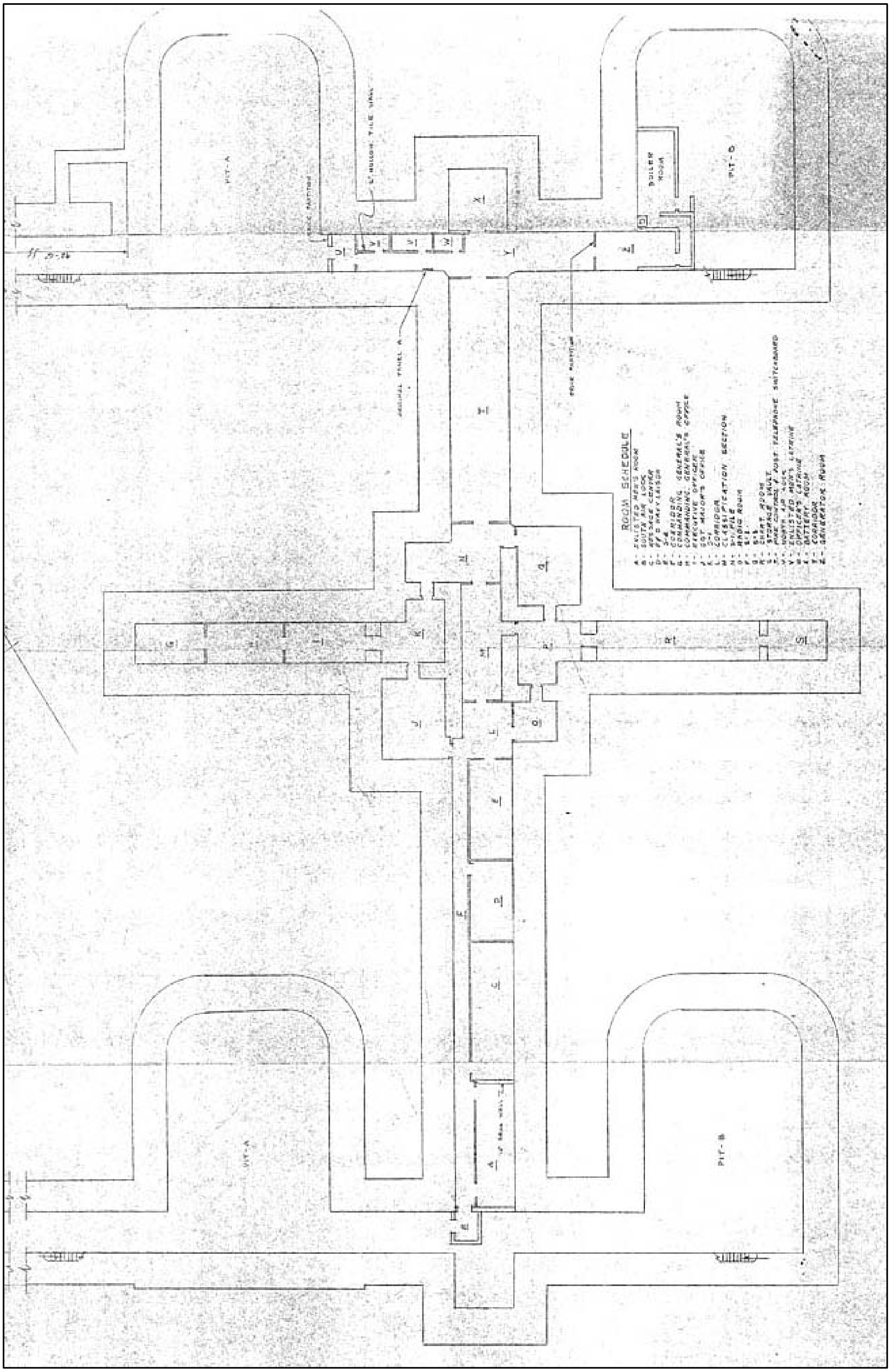


Figure 153. Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, General Layout, ca. 1944.

Figure 154. Mortar Battery, switchboard room (room 112), ca. 1941.

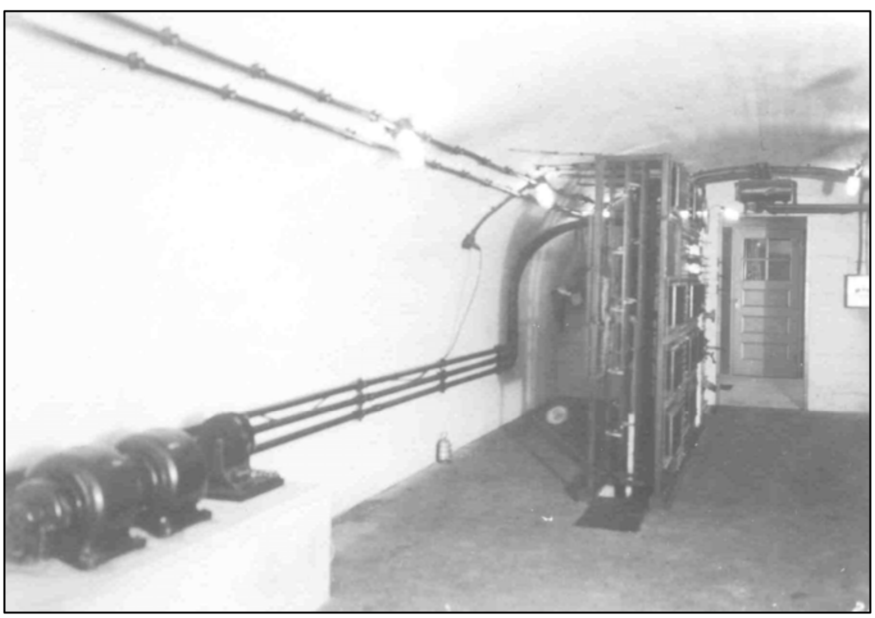


Figure 155. Mortar Battery, interior of switchboard room, ca. 1922.

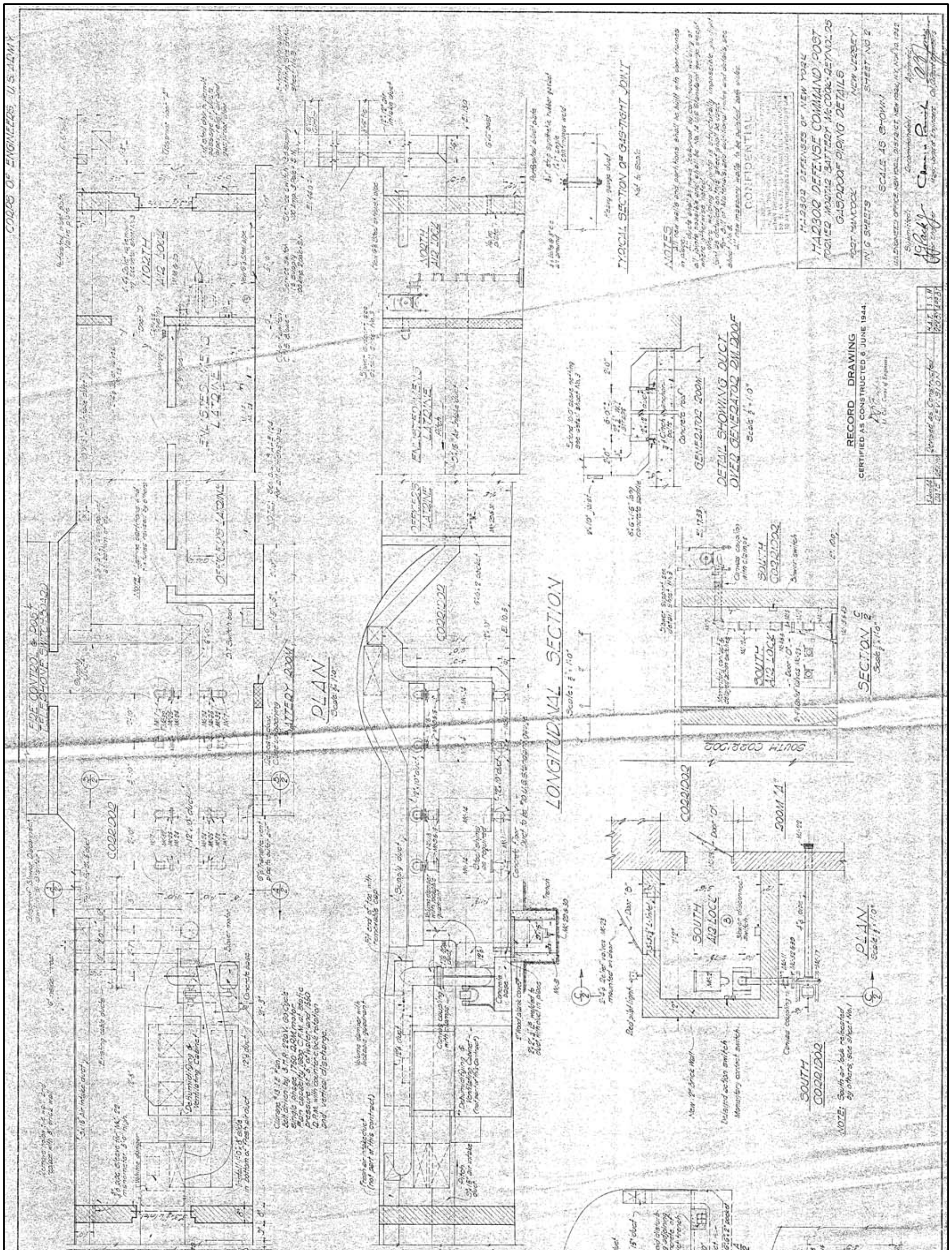


Figure 156. "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Gasproof Piping Details, certified June 6, 1944."

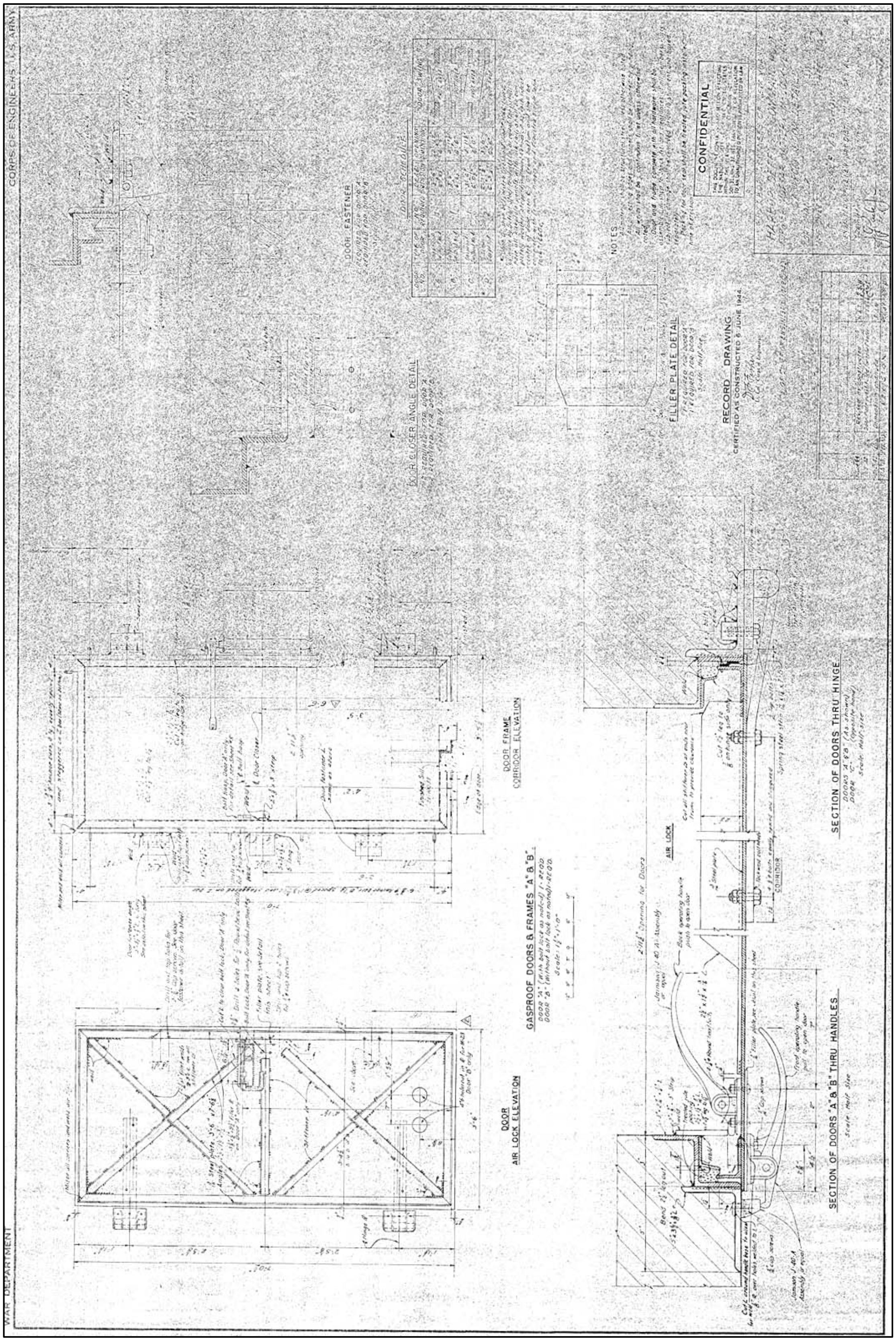


Figure 157. "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Gasproof Door Details, certified June 6, 1944."

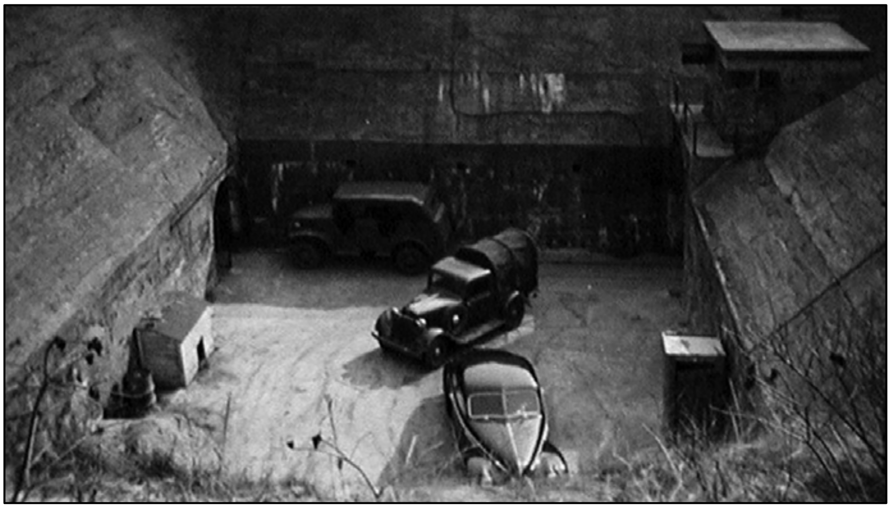


Figure 158. Mortar Battery, view of northwest pit with vehicles as described by Ed Biedermann, ca. 1944.

Figure 159. Mortar Battery, sentry post at the southwest entrance to mortar pits, ca. 1944. Note observation tower at left side of photograph.

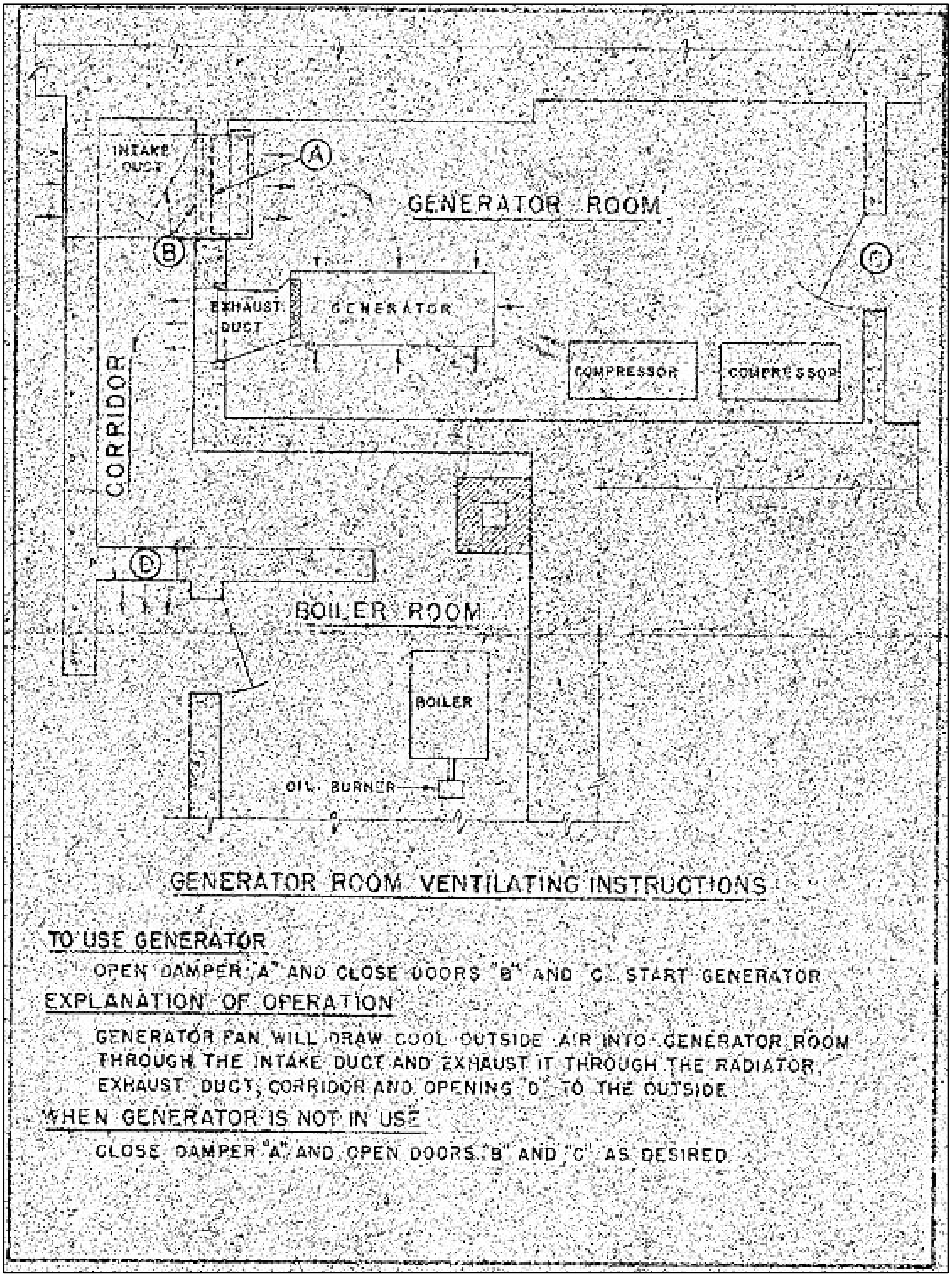


Figure 160. Detail of generator room. From "Harbor Defenses of New York, Harbor Defense Command Post, Former Mortar Battery McCook – Reynolds, Generator Room Ventilating System, March 1944."

Figure 161. Southwest corner of Mortar Battery, 1943; view from lighthouse during training exercises. Note netting and camouflage over battery on left side of photograph.

Figure 162. Battery Reynolds, southwest entrance gallery (room 135), 1943. Note netting over battery at top of photograph.

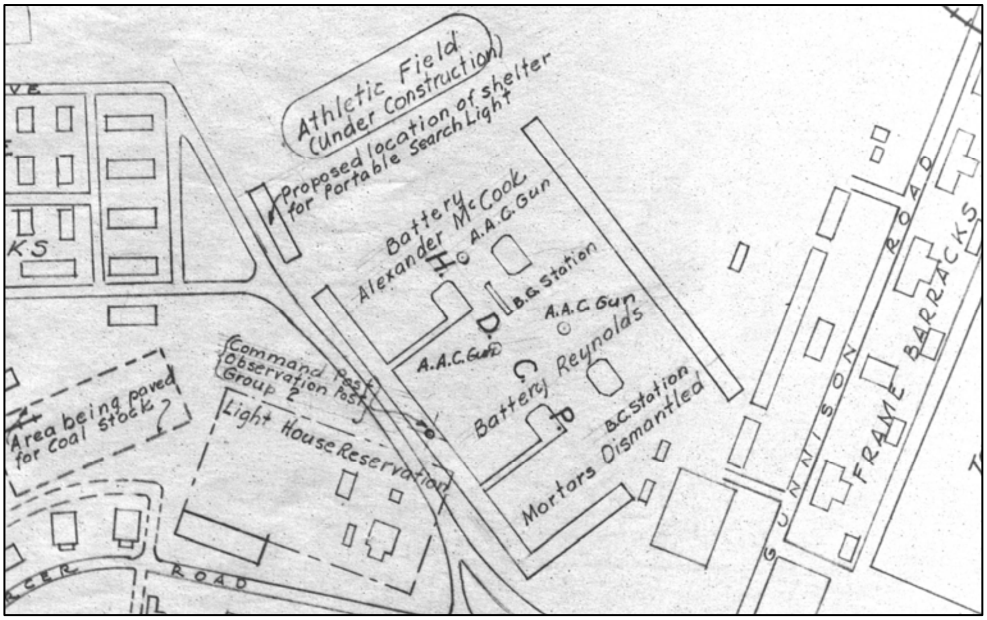


Figure 163. Detail from map of Sandy Hook, N.J. during World War II, showing Mortar Battery and surrounding structures.

Figure 164. Antiaircraft gun mounted on the top of the Mortar Battery. Lt. Brian P. Emerson, 245th Coast Artillery, instructs on the working of a 3-inch antiaircraft gun, ca. 1942. Note also the .50-caliber machine-gun emplacement on hill in background.

CURRENT PHYSICAL DESCRIPTION

Introduction

The following physical description of the Mortar Battery is meant to augment the descriptions in the preceding sections "Original Appearance" and "Alterations." Much of the existing material appears to be original, and so has been described previously. The addition of the telephone booths and battery commander stations, and the alterations related to the switchboard room and the Harbor Defense Control Post (HDCP), were also discussed in the section "Alterations." Those descriptions should be considered as part of the current physical description, and will not be reiterated here.

Plans of the Mortar Battery with battery and mortar pit designations (fig. 110) and plans with room numbers (figs. 133 -135) that were included in previous sections provide references to the gun pits, galleries, and interior rooms of the battery. The photographs included with this section are intended to illustrate the current physical description. This report does not include a condition assessment, but many of the following descriptions will note existing conditions as part of the existing physical characteristics. A separate report, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*, includes a section on existing conditions at the Mortar Battery.[1] It should be noted that the current condition, as documented in many of the photographs included with this report, is poor. The interior rooms of the battery retain asbestos soundproofing that is in a deteriorated condition. Due to the hazards associated with the deteriorated asbestos, the interior rooms of the battery were only toured during the initial site visit. Nevertheless, many of the extant elements of the Mortar Battery are significant and can be stabilized.

Mortar Battery – Exterior Elements

Counterscarp Walls

As previously described, sections of the counterscarp wall were demolished in 1938. The sections of the counterscarp wall still intact include the west wall, a portion of the south wall, and the southwest gallery. On the exterior of the counterscarp, the west wall is the most prominent (fig. 165). The sand and vegetation that once covered the exterior of the counterscarp wall has either eroded or been removed, exposing the stepped concrete

[1] Einhorn, Yaffee, Prescott, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery, Sandy Hook Unit, Gateway NRA, New Jersey* (May 2005), section 2, pp. 1-2 and 5.

structure of the wall. The massive concrete walls rise approximately 15 feet above grade to a flat ledge. In the southwest corner the wall is thicker at the ground level, and 5 feet higher, to reinforce and protect the counterscarp gallery. The opening in the west wall that was cut through in the 1930s is now the primary visitor access to the battery. The exterior concrete of the counterscarp appears to be in good condition, with some cracking and vegetation growing along the wall. At the southwest corner where the concrete wall is thicker, there is evidence of spalling. In addition, vegetation is especially dense along the south wall.

The interior walls of the extant sections of counterscarp retain their original configuration (fig. 166). The concrete walls rise straight up to the top of the counterscarp, and are covered with a concrete parge coat. The top of the wall is sloped up to the higher level near the southwest corner. At the southwest corner, the walls are pierced with round ventilation holes and the gun ports of the counterscarp gallery. The arched doorway to the counterscarp gallery is located on the south interior wall of the counterscarp. Beyond this point, the counterscarp wall was demolished, and the area is not accessible.

There is vegetative growth at the base of the wall and against the wall, as well as vine growth on the wall. The concrete parge coat is spalling in many areas, and efflorescence was evident. Overall, the extant counterscarp walls appear to be stable and well-preserved.

Counterscarp Galleries

The northeast counterscarp gallery was demolished in 1938, along with the adjacent sections of the counterscarp wall. The southwest counterscarp gallery is extant and retains its original configuration. The gallery is accessed from the perimeter ditch through an arched doorway. The doorway has an arched wooden door, which is clad with an exterior steel plate and has two gun loops (fig. 167). The door is hung from two large strap hinges and pintles set in the concrete jamb of the doorway.

The interior of the counterscarp gallery is a series of four 10-foot-square arched rooms. The rooms are connected by 4-foot-wide corridors. The two rooms at the corner of the gallery are connected by a wider angled corridor, which essentially forms one large trapezoidal room. The floors of the gallery are concrete. The vertical concrete walls are 5 feet high; they support the arched ceilings, which span 10 feet and are 3 feet high. The walls and ceilings appear to be parged with concrete and finished with paint. Each room has an arched alcove retaining the mounting shelf, gun port, and embrasure for the machine gun mount formerly here (fig. 168). The frame for the vertical steel shutter that once protected each gun port is still in place, but the shutters are missing.

Overall, the counterscarp gallery appears to be stable, but some deteriorated conditions were noted. The grade at the entry doorway is too high, allowing water to flow into the corridor. The wooden and steel elements of the door are deteriorated and should be repaired. The interior of the gallery is damp, with standing water on the floor. The parging and finishes on the walls and ceilings are deteriorated.

Perimeter Ditch

The sections of the perimeter ditch that are still accessible are those along the extant counterscarp wall (fig. 110). The extant perimeter ditch extends along the west side of the battery, and terminates at the northwest and southwest corners. The pathway is about 8 feet wide and is paved with sand and gravel. The superior slopes of the Mortar Battery begin along the east side of the ditch and extend to the top of the battery. The entrance galleries for both Battery McCook and Battery Reynolds are also located on the east side of the ditch. There are manhole covers for access to the original drainage system along the pathway. At the southwest corner in front of the counterscarp gallery, the open drainage system originally installed by the Engineers has filled with sand and vegetation.

This section of the perimeter ditch has been left open for visitor access. The gravel pathway is well-defined, but vegetation is encroaching on both sides. Other sections of the original perimeter ditch were overgrown and not accessible.

Sand Cover

The sand cover has deteriorated over time. The sand that covered the extant section of the counterscarp wall has completely eroded (fig. 165). The sand covering the interior portions of the battery has remained more stable, but has suffered some erosion. The embankments above the perimeter ditch are overgrown with vegetation and practically inaccessible (figs. 169 and 171). Most of the sand on the superior slope remains intact, but densely overgrown.

Mortar Battery – Interior Elements

Overview

The interior spaces of the Mortar Battery retain the overall original configuration and alterations previously described. Unless otherwise noted, the galleries, storage rooms, and magazines retain the original concrete floors, walls, and arched ceilings that were part of the original structure. The removal of the armament and the addition of tile, brick, and wooden partitions to the interior of the battery created more rooms and changed the character of the structure. As a communications and command post, the interior of the battery was no longer designated as Batteries Reynolds and McCook, but rather as the Harbor Defense Command Post, which functioned as a single unit.

The overall condition of the interior spaces appears to be stable, but some of the added materials are deteriorated; their physical integrity is questionable, and most of the finishes are degraded. Large sections of the extant ductwork are corroded and have fallen from the ceilings. The asbestos that covers the arched ceilings throughout the interior creates a hazardous environment. These conditions make the interior spaces of the battery inaccessible to the public. However, the rehabilitation of the Mortar Battery and removal of safety hazards could lead to limited access to these rooms. These issues are addressed in the subsequent section "Recommendations."

North End (Battery Alexander McCook)

North Entrance Gallery

The north entrance gallery (room 101) is 10 feet wide, and extends from the perimeter ditch to the northwest pit (fig. 169). The floor of the gallery is concrete, and it has a set of railroad tracks that run into the mortar pit and the battery. The walls are vertical and of concrete. At the beginning of the entrance, the walls are ramped from grade to 10 feet above grade. The walls continue at 10 feet above grade through the rest of the gallery. Above the 10-foot line, the concrete is sloped up toward the top of the battery. The north side of the wall has three small concrete hoods set about 8 feet above grade, which are remnants of earlier light fixtures (fig. 170). A doorway to the former dynamo room (room 102) is located on the north wall at the east end of the entrance gallery. On the south side of the wall, steps were cut into the concrete to access the telephone booth that spans the east end of the gallery. The steps are deteriorated, and are closed off by metal grating added by the NPS in 2003.

Dynamo Room

This space, designated room 102, is located on the north side of the north entrance gallery (room 101). It was originally labeled "Dynamo," and so would have housed the electrical plant for the battery. The doorway to room 102 has a cast-iron gate, but no other door is extant. The room is 10 feet wide by 14 feet long, with concrete floors and walls. Typical of the battery, the room has an arched concrete ceiling.

Northwest Mortar Pit

The northwest pit (room 103) retains its original configuration (fig. 171). The mortar pit is a D-shaped, open concrete structure that measures 40 feet wide by 60 feet long. It is typical of the four gun pits at the Mortar Battery.

The floor of the mortar pit is covered with concrete that is broken and cracked. Vegetation grows between the cracks and in areas where the concrete is missing. The outlines of the bases for the four mortar platforms are still discernible in the concrete floor.

The walls of the mortar pit rise 10 feet above grade and are curved at the north end to form the D-shape of the pit. The pit is accessed from the entrance gallery on the west side, and has an arched doorway on the east side to the transverse gallery and the interior of the battery. The curved corners of the pit have rounded indentations in the wall that were apparently made to allow room for the muzzles of the two front mortars when in the horizontal (loading) position (fig. 172). Though these indentations were not part of the original specifications for the battery, they were likely created soon after the guns were in place. Documentation on the installation of the guns did note that they were installed off-center, and this may have been the reason for slightly carving out the walls (see the previous section "Original Appearance, North End, Mortar Pits"). The vertical walls of the mortar pit are cracked and spalling. There is evidence of efflorescence, and vegetation is growing against and on the walls.

The concrete walls of the pit transition to an angled blast slope. The blast slope was also constructed with concrete, and follows the D-shaped configuration of the pit. The lower sections of the slope appear to have had a concrete parging, which has spalled off in some places. The stratification of the layers of concrete is clearly visible on the upper portions of the blast slopes. There is evidence of cracking and spalling on the blast slopes, as well as vegetation. However, the overall mass of the slopes appears to be stable.

The superior slope of the battery continues beyond the blast slope to the top of the battery. That slope was originally covered with sod to control erosion. The sand and earth slopes are currently covered with grasses and dense vegetation.

Likewise, the top of the battery is now covered with grasses and dense vegetation. There are remnants of pathways lined with a post-and-cable safety railing for visitor access. The pathways are currently closed to the public; the post-and-cable railing is in disrepair, and would not provide adequate safety for visitors.

North Transverse Gallery

The north transverse gallery (room 108) is accessed via an arched doorway (fig. 174) in the east side of the northwest pit. This original doorway was altered twice. When the gallery was widened in 1907-08, a steel door was hung from rollers on a rail above the doorway. Later, when the north air lock (room 104) was built in the west end of the transverse gallery, a smaller doorway was cut through the rolling door. This was fitted with a hinged steel door, and became the entry doorway to the north air lock.

Proceeding into the north air lock, the brick walls that were erected to create the airtight room are intact. The east doorway of the air lock is also equipped with the gas-proof door installed in the 1940s.

East of the air lock along the north wall of the transverse gallery are the latrines for the enlisted men and the officers (rooms 105a, 105b, and 106). These rooms are separated by wooden partitions. Some of the bathroom fixtures are intact, but most are broken.

At the midpoint of the transverse gallery, where it is intersected by the main longitudinal gallery of the battery, is room 107. This space was constructed in the north or outside wall as a "Firing Alcove"; it served as a storage battery room in the 1920s through 1940s. The tile wall that partitioned the room from the transverse gallery is still intact. The doorway to the room is centered on the tile wall. The concrete floor of room 107 has two raised concrete pads that were used as bases for the storage batteries.

Beyond the midpoint, the transverse gallery leads to the generator room (room 109) for the 1944 ventilation system. The generator room occupies the east end of the transverse gallery, and extends into the southwest corner of the northeast mortar pit. A brick partition separates the corridor from the generator room. The doorway to the generator room is equipped with a steel gas-proof door. The ductwork for the ventilation system runs above the doorway. As previously described, the portion of the room that extends into the pit has concrete walls and a flat concrete ceiling. Rusted pieces of pipe and ductwork hang from the ceiling of the generator room.

Also part of the structure in the southwest corner of the northeast mortar pit is an L-shaped corridor and former boiler room (room 110). The floors of these rooms are concrete, and the walls and flat ceilings consist of reinforced concrete.

Northeast Mortar Pit

The northeast mortar pit (room 111) is accessed from the transverse gallery through the concrete generator room and boiler room built in the pit's southwest corner circa 1944. As previously described, all of the mortar pits were constructed with the same configuration. The northeast pit retains its basic D-shape, but a large amount of sand has accumulated on the floor, and the pit is completely overgrown. The walls and blast slopes of the mortar pit are also overgrown. Overall, the concrete shows typical signs of deterioration, but appears to be relatively stable.

The alterations to the pit are still evident. On the south wall of the pit, the concrete stairway to the telephone booth is extant; it includes sections of a pipe railing. The stairway is falling apart, and the bottom steps are missing. The reinforced-concrete structure that housed the ca.-1944 boiler room and generator room occupies the southwest corner of the mortar pit. That structure is overgrown with vines and other vegetation. The walls of the structure appear to be stable, but the roof may not be sound.

North Longitudinal Gallery

The north longitudinal gallery (room 112) is a 15-foot-wide arched corridor (fig. 175). Although the room was adapted for use as a switchboard room, it still retains the original configuration of the longitudinal gallery that serviced Battery McCook. The original concrete walls and arched ceiling remain intact, with some later alterations still in place. The hollow tile partitions erected at either end of the gallery for the switchboard room are also intact (fig. 176). Large ducts that were part of the 1944 ventilation system still hang from the ceiling, and the asbestos soundproofing that was sprayed on the arched ceiling and ductwork is also extant. However, the ductwork and its asbestos covering are severely deteriorated, and large sections of both are falling from the ceiling. The condition of the asbestos on the ductwork and the ceiling create a hazardous environment in the room.

West Storage Rooms and Magazine

A doorway at the south end of room 112 leads to an L-shaped room (room 113). This room is formed by a short section of the longitudinal gallery, and an adjacent storage area to its west (fig. 177). The walls and ceilings of the room are formed by the concrete structure of the battery. The gallery section has a partition at its south end with a doorway that leads to the centermost section of the longitudinal gallery (room 119). The partition was wood-framed and paneled. There are remnants of the tile flooring that was installed over the concrete floor when the battery served as the HDCP in the 1940s.

Proceeding into the original west magazine area, the first space encountered is the L-shaped room 114. Its original function appears to have been to connect the magazine with a storage room. It was labeled as S-1 in the 1944 plans of the battery; according to Ed Biedermann, S-1 referred to Intelligence operations.[2] The walls and ceiling are concrete; doorways in the room lead to the magazine and a storage room.

The west magazine area of the battery was subdivided into three rooms ca. 1942 (rooms 115-117). Partitions were wood-framed with paneling. The rooms were used as the offices of the commanders at the HDCP. Each room retains the concrete walls and barrel-vaulted concrete ceiling of the original design.

The former storage room (room 118) was also used by the officers of the HDCP. The room has the concrete walls and vaulted concrete ceiling characteristic of the original construction. An east doorway leads to the south end of the longitudinal gallery of the battery.

The center section of the battery's longitudinal gallery was partitioned off at either end to create a room at the center of the battery (room 119). This room retains the concrete side walls and vaulted ceiling of the original structure. Moreover, this section of the longitudinal gallery was not widened during the 1907-08 alterations to the battery, and so retains the original 10-foot width of the gallery. The end partitions, installed ca. 1942, are wood-framed with paneling.

South End (Battery John F. Reynolds)

South Entrance Gallery

The south end of the Mortar Battery is very similar to the north end. Like the north entrance gallery (room 101), the south entrance gallery (room 135) is 10 feet wide and defined by the 10-foot-high concrete walls. Railroad tracks that once served as part of the ammunition service still run the length of the entrance gallery and continue into the southwest mortar pit. The north wall of the entrance gallery has light recesses with concrete hoods and remnants of the light fixtures. A stairway to the telephone booth is cut into the south wall of the gallery; it

[2] Interview with Ed Biedermann, Technical Sergeant stationed at Fort Hancock 1940 – 1945; July 4, 1981.

is closed off with metal grating. The telephone booth overlooking the southwest mortar pit spans the east end of the entrance gallery.

Southwest Mortar Pit

The southwest mortar pit (room 134) was designed and constructed in the same manner as the other mortar pits (fig. 173). The floor of the pit is concrete, and the former locations of the four mortars are evident. The concrete floor is cracked and broken, but appears to be stable. The concrete walls form the D-shape characteristic of the Mortar Battery, and they transition to the blast slopes, which in turn lead to the superior slope and the top of the battery. The concrete walls and slopes of the southwest mortar pit exhibit signs of efflorescence, cracking, and spalling, but appear to be stable. Some vegetation was present in this mortar pit, but it appears that greater efforts have been made to control the growth here.

South Transverse Gallery

With the exception of the south air lock that juts into the gallery, the south transverse gallery (room 131) retains the form and character of the original structure. The floors are concrete, and the rails of the ammunition service are extant in the center of the gallery. The concrete walls and vaulted ceilings are intact, as is the “firing recess” (room 133) on the south wall of the gallery. At its east end the transverse gallery leads to the southeast mortar pit, and at its west end it leads to the southwest mortar pit. The arched doorway at the west end retains its sliding steel door, which has a smaller hinged door cut into it.

Southeast Mortar Pit

The southeast mortar pit (room 132) retains the concrete D-shape typical of the mortar pits at this emplacement. The pit is accessed through an arched doorway from the transverse gallery of Battery Reynolds. The pit resembles the northeast pit in design, construction, and overall condition. The floor of the southeast pit is covered with sand and dense vegetation. The concrete walls and slopes of the pit are also overgrown.

The only major alteration to the southeast pit since original construction was the addition of the telephone booth, which is extant. The booth was constructed over the southwest corner of the pit. A concrete stairway was constructed along the south wall of the pit to provide access between the pit and the telephone booth. The stairway is also extant, but in poor condition.

South Longitudinal Gallery

The longitudinal gallery continues south of room 124. In 1944, four rooms (rooms 125, 127, 128, and 129) were built along the east wall of this gallery, leaving a long narrow corridor (room 126, fig. 179). Room 125 is accessed from a doorway at the south end of room 124; the other three rooms (127, 128, and 129) are accessed from the corridor. The concrete floors in these rooms have remnants of the tile floor installed in the 1940s. The concrete structure of the longitudinal gallery forms the outside walls and vaulted ceilings of these rooms. The partition walls are constructed with either hollow tile (rooms125, 127, and 129), or are wood-framed with paneling (room 128). A 12-inch-thick brick partition separates rooms 128 and 129. A doorway at the south end of the corridor leads to the south air lock.

The south air lock (room 130) is located at the intersection of the longitudinal gallery and the south transverse gallery (fig. 180). The air lock is a small rectangular room with concrete floors and brick walls. The walls extend up to the vaulted concrete ceiling of the transverse gallery. The south air lock has two doorways that are equipped with gas-proof doors. The doorway on the west wall of the room leads to the south transverse gallery (room 131).

East Storage Rooms and Magazine

The east magazine area (rooms 120 – 124) also retains the original configuration of the concrete emplacement. The concrete floors, walls, and vaulted ceilings are intact, with few alterations or additions; the rooms convey the original purpose of the interior of the battery. The only partition on the east side of the longitudinal gallery is a masonry wall built between rooms 122 and 123. Since the partition is located at the east end of the magazine, the magazine retains the appearance of a long ammunition-storage corridor (fig. 178).

Like room 113, room 124 is an L-shaped space formed by a short section of the longitudinal gallery and a former storage area east of the gallery. In the 1944 plans, room 124 was partitioned into two rooms. The storage area was used as a radio room, and the short section of the longitudinal gallery was a corridor. The partition was later removed, and the current configuration forms a corridor (room 124).

Telephone Booths

All four telephone booths of the Mortar Battery (rooms 201 – 204) are intact. The booths are rectangular structures constructed of reinforced concrete. As previously explained, the booths were built on concrete platforms positioned at the southwest corners of each mortar pit. The floors, walls, and ceilings are all of concrete, and three small windows pierce the northeast corner of each booth. The windows were constructed with embrasures that allowed the observers a clear view of the mortar pit. Each booth had a single doorway on the west wall, but the sliding doors here are no longer extant.

The telephone booths for the two west mortar pits (rooms 201 and 204) were built over the inner ends of the two entrance galleries here (figs. 181-182). The platforms of the structures are supported by concrete arches that span the entrance gallery (fig. 183). The telephone booths for the east pits (rooms 202 and 203) were constructed over the southwest corner of each pit and supported by arches that spanned that corner of the pit (fig. 184). The positioning of rooms 202 and 203 required that the northeast corner of each booth be "clipped."

Overall, the telephone booths appear to be stable structures. There is evidence of spalling, and some of the metal reinforcing material is exposed. This was especially evident on the underside of the supporting platforms. The pipe railings that extended around the perimeter of the booth platforms are corroded and missing sections, and access to the booths is limited.

As described previously, the booths are linked to the mortar pits via concrete stairways that are in varying states of deterioration. There are also stairways leading from the booths to the top of the battery. These stairways are extant, but are deteriorated and overgrown.

Battery Commander Stations

The battery commander stations are extant at the Mortar Battery. The rectangular structures are located on the top of the battery, and originally had a clear view of the mortar pits that they commanded and the Atlantic Ocean. The top of the Mortar Battery is now heavily vegetated, and the views from the battery commander stations are obstructed. The south battery commander station has less vegetation surrounding it, and is more accessible than the north station (fig. 185).

Both battery commander stations are rectangular structures of reinforced concrete. The foundations are poured concrete and have no finishing detail. The foundation of the south station is exposed, while the foundation of the north station remains below grade. The exterior concrete walls of the structures are scored with horizontal v-grooves every 6 inches. The roofs are constructed of concrete and have a shallow-pitched hip profile. The interior floors, walls, and ceilings are exposed, unfinished concrete. The instrument pedestals are extant at the north end of the buildings, but are rusted. The windows and doorways are in their original locations; the tilt sashes and sliding steel doors are not in place, but the door for the south booth is resting against the back of the structure. The extant steel used in the construction of the windows, including the plate at the lintel and the corner supports, is corroded, as is the extant steel at the doorway. The original woodwork that was associated with the doorways and windows is no longer extant.

Overall, the battery commander stations appear to be in stable condition. However, there is some minor spalling and evidence of some larger cracks. The west elevation of the south station exhibits a significant crack and some minor spalling. The crack starts at the top corner of the window and continues to the roof. The roof structure is also cracked at this location. There is some rust staining on both the exterior and interior concrete surfaces. Additionally, it should be noted that the 1990 *Stabilization Investigations* noted that "the later additions (1907) are more in danger of failure."[3] This is due in part to the exposed location of the booths, to the thin nature of the concrete, and the means of construction, which apparently used insufficient concrete covering for the reinforcing materials.[4]

[3] Todd Rutenbeck, *Stabilization Investigations, Historic Concrete Batteries, Fort Hancock, Sandy Hook Unit, Gateway NRA, New Jersey* (Denver, CO: Bureau of Reclamation, June 1990), p. 18.
[4] Rutenbeck, *Stabilization Investigations*, p. 18.

Figure 165. Mortar Battery, exterior view of west side of counterscarp wall, 2006.

Figure 166. Mortar Battery, view of counterscarp wall interior and southwest counterscarp gallery, 2006.

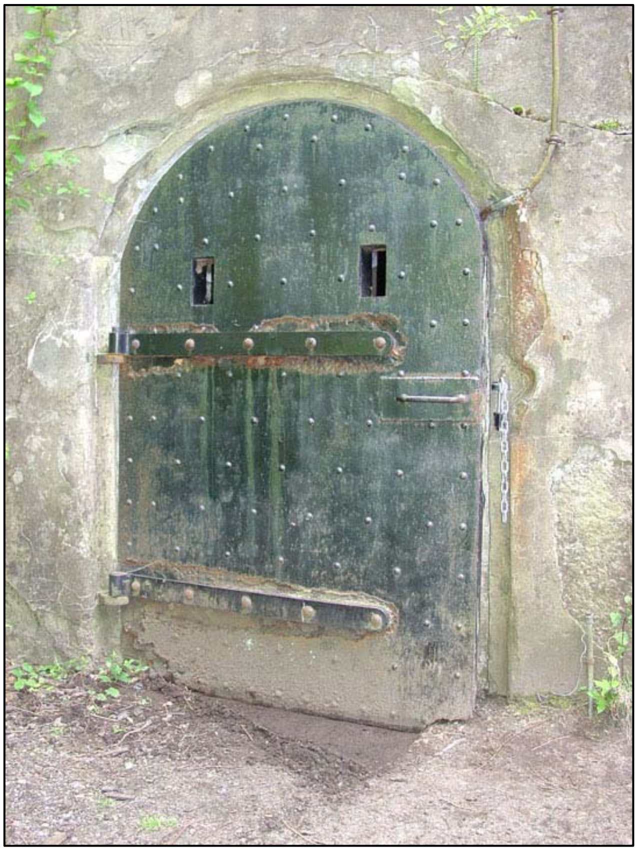


Figure 167. Mortar Battery, exterior doorway to southwest counterscarp gallery, 2006.

Figure 168. Mortar Battery, interior view of gun port embrasure in southwest counterscarp gallery, 2006.

Figure 169. Mortar Battery, entrance gallery to southwest mortar pit, Battery Reynolds, 2006.

Figure 170. Mortar Battery, extant light fixture in entrance gallery to southwest mortar pit, 2006.

Figure 171. Mortar Battery, view of northwest mortar pit from top of battery, 2006.

Figure 172. Mortar Battery, section of wall in mortar pit with rounded indentation to allow for swing of gun barrel, 2006.

Figure 173. Mortar Battery, view of southwest mortar pit from top of battery, 2006.

Figure 174. Mortar Battery, doorway and altered steel door from southwest mortar pit to transverse gallery, 2006.

Figure 175. Mortar Battery, within Battery McCook, north end of longitudinal gallery (room 112), 2006.

Figure 176. Mortar Battery, within Battery McCook, hollow-tile partition wall at north end of longitudinal gallery (room 112), 2006.

Figure 177. Mortar Battery, within Battery McCook, corridor and storage area (room 113), 2006.

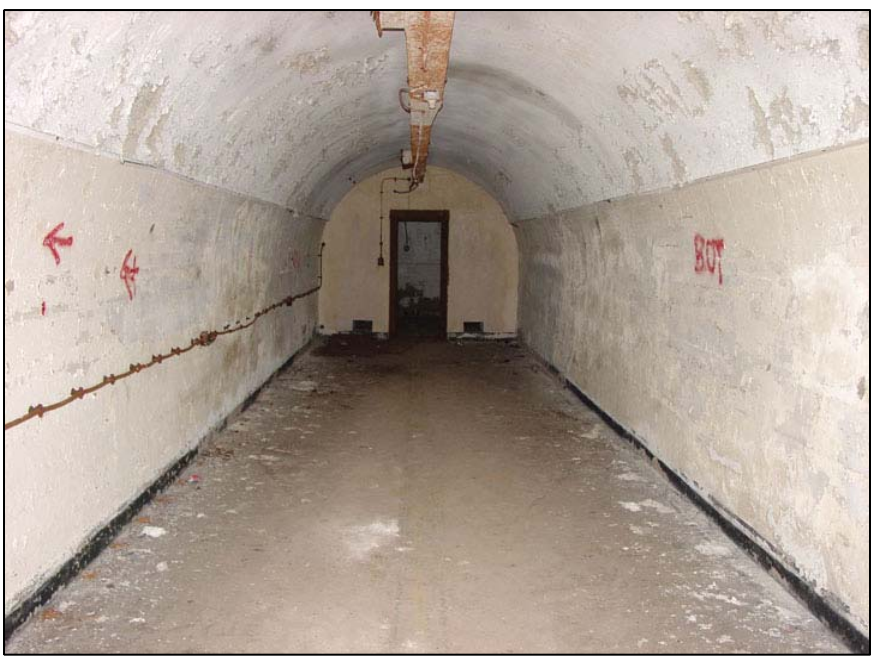


Figure 178. Mortar Battery, within Battery Reynolds, east magazine (room 122), 2006.

Figure 179. Mortar Battery, within Battery Reynolds, south end of longitudinal gallery (room 126), 2006.

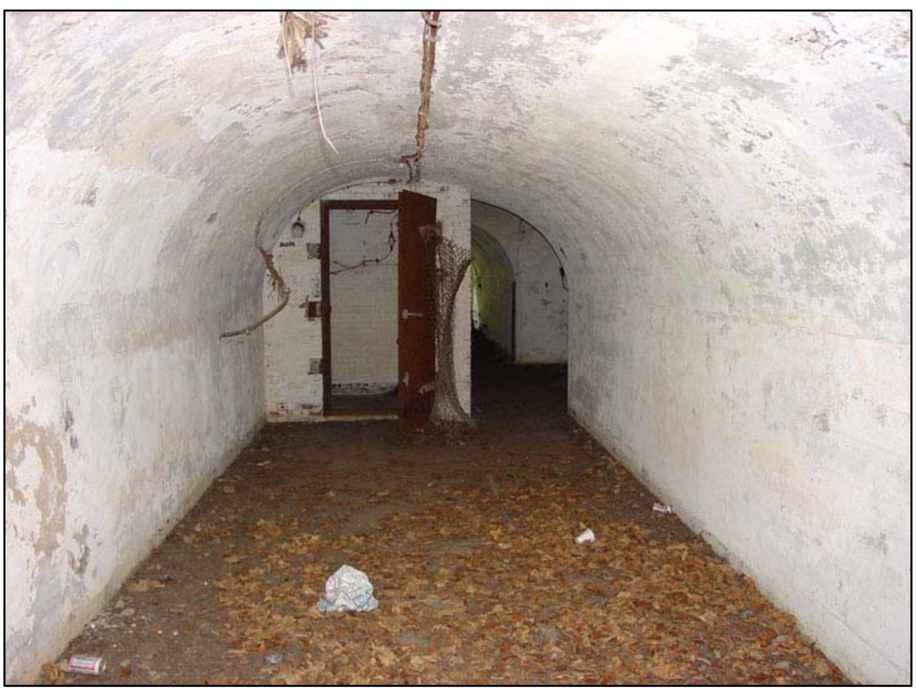


Figure 180. Mortar Battery, within Battery Reynolds, west end of transverse gallery (room 131) and south air lock (room 130), 2006.

Figure 181. Mortar Battery, telephone booth at southwest mortar pit, Battery Reynolds, 2006.

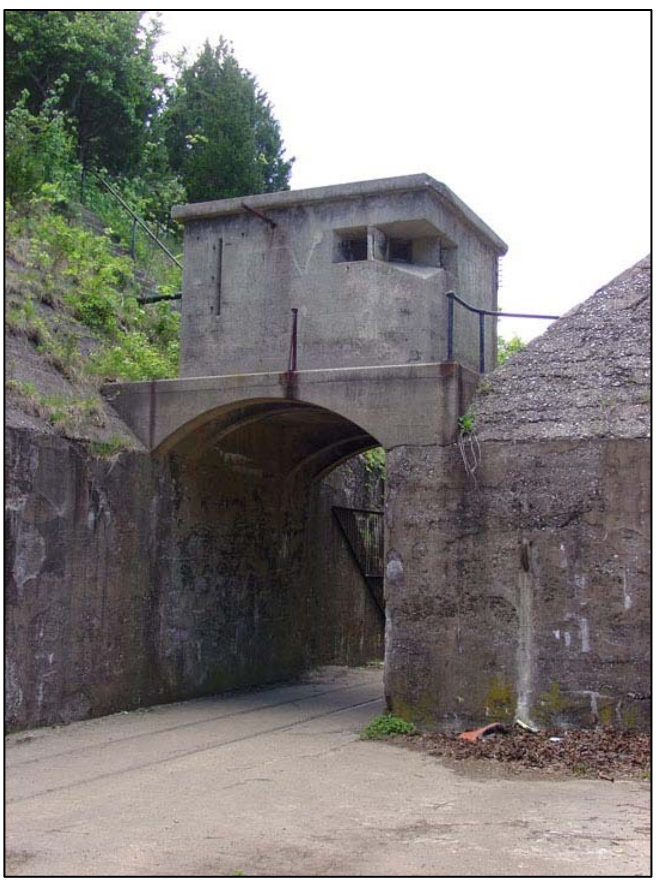


Figure 182. Mortar Battery, telephone booth at southwest mortar pit, Battery Reynolds, 2006.

Figure 183. Mortar Battery, supporting arches of telephone booth at southwest mortar pit, Battery Reynolds, 2006.

Figure 184. Mortar Battery, telephone booth at southeast mortar pit, Battery Reynolds, 2006.

Figure 185. Mortar Battery, battery commander station for Battery Reynolds, located on top of superior slope at south end of battery, 2006.

DEVELOPMENTAL HISTORY:

BATTERY JOHN GUNNISON

CHRONOLOGY OF DEVELOPMENT AND USE

Introduction

Emplacements constructed during the latter part of the Endicott System included smaller-caliber rapid-fire batteries.[1] When it was completed in 1905, Battery John Gunnison was Fort Hancock's smallest-caliber disappearing gun battery. It was also one of the last Endicott System emplacements constructed on Sandy Hook. The subsequent sections on the development and use of Battery Gunnison discuss the history of the structure from planning and construction to present condition. Some information relevant to Sandy Hook and Fort Hancock was included in the section on historical context, and will not be repeated in the same detail in this section. Research for this report uncovered some primary source materials regarding the development and use of Battery Gunnison. Previous reports by Edwin Bearss were also relied upon for information about the battery. The reader may want to refer to Mr. Bearss' reports for additional information and details.

Battery Gunnison – Construction

The initial attempts to construct a 6-inch disappearing gun emplacement on Sandy Hook southeast of the existing Endicott System batteries – the eventual location of Battery Gunnison – were thwarted by the Ordnance Department. Brig. Gen. John M. Wilson, Chief of Engineers, had approved the construction of two 6-inch rapid-fire guns at Fort Hancock on April 25, 1898, and $16,000 was allotted from the appropriation for "National Defense" for the construction of the emplacements. Upon approval of the plans for the battery by Chief Engineer Wilson, work had begun on the emplacement in July 1898. However, the location of the 6-inch battery interfered with operations at the Sandy Hook Proving Ground, and work was temporarily stopped in August. When the project resumed near the end of that month, the Ordnance Department complained once again, and the project was finally shut down on August 30, 1898.[2]

---

[1] Edwin C. Bearss, *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, September 1983), p. 308.

[2] Bearss, *The Sandy Hook Defenses*, p. 336.

Though Brig. Gen. Wilson subsequently reallocated the original funding for the construction of the 6-inch emplacement,[3] the project was not completely abandoned. Major William Marshall was informed in November 1902 that funds had been appropriated that year for the construction of two 6-inch rifles on disappearing carriages at Fort Hancock. The letter from Major Abbot noted that personnel at Fort Hancock should proceed with selection of the site. A provisional allotment of $36,000 had been made for the construction of the emplacements, but no expenditures were to be made without the authority of the Chief of Engineers.[4] This correspondence began the next phase of planning for the construction of the 6-inch rapid-fire battery that would become Battery Gunnison.[5]

The search for a site for the 6-inch emplacement commenced in 1903, and one was chosen, but on June 25 Assistant Engineer Hurlbut informed Major Marshall that it was too near the proving ground's powder magazine (fig. 186). Hurlbut did indicate that a new area south of the unsuitable site would be surveyed, and by the end of June a new site had been chosen (fig. 187).[6]

Planning for the 6-inch emplacement progressed, and on August 2, 1903, Major Marshall forwarded plans and some specifics about the battery to Chief of Engineers George L. Gillespie. Marshall's correspondence noted that the 6-inch rapid fire guns would be mounted on Model 1903 disappearing carriages. Major Marshall noted the following details regarding the location of the emplacements:

> The location recommended commands the southern approach to Fort Hancock, and is about 125 yards southeasterly from the site indicated for 4 six-inch guns in the approved project for defense. This modification is made to avoid interference with a powder magazine of the Ordnance Department.
>
> The site is on the reservation of the Sandy Hook Proving Ground.[7]

Major Marshall estimated the cost of the two 6-inch rapid-fire gun battery to be $45,000, which he noted was high because the cost of clearing the remote site and extending the railroad to the site. The blueprints forwarded under separate cover included plans for the construction railroad spur, as well as a plan showing the fields of fire of the guns.[8]

---

[3] Bearss, *The Sandy Hook Defenses*, p. 336.

[4] Major Abbot, by order of Acting Chief of Engineers, to Marshall, through Col. Mansfield, Div. Engineer, Eastern Division, Nov. 15, 1902; file 96, enclosure 1, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[5] Though previous reports did not cite this fact, Battery Gunnison was the only 6-inch emplacement on disappearing carriages being planned at Fort Hancock in 1902 – 1903. In addition, this letter was filed with other correspondence relating to Battery Gunnison. For those reasons, it was determined that the 6-inch emplacements referenced in the letter were those eventually constructed for Battery Gunnison.

[6] Hurlbut to Marshall, June 25 and 30, 1903; file 96, enclosures 4 and 5, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[7] Marshall to Gillespie, August 2, 1903; file 96, with enclosure 1, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[8] Marshall to Gillespie, August 2, 1903.

Chief Engineer Gillespie notified Marshall on September 14, 1903, that $45,000 had been allotted from the "Gun and Mortar Batteries" appropriation, Act of March 3, 1903, for the construction of the 6-inch emplacements.[9] Four days later, Marshall informed Hurlbut that he was to proceed with the construction of the battery with the available funds.[10]

The final site of the 6-inch gun emplacements was 1,600 feet southeast of the Mortar Battery (fig. 187).[11] However, communications between now-Lt. Col. Marshall and Asst. Eng. Hurlbut in September 1903 suggest that the exact location for the emplacements had not been determined, and that there remained some difficulty in situating the battery so close to the Sandy Hook Proving Ground. While staking out the site on September 25, Hurlbut determined that the north gun would be 100 feet from the railroad tracks that ran along the eastern shoreline of Sandy Hook. He felt that the battery should be moved back 50 to 60 feet, but was apparently overruled by Lt. Col. Marshall. Review of the maps of the area and the siting near both the proving ground and the powder magazine may have made it impractical to move the battery to the location desired by Hurlbut. As of September 29, 1903, the north gun was located 100 feet from the railroad tracks, and the south gun was located 130 feet from the tracks.[12] At that time, Asst. Eng. Hurlbut felt that it would be necessary to build a traverse to protect the new work from the firing at the proving ground.[13]

Work on the battery during the latter part of 1903 included the extension of the railroad 2,100 feet for construction of the emplacements, and the clearing of the site. In March 1904 the plant for the construction of the battery was positioned, and construction began on the emplacements soon thereafter. The battery was constructed with a south emplacement (no. 1) and a north emplacement (no. 2) that were connected by a traverse, as recommended by Asst. Eng. Hurlbut. The traverse contained rooms for personnel and storage of equipment and ammunition.

The traverse of the battery and the parapet walls of the emplacements were protected by sand embankments. The sand embankments were constructed on the east/front side of the battery and the north and south flanking elevations. The sand fill extended over the roof of the traverse where it was 3 to 4 feet thick. The embankment sloped toward the east and flanking sides down to grade approximately 50 feet from the crest of the slope. The sand embankment was placed during the construction of the battery, and was an important part of the battery's defenses.

As construction of the battery progressed, it became apparent that the cost of construction had been underestimated, and that an additional $20,000 would be needed to complete the project. Upon Lt. Col. Marshall's request for that amount on June 23, 1904, Chief of Engineers Mackenzie allotted funds, and work on the battery continued.[14]

---

[9] Gillespie to Marshall, Sept. 14, 1903; file 96, enclosure 3, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA Northeast Region (NYC).

[10] Marshall to Hurlbut, Sept. 18, 1903; Vol. III, p. 57; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).

[11] Bearss, *The Sandy Hook Defenses*, p. 338.

[12] Hurlbut to Marshall, Sept. 25 and 29, 1903; file 96, enclosures 10 and 11, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[13] Hurlbut to Marshall, Sept. 25 and 29, 1903.

[14] Bearss, *The Sandy Hook Defenses*, p. 338.

By a General Order issued by the War Department on December 27, 1904, the 6-inch rapid-fire gun battery was named Battery Gunnison, in honor of John W. Gunnison.[15] Gunnison was from Goshen, New Hampshire, and graduated second in his class from the U.S. Military Academy at West Point, class of 1837. John Gunnison enjoyed a successful career in the military, eventually earning the rank of captain in 1853. In May of that year, Capt. Gunnison was put in charge of an expedition with the mission of surveying a central route for a railroad to the Pacific Coast. At Sevier Lake in Utah Territory, Gunnison had divided his party in order to expedite the survey. On the morning of October 26, 1853, Gunnison and seven of his survey party were killed by Pahvant Utes seeking vengeance for the slaying of one of their chiefs. It was initially thought that the Utes were acting under the direction of the Mormons, but that was later proven untrue.[16]

The documents reviewed suggest that the battery was not complete by the end of December 1904 when the first disappearing carriage for the 6-inch emplacement arrived at Sandy Hook (see the subsequent section "Armament").[17] Construction on Battery Gunnison continued through most of the following year. On November 2, 1905, Brig. Gen. Mackenzie informed the Military Secretary and the Secretary of War that the "two emplacements for 6-inch rifles on disappearing carriages, constituting Battery Gunnison, Fort Hancock, N.J." was complete and ready for transfer. On November 11, Asst. Eng. Hurlbut submitted a list of the articles to be turned over to the Artillery Corps with the two 6-inch emplacements. The list included the following:

16 Yale & Towne padlocks
43 Steam tight fixtures for electric lights
1 switch box
1 recording ampere ammeter on switchboard
1 latrine with three frost-proof water closets 2 hydrants
10 speaking tube mouth pieces
10 flexible tube mouth pieces[18]

The list noted that the latrine was turned over on a memorandum receipt. The plans of Battery Gunnison indicate that the latrine was a separate structure situated nearby. The other items transferred accounted for some of the fixtures that were installed at the battery by the Engineers. The two emplacements at Battery John Gunnison were officially transferred to the Artillery Corps on December 5, 1905.[19]

---

[15] Bearss, *The Sandy Hook Defenses*, p.339.

[16] Information on John W. Gunnison from http://en.wikipedia.org/wiki/John_W._Gunnison.

[17] Marshall to Maj. Henry Harris, Artillery Corps, Dec. 29, 1904; file 96, enclosure 18, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[18] Hurlbut to Marshall, Nov. 11, 1905; file 96, enclosure 21, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[19] Mackenzie to the Military Secretary, Nov. 2, 1905; endorsed by F.C. Ainsworth, Military Secretary, Nov. 2, 1905, and Robert S. Oliver, Acting Secretary of War, Nov. 3, 1905; final endorsement U.S. Engineering Dept., New York, Dec. 14, 1905; file 96, enclosure 19, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

Battery Gunnison – Armament

Major Henry L. Harris, Artillery Corps, Fort Hancock, N.J., notified Lt. Col. Marshall on December 29, 1904, that the first of the 6-inch disappearing carriages for the new emplacement had been received at Sandy Hook. Since the battery was incomplete, Harris was instructed to haul the L.F. Model 1903 disappearing carriage to the emplacement to await mounting.[20] In January 1905, Lt. Col. Marshall ordered Asst. Eng. Hurlbut to make railroad track and cars available to Major Harris in order to transport the carriages and guns from the wharf to the battery.[21]

However, it appears that the carriages and guns were not actually mounted until after the battery was turned over to the Artillery Corps in November 1905. The documents that transferred Battery Gunnison to the Artillery Corps at that time indicate that the transfer was of "two emplacements for 6-inch rifles on disappearing carriages,"[22] but they do not reference any armament. This suggests that the carriages and guns had not been mounted when the battery was transferred from the Corps of Engineers to the Artillery Corps.

The Fort Record Book for Fort Hancock provides further evidence that the two carriages and gun no. 1 were mounted in 1906, and that gun no. 2 was mounted in 1908, all under the supervision of the Ordnance Department. The data for Battery Gunnison confirms that emplacements no. 1 and no. 2 were received by now-Lt. Col. Harris on December 5, 1905. It further notes that the disappearing carriage for emplacement no. 1, Model 1903 L.F., serial no. 52, was mounted on February 12, 1906, under the supervision of 1st Lt. Beckham, Ordnance Department, Fort Hancock, N.J. The gun for emplacement no. 1, a 6-inch breech-loading rifle, Model 1903 O.D., serial no. 5, was mounted on the same day under the supervision of Ordnance Officer 2nd Lt. William Jones. Lt. Jones also supervised the mounting of the carriage for emplacement no. 2 in March 1906. Emplacement no. 2 was equipped with a disappearing carriage, Model 1903 D.C., serial no. 57. The Fort Record Book also documented that the 6-inch breech-loading rifle for emplacement no. 2, Model 1903 O.D., serial no. 34, was not mounted until March 14, 1908.[23] This was confirmed in a communication from Asst. Eng. Hurlbut to Lt. Col. Marshall on March 17, stating that the 6-inch disappearing gun at emplacement no. 2 was mounted (fig. 188).[24] The disappearing carriages for Battery Gunnison were manufactured by Detrick and Harvey Machine

[20] Marshall to Harris, Dec. 29, 1904; file 96, enclosure 18, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[21] Bearss, *The Sandy Hook Defenses*, p. 338.

[22] Mackenzie to the Military Secretary, Nov. 2, 1905; file 96, enclosure 19, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

[23] Fort Record Book, Fort Hancock, New Jersey, October 1924, revised Nov. 4, 1942, p. 74; Entry 224; RG 392; NARA - Northeast Region (NY).

[24] Hurlbut to Marshall, March 17, 1908; Armament, Miscellaneous; folder 20, box 35; Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY). Edwin Bearss wrote that one of the guns at Battery Gunnison was dismounted and then remounted in 1908, but the documents reviewed and the Emplacement Book suggest that 1908 was when the gun was first mounted.

Company, Baltimore, Maryland, and the 6-inch breech-loading rifles were fabricated at the U.S. Army's Watervliet Arsenal.[25]

The Emplacement Book for Battery Gunnison appears to confirm the dates noted in the Fort Record Book. The Emplacement Book records that the 6-inch gun at emplacement no. 1 was first proof-fired on April 14, 1906, and that the gun at emplacement no. 2 was first proof-fired on August 27, 1909. The Emplacement Book records active service for both of these guns until July 1942 (see the subsequent section "Alterations").[26]

[25] Fort Record Book, Fort Hancock, New Jersey, October 1924, revised Nov. 4, 1942, p. 74; Entry 224; RG 392; NARA - Northeast Region (NY).

[26] Battery Gunnison Emplacement Book; Entry 222; RG 392; NARA - Northeast Region (NY).

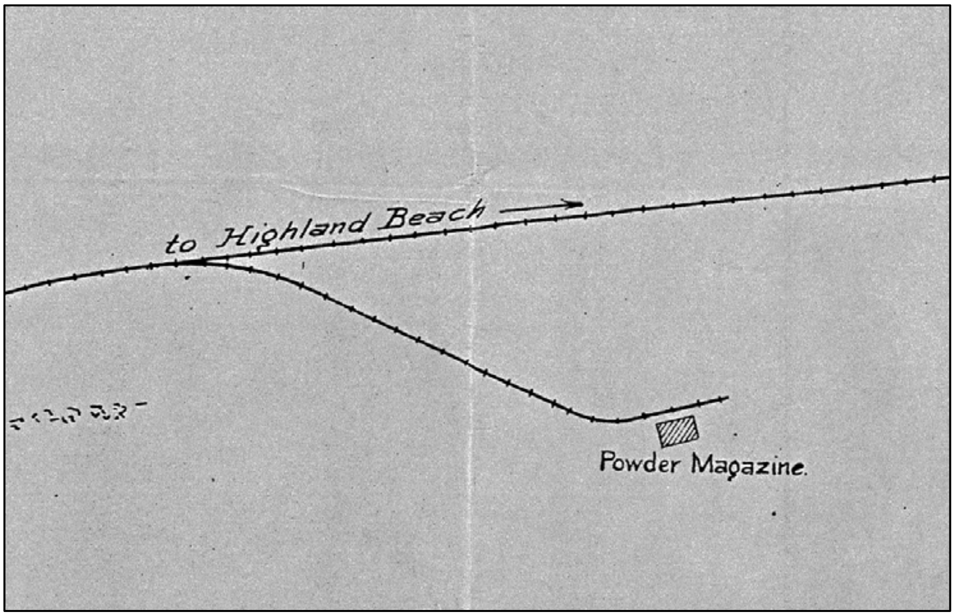


Figure 186. Detail of 1901 Sandy Hook map, depicting railroad tracks and powder magazine near future site of Battery Gunnison.

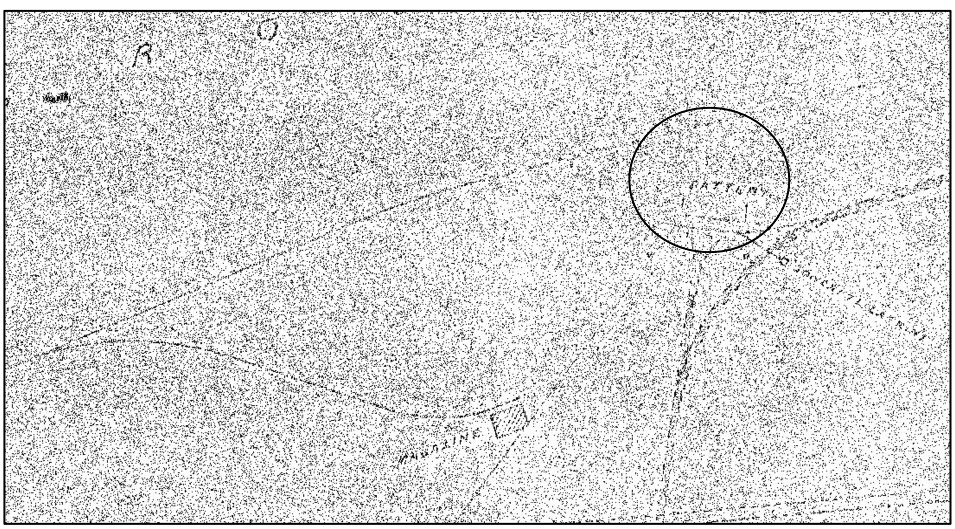


Figure 187. Detail of 1905 Sandy Hook map, depicting railroad tracks and powder magazine near Battery Gunnison (circled).

Figure 188. Battery Gunnison, north emplacement (no. 2) with 6-inch gun on disappearing carriage, August 11, 1932.

ORIGINAL APPEARANCE

Introduction

The following descriptions are based on historical documents reviewed during research and observations of existing elements. Although construction plans were not found, drawings of the drainage and electric systems from 1905 provide an original floor plan and room designations for Battery Gunnison. Also, and a blueprint for the original steel doors provides some information about original elements (figs. 189-190). These plans, along with plans from the 1940s, historic photographs, and the observation of extant materials, provided the following information on the original configuration and appearance of the battery.

Battery Gunnison – Exterior Elements

Overview

Battery John Gunnison was planned as a D-shaped concrete battery facing southeast, with 6-inch gun emplacements on the south (no. 1) and the north (no. 2) sides of the battery, and storage rooms situated between the emplacements. The battery was constructed of reinforced concrete, and portions of the battery were covered with sand. A plan of the battery depicting the drainage and electrical systems in 1905 was the only early full plan found during the research (fig. 189). The plan also depicts the layout of the battery and identifies the interior spaces, and so is considered to document the original configuration of Battery Gunnison.

The perimeter concrete walls formed the "D" configuration of Battery Gunnison. Typical of Endicott System batteries, Gunnison was designed as a partially covered battery that would blend in with the surrounding landscape. Thus, the sand and ground cover on the east elevation of the battery sloped from the ground level up to the parapet wall that protected the emplacements. Given the D-shape of the battery, a similar contour extended around the north and south flanking sides of the battery. The sand cover also extended over the center of the battery, covering the roof of the traverse. Historic photographs of the battery suggest that the sand embankments were covered with sod and low shrubbery. The vegetation was probably similar to that used at the Mortar Battery, which was marsh sod and native heath. The sand embankment and vegetation were important parts of the camouflage and defense for the battery.

In contrast to the east side of the battery, the approach from the west revealed the exterior concrete walls and battery commander station flanked by the south and north emplacements. The concrete platform that forms the base of the battery was one step above grade. The concrete platform extended from the south side of the battery to the north, and the interior rooms and emplacements were accessed from there.

Emplacements

Emplacement no. 1 was located on the south side of the battery, and was constructed behind the parapet wall. The basic configuration of the emplacement was a series of concentric circles and semicircles, with the mount for the disappearing carriage at the center. The foundation of the emplacement was a semicircular concrete platform approximately 18 inches above the base platform of the battery. The next level of the emplacement formed the loading platform, and was approximately 5 feet above the base platform. The loading platform was also semicircular in shape, and was supported by reinforced-concrete walls that were built on top of the base platform. The outer walls of the loading platform were constructed with recesses that were intended for reserve ammunition (fig. 191).[27] The loading platform could be accessed via seven concrete steps at the south side of the platform, or four steps from the foundation level of the emplacement at the east edge of the platform. A circular depression in the loading platform formed the pit for mounting the disappearing carriage Model 1903 and the 6-inch breech-loading rifle.

The emplacement was protected by a parapet wall along the east and south sides of the loading platform (fig. 192). The southeast corner of the parapet wall was semicircular in form to accommodate the positioning of the armament for the emplacement. The reinforced-concrete parapet wall rose to a crest that was approximately 9 feet above the level of the loading platform. The south wall sloped gently toward grade level, and the east wall extended toward the concrete structure of the interior of the battery. A set of seven concrete steps leading from the loading platform to the top of the parapet wall were cut into the south wall of the parapet. Beyond the crest of the parapet, a concrete apron sloped toward the exterior of the battery and eventually to the sloped sand cover.

Emplacement no. 2 was located on the north side of the battery (fig. 189), and was the mirror of emplacement no. 1.

Traverse (Main Block)

The traverse of the battery measured 64 feet along its west elevation. The north and south side walls measured 53 feet from the west elevation to the parapet wall. The exterior walls at the west elevation of the battery were 3 feet thick, and the walls of the ammunition storage rooms were 13 to 14 feet thick.

---

[27] Marshall to Gillespie August 2, 1903; file 96, with enclosure 1, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

The exterior concrete wall of the west elevation was built up to elevation 26.5, which was approximately 12 ½ feet above the base platform (fig. 193). The wall was capped with concrete coping that extended around the perimeter of the exterior wall. At the north and south ends of the west elevation, approximately 6 feet from the corner, the wall sloped down at a 45° angle for about 3 feet. This created what appeared to be a flat-topped hip-roofed structure.

The west rooms of the battery were accessed through doorways on the west elevation. There were four doorways on that elevation, and each was equipped with a steel door hung on wrought-iron hinges and pintles. During the planning of the battery, Lt. Col. Marshall had instructed Asst. Eng. Hurlbut to that the doorway and window openings at Battery Gunnison should be constructed to match those of a similar battery at Fort Hamilton. Marshall included blueprints of the steel doors and shutters ordered for the battery at Fort Hamilton, which were marked up to create the order for Battery Gunnison (fig. 190).[28] The doorways were 3 feet wide, and the steel doors were 3 feet 3 inches wide, overlapping the recessed doorway surround.

Lt. Col. Marshall's letter also indicated that the windows should be made to the specifications of the fixtures used at Fort Hamilton. There were four windows on the west elevation of the structure. The windows were 2 feet 6 inches wide by 3 feet 6 inches high, and were constructed with splayed jambs. Steel grates and shutters detailed in the blueprints were installed in the windows. The doorways and window openings on the west elevation had cast-in-place concrete lintels, which provided the only decorative detail on the west elevation.

The north and south side walls of the traverse of the battery mirrored one another. On both elevations, an 8-foot-wide doorway leading to the interior corridors and ammunition rooms was located 15 feet from the west corner. The doorway had double steel-grate doors that swung on steel pins set in a steel plate. Approximately 3 feet east of the doorway, a recess in the wall originally served as a "telephone station" for the adjacent emplacement. The recesses were 3 feet square with a ceiling height of 6 feet 5 inches. Despite their names, they were equipped only with speaking tubes for communications within the battery (see the subsequent section "Utilities"). Historic photographs and extant evidence indicate that these recesses were equipped with sliding steel doors.

Both the south and north walls had three recesses along the elevation at a height of about 9 feet above grade. The recesses were 14 inches wide by 18 inches high by 8 inches deep, with splayed sides and molded edges. These recesses were part of the original lighting system, and were depicted in plan in the 1905 drawings (fig. 189). At the east end of the wall was an additional rounded recess. The plans indicate that this was the location of a hydrant for each emplacement; these were also included in Asst. Eng. Hurlbut's list of transfer articles.[29]

---

[28] Marshall to Hurlbut, Jan. 20, 1904; Vol. III, p. 142; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).

[29] Hurlbut to Marshall, Nov. 11, 1905; file 96, enclosure 21, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

At the east end of the south wall of the traverse was a doorway in the east parapet wall (fig. 195). This doorway allowed personnel to carry ammunition out of the powder passage inside the battery and up a flight of steps to the loading platform. The doorway was equipped with a steel door that swung open toward the south wall of the traverse. Here, the door fitted into a recess in the wall – presumably created to make the opening as wide as possible. The same arrangement of doorway, door, and recess was used on the north wall of the traverse, except in a mirror image of the south doorway.

Plans of Battery Gunnison indicate that the roof over the main block was a low-pitched roof with multiple slopes. Like the rest of the structure, the roof was constructed of concrete as much as 6 feet thick in some sections. During the construction of the battery, Lt. Col. Marshall wrote Asst. Eng. Hurlbut with instructions for waterproofing the roof structure. The correspondence noted that the waterproofing should consist of tarred 40-pound felt applied in five thicknesses and coated with hot coal tar at 138° F. The roof of the battery was pierced by two ventilation chimneys. Each ventilator was a rectangular concrete chimney with two ventilation stacks (fig. 194). There were also four ventilation stacks for the interior rooms (rooms 101, 102, 103, and 104) at the west end of the battery (see the subsequent section "Interior Elements"). These stacks vented along the west edge of the battery's roof. All of the ventilation stacks were capped with metal vent caps. The ventilation system assured that the interior rooms of the Battery Gunnison remained dry. The roof was covered with sand and sod soon after it was constructed.

Battery Commander Station

The battery commander station for Battery Gunnison was perched on the west side of the roof of the battery (figs. 193-194). The station was constructed on a slab of concrete on top of the roof. The slab also formed the floor of the station. The station was accessed via two metal staircases on the west side of the battery. There was a landing at the top of the stairway that was cantilevered over the west wall and supported by I-beams. The landing formed the west end of the room.

The double stairway on the west elevation of the traverse provided access to the battery commander station. Review of historic photographs and plans from the 1940s indicated that the metal stairway leading to the station were approximately 2 feet 6 inches wide, with 18 metal steps ascending to the landing. The risers of the stairs were open, and the treads appear to have been metal grating. Both staircases were constructed with pipe railing and metal balusters spaced every two steps.

The east, north, and south walls of the battery commander station were constructed of reinforced concrete and were 4 ½ feet high. Historic photographs depict that the west wall, which was built on the extended platform, was wood-framed with clapboard siding.

A band of windows positioned above the concrete walls wrapped around the north, east, and south sides of the structure. Though the windows are no longer extant, historic photographs suggest that they were similar to those used on the battery commander stations at the Mortar Battery. Photographs depict the windows tilted down when in the open position.

The roof of the station was a hip roof with a wide soffit. The roof is not extant, but historic photographs and park personnel document that it was wood-framed.[30]

The interior of the station had a concrete pedestal for the observation equipment. On the east wall were three speaking tubes for communication within the battery.

Battery Gunnison – Interior Elements

Overview

Figure 195 shows the interior layout of Battery Gunnison. The rooms along the west end of the battery were accessed through doorways on the west elevation of the structure (fig. 193). There were four rooms here – a storage room at each end, and a guard room and an office between them. As previously described, the exterior concrete walls at this section of the battery were 3 feet thick. The ammunition storage rooms for Battery Gunnison were located in the interior core of the battery, and were protected by thicker exterior concrete walls and the sand embankment to the east. The interior partition walls were also constructed of concrete and were 2 feet thick. They were constructed with concrete footings that were set approximately 3 feet below the floor level, and which were 4 feet wide at the base.

Storage Battery Room

The storage room (room 101) in the northwest corner of the battery was labeled the "Storage battery Room" on the 1905 plans, which suggests that it held a large battery that assisted in the generation of electricity for Battery Gunnison. The room measured 10 feet 9 inches wide by 16 feet long, with a jog in the southeast corner where the width narrowed to 8 feet. The floors, walls, and ceiling of the room were concrete. A recess with splayed sides in the north wall housed the electric light fixture for the room. The doorway was near the northwest corner, and a window was located approximately 4 feet south of the doorway. The doorway had a steel door, and the window had steel grating and a steel shutter, which were described previously.

[30] SAHO Park Historian Thomas Hoffman.

Guard Room

South of the storage battery room was the guard room (room 102), which was a rectangular room measuring 10 feet wide by 20 feet 9 inches long. The guard room was also accessed from a doorway on its west elevation, and a window was to the left of the doorway. As with the other rooms, the floors, walls, and ceilings were concrete. A recess for a light fixture was cut into the north wall. An opening 3 feet wide by 1 foot high in the east wall opened into the shell room, for ventilation and communication. The 1904 blueprints for the steel doors included shutters for these openings. The 1905 plans indicate that a "fireplace" was situated in the middle of the north wall of the room. It is not known whether this was an open fireplace or a flue for a stove, but given the depth of the "fireplace" depicted on the plans, it seems likely that it was equipped with a shallow coal-burning stove. The room was presumably used by the military personnel manning and guarding the battery.

Office

The office (room 103) was located south of the guard room and was a mirror of that room. The partition wall between the two rooms was at the center of the battery. The office was set up in a similar manner as the guard room, and had a "fireplace" and a light fixture recess on the south wall. The east wall of the room also had an opening into the shell room that was probably equipped with a steel shutter. In the northwest corner of the room was a switchbox to control the lighting for the battery.

Store Room

The store room (room 104) next to the office was the mirror of the storage battery room (room 101). The doorway to the room was situated near the southwest corner of the room, and a single window was located north of that. The south wall contained a splayed recess for the room's electric light fixture.

Shell Room

The 8-foot-wide exterior doorways on the north and south elevations each led to corridors that in turn led to the shell room (room 105) of the battery. The corridors on both sides of the battery measured 8 feet wide by 19 feet long and were mirror images of each other. Where the corridors entered the shell room, their walls were slightly splayed.

The shell room was 12 feet wide by 38 feet long. This was an open room for the storage of the projectiles used by the 6-inch guns. A shallow drainage trough was installed around the perimeter of the room, and it drained into the system for the entire battery. The exterior concrete walls of the room were as much as 13 feet thick, and the concrete roof was approximately 6 feet thick. Both the north and south walls had recesses for lighting fixtures and speaking tubes. The west wall had doorways into the guard room and the office, as previously described. The east wall was a concrete partition wall between the shell room and the cartridge room (room 106). The shell room had a flat concrete ceiling that was pierced with a series of ventilation holes near the east wall. The ventilation holes were connected to larger vent pipes that extended up through the concrete roof of the battery. Doorways at the north and south ends of the east wall provided access to the cartridge room.

The doorways were built with jambs that angled toward the interior of the battery, which accommodated the thicker exterior walls of the adjacent cartridge room. The splayed doorways were 4 feet wide and framed with 2-foot-thick concrete walls. Each doorway was equipped with a steel door a quarter of an inch thick, hung on wrought-iron hinges and pintles. The detail drawings of the doors and extant evidence indicate that the original doors were installed on the cartridge-room side of the wide jamb. The extant pintles for the original doors are anchored into the exterior wall of the cartridge room (see the subsequent section "Alterations").

Cartridge Room

The eastern storage magazine was designated the cartridge room (room 106) in the 1905 drawings.[31] It was a rectangular room measuring 14 feet 3 inches wide by 36 feet long. Like the shell room, the cartridge room had a shallow perimeter drainage trough that fed into the drainage system for the battery. The exterior walls of the room were 14 feet thick at this section of the battery, and the east and west walls were 2-foot-thick concrete partition walls. The south and the north walls had two recesses for electric light fixtures. There were no speaker tubes evident in the cartridge room. The cartridge room had a flat concrete ceiling that was pierced with a series of ventilation holes near the west wall. The ventilation holes were connected to larger vent pipes that extended up through the concrete roof of the battery. Doorways to the adjoining rooms were located in the ends of the east and west walls.

The west-wall doorways to the shell room (room 105) were described previously. The doorways to the powder passage (room 107) were located at the north and south ends of the east wall. Each doorway was 4 feet wide and passed through the 2-foot-thick partition wall. The doorways were equipped with steel doors similar to the interior doors described previously.

[31] Plan Showing Drainage and Electric Systems, Battery John Gunnison, Fort Hancock, New Jersey, November 1905; Sheet 128-4, Drawer 45; RG 77; NACP. This room was designated the powder room in 1942 drawings (see the subsequent section "Alterations").

Powder Passage

The east doorways of the cartridge room led to the powder passage (room 107). This was a long, narrow corridor that ran along the east side of the traverse and extended beyond it at both ends. The function of the passage was to provide a way for ammunition to be carried out of the interior rooms up to the gun emplacements. At each end of the corridor, three concrete steps ascended to a landing that occupied the space beyond the traverse. The west wall of each landing contained a doorway that led out to the adjacent emplacement.

The floor of the powder passage had a perimeter drainage trough and drains to the main system. The east wall of the passage was the exterior wall of the battery, and so was more than 11 feet thick. There were two lighting recesses on the wall, and a steel rack for equipment. The north and south end walls each had a recess for electric lighting. As explained previously, the north and south ends of the west wall contained the exterior doorways to the emplacements.

The doorways here had both steel-grating doors and steel-plate doors. The grating door was on the inside of the doorway and swung into the corridor. The door was hung on a pintle near the top of the jamb, and a gudgeon or pintle set into the concrete threshold of the doorway. The steel-plate door opened outward, and was hung on wrought-iron hinges and pintles set into the door jamb. Outside these doorways, a concrete stairway along the east parapet wall ascended to the loading platform of the emplacement.

Utilities

Speaking Tubes

Battery Gunnison was constructed with speaking tubes for communication between the "telephone" recesses in side walls of the traverse, the battery commander/observation station, and interior rooms. Lt. Col. Marshall's instructions to Asst. Eng. Hurlbut in January 1904 were that the speaking tubes would open into the telephone recesses, and that they should be placed near one corner to leave the rest of the wall space open.[32] Among the articles turned over to the Artillery Corps in 1905 were speaking-tube mouthpieces and flexible tube mouthpieces.[33]

Extant brass fittings for the speaking-tube system at Battery Gunnison indicate how communication within the battery was accomplished. Each brass fitting for the tube system is labeled to indicate where the tube connected. In the south-wall telephone recess (for emplacement no. 1) were three tubes marked "Shell Room," "Gun Booth No. 2," and "Observation." Similarly, the recess at emplacement No. 2 could communicate with the shell

[32] Marshall to Hurlbut, Jan. 20, 1904; Vol. III, p. 142; Press Copies of Letters Sent Relating to Fort Hancock, July 1889 – Dec. 1906; Entry 814; RG 77; NARA - Northeast Region (NY).

[33] Hurlbut to Marshall, Nov. 11, 1905; file 96, enclosure 21, box 32; Letters Received Sandy Hook 1901-1906; Entry 829; RG 77; NARA - Northeast Region (NY).

room, observation station, and recess no. 1. Speaking tubes in the shell room corresponded with the telephone recesses, and the observation station could communicate with both telephone recesses and the office. Though not placed near the corner of the recess as instructed by Lt. Col. Marshall, the speaking-tube system was the original means of communication within Battery Gunnison.

Electrical System

In addition to the speaking-tube system, the Engineers also turned over 43 "steam tight" electric light fixtures to the Artillery Corps. The splayed recesses in the concrete walls for the light fixtures have been described previously. The recesses in the interior rooms were approximately 4 feet off the ground, and were 1 foot 4 inches wide by 2 feet high and 1 foot deep, with quarter-round molded outside edges. The exterior recesses were located higher on the south and north walls of the main block of the battery, and were smaller. There were also recessed fixtures in the parapet walls of both emplacements that were covered over by later alterations. The light fixtures for Battery Gunnison were controlled from a switchbox in the office.[34] Battery Gunnison was connected to the main power plant of Fort Hancock in November 1911.[35]

Communication Systems

The communication systems for Battery Gunnison were installed soon after the battery was completed. The Fort Record Book indicates that the initial system was installed in November 1907, but does not provide the details of that system.[36] Presumably it was a system that included communication to the recently complete fire-control station on Battery Potter and the battery commander station at Gunnison. Edwin Bearss noted that a terminal booth was installed at one of the emplacements in 1908,[37] and the Emplacement Book noted that a standard communications system was installed in 1909.[38]

The schematic of Battery Gunnison's communications in 1909 indicated that orders were communicated to the battery commander station. The plan also diagramed the routes of communication for the battery (fig. 196). The diagram indicates that a system of communication between "Spotters" and "Readers" for each emplacement, the plotting room, and the battery commander station was coordinated for positioning and firing the guns.

[34] Plan Showing Drainage and Electric Systems, Battery John Gunnison, Fort Hancock, New Jersey, November, 1905; Sheet 128-4, Drawer 45; RG 77; NACP.
[35] Hurlbut to Roessler Nov. 23, 1911; file 38651-494; General Correspondence 1894 -1923; Entry 103; RG 77; NAB.
[36] Fort Record Book (revised Nov. 4, 1942), p. 74.
[37] Bearss, *The Sandy Hook Defenses*, p. 340.
[38] Battery Gunnison Emplacement Book.

The Signal Corps installed telautographs and telephones at the emplacements in February 1910.[39] The telautograph reproduced handwriting and drawings by transmitting the movements of an electromagnetically controlled pen along a line to a similar pen at the receiving end.[40] The noise of the battery made the use of telephones impractical, so the telautograph was installed at many U. S. coastal defense fortifications.[41] However, the telautographs at Battery Gunnison were discontinued in 1911.[42] Otherwise, the communication system for the battery continued as diagramed by the Coast Artillery.

---

[39] Fort Record Book (revised Nov. 4, 1942), p. 74.
[40] *CHIPS - The Department of the Navy Information Technology Magazine*, website reference http://www.chips.navy.mil/archives/03_spring/webpages/DaleSpring2003.htm.
[41] *CHIPS*.
[42] Battery Gunnison Emplacement Book.

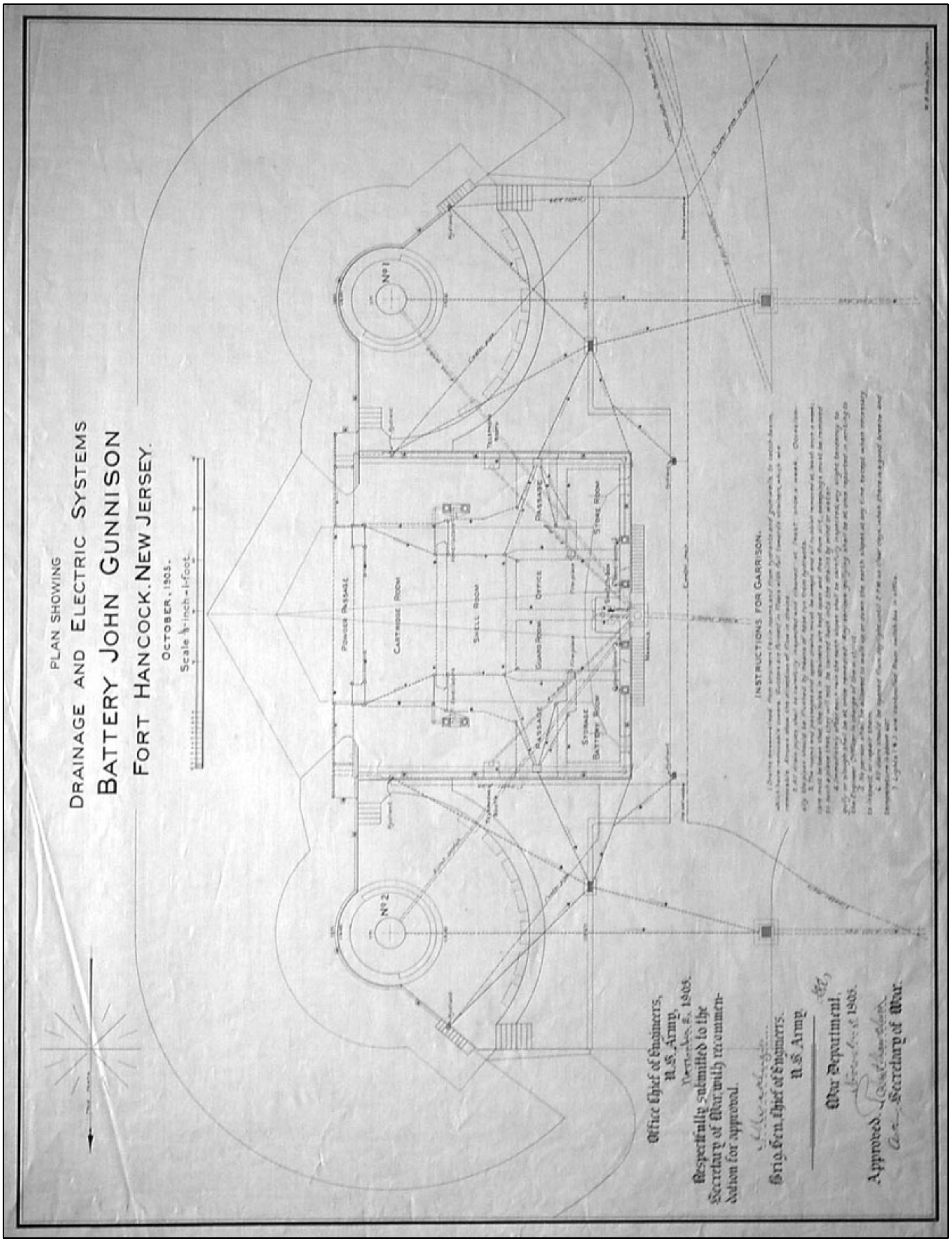


Figure 189. "Drainage and Electrical Systems for Battery John Gunnison, Fort Hancock, New Jersey. October 1905." Plans showing emplacements and interior room layout and room designations.

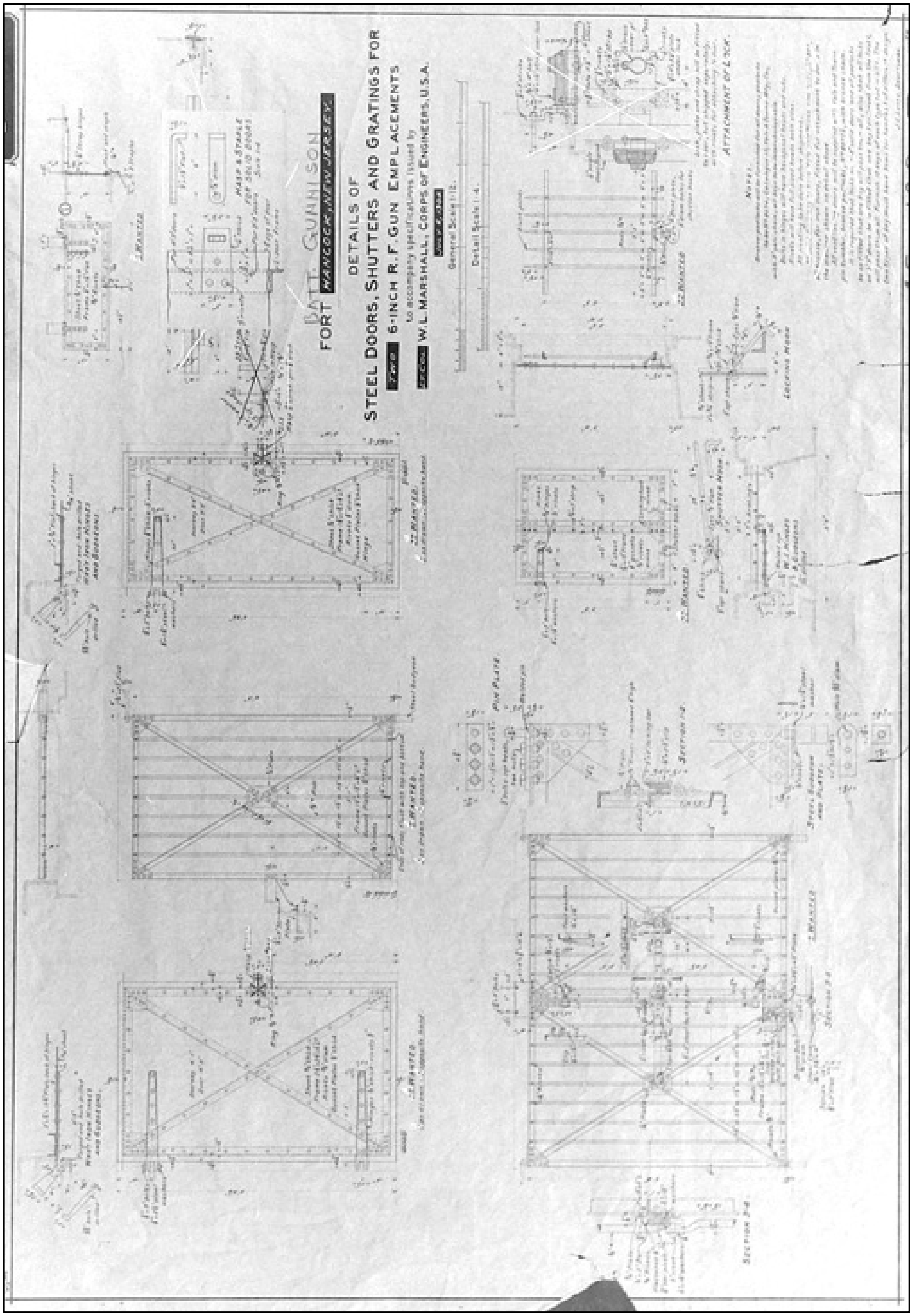


Figure 190. "Battery Gunnison, Fort Hancock, New Jersey, Details of Steel Doors, Shutters, and Gratings for Two 6-inch R.F. Gun Emplacements. July 6, 1904."

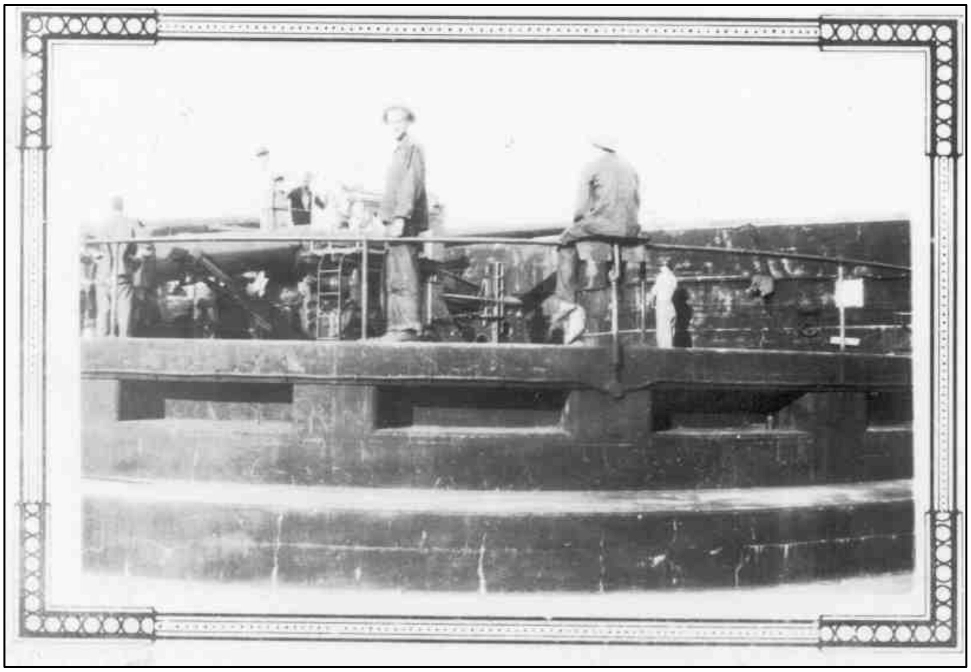


Figure 191. Battery Gunnison, view of retaining wall of emplacement loading platform, showing recesses for ammunition, ca. 1930.

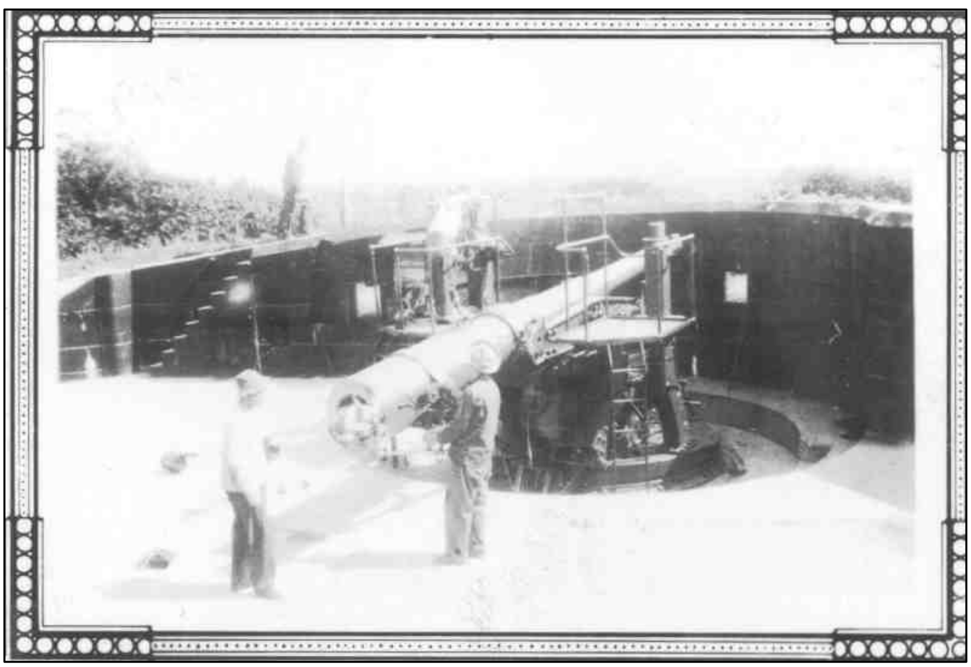


Figure 192. Battery Gunnison, view of north emplacement loading platform and parapet wall, ca. 1930.

Figure 193. Battery Gunnison, view of west elevation of traverse and battery commander station, ca. 1930.

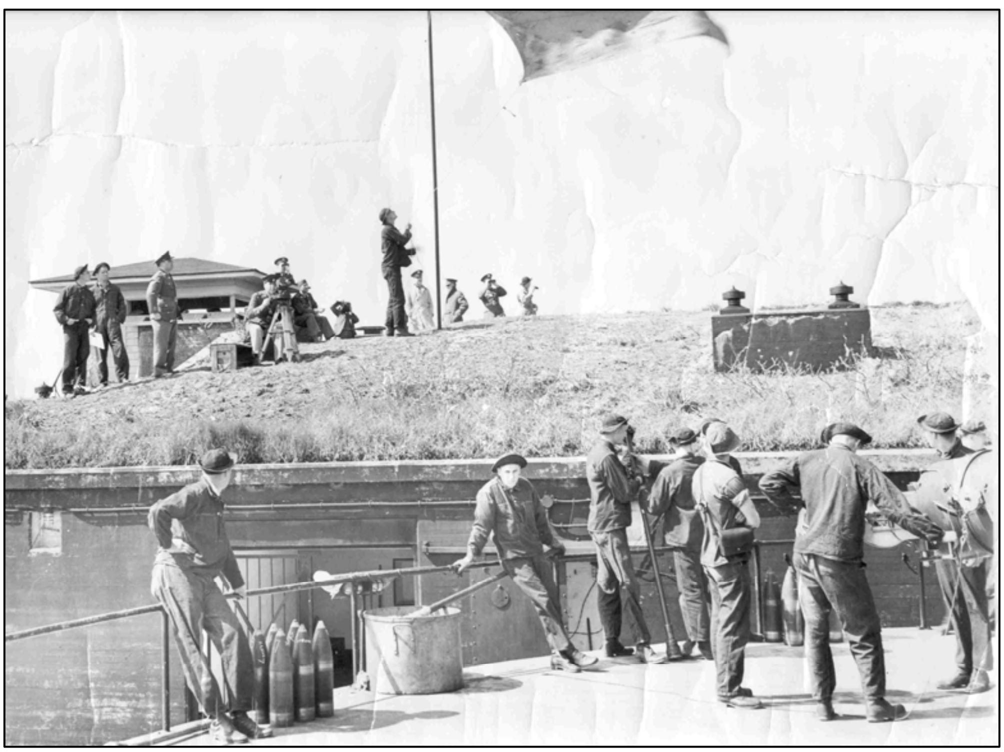


Figure 194. Battery Gunnison, view looking from south emplacement toward south elevation of traverse, showing battery roof with vent chimney and battery commander station, ca. 1940.

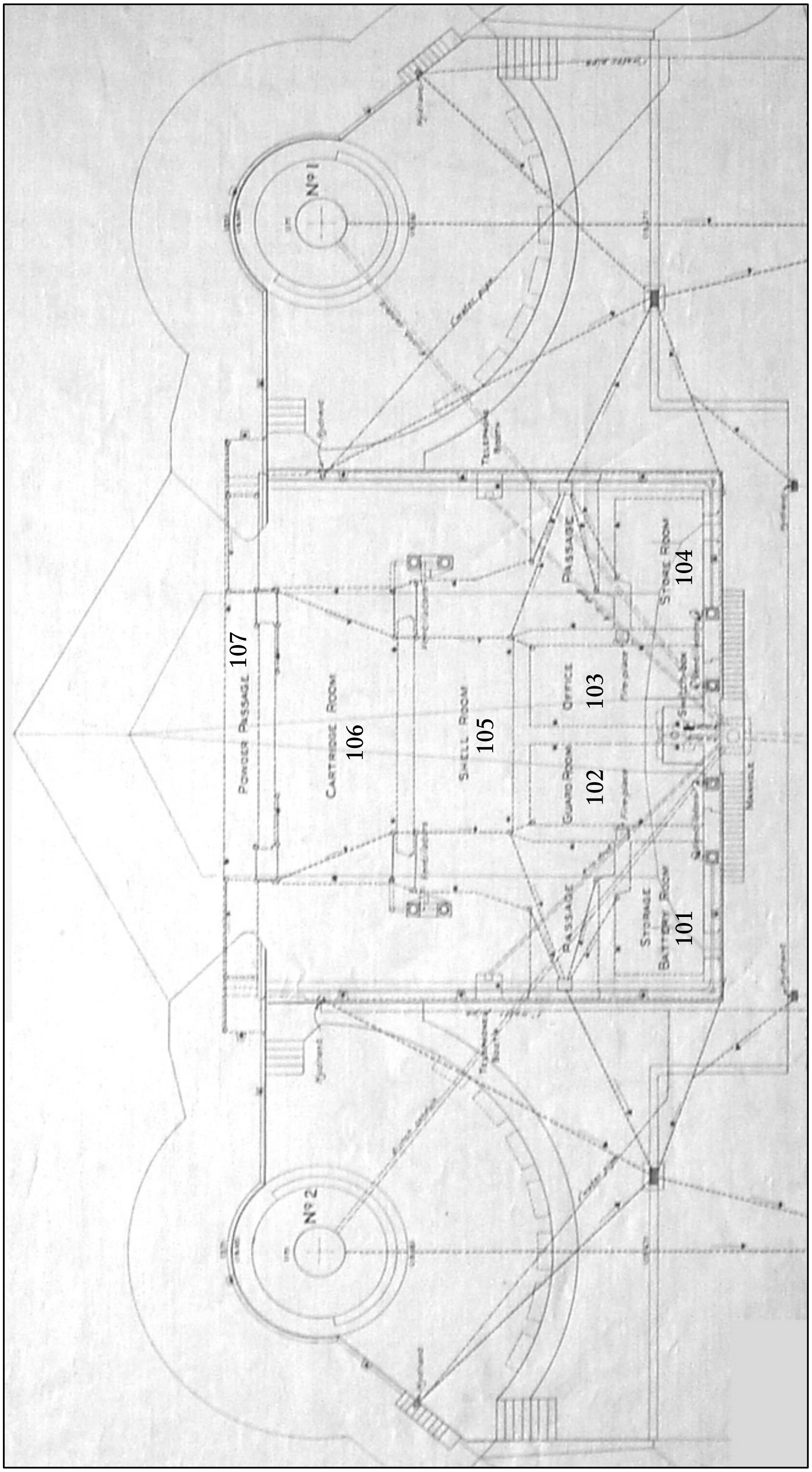
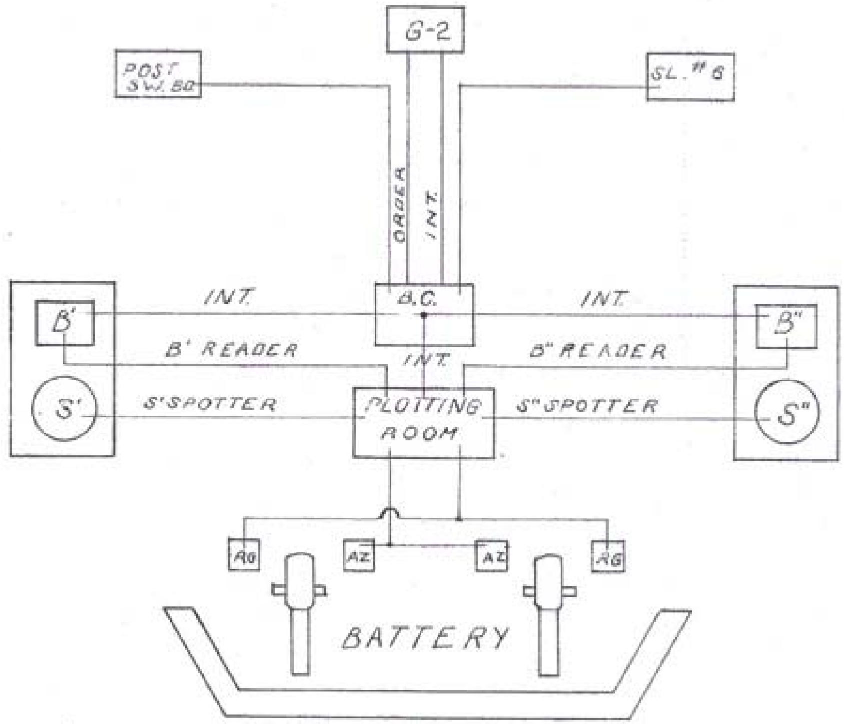


Figure 195. Battery Gunnison, 1905 plan of battery with modern room numbers added.



BATTERY GUNNISON

SCHEMATIC COMMUNICATION DIAGRAM

(4) COMMUNICATIONS. Date and character of installation; 1909 Standard.
Date of important modifications; telautographs discontinued 1911.

1 line B.C. - B' - B'' (Intelligence)
1 Line B.C. - P.S.B.
2 lines B.C. - G-2
1 line B.C. - S.L. #6
2 lines B.C. - Plotting Room

1 line Plotting Room - B' (Reader)
1 line Plotting Room - B''(Reader)
1 Line Plotting Room - S' (Spotter)
1 line Plotting Room - S''(Spotter)
2 lines " " - Battery

Vincent A. Yates
VINCENT A. YATES
Captain, 245th Coast Artillery

Figure 196. "Battery Gunnison, Schematic Communication Diagram."

ALTERATIONS

1908 to 1940

Battery Gunnison, like all similar batteries, needed a plotting room to function. The 1905 plans of the battery did not include such a space, but in 1909 one of the rooms below the battery commander station was converted to a plotting room.[43] This was most likely the former office (room 103), since it already had a communication link with the battery commander station and was located beneath that station. Documents from 1942 indicate that by that time, Battery Gunnison had two separate plotting rooms (not joined as they are today).[44] The single large plotting room extant today combines the original guard room (room 102) and office (room 103). It seems likely that the guard room and the office were each converted to a plotting room sometime after the battery was completed – the office in 1909, and the guard room sometime before 1942.

Records document general maintenance and minor improvements to Battery Gunnison, but no major alterations were undertaken until the World War II era. A damaged retaining wall at the battery was repaired in September 1915.[45] Regular maintenance at the battery included painting the ironwork, repairing the electrical wiring, and maintaining the drainage system, as well as repairs to the battery commander station's windows.[46]

Sand erosion was a problem at many of the emplacements at Fort Hancock, and Battery Gunnison was among them. A letter dated January 9, 1929, from the District Engineer to the Chief of Engineers noted that Battery Gunnison was one of five batteries that had suffered from sand erosion, and that the sand cover should be replaced.[47]

[43] Bearss, *The Sandy Hook Defenses*, p. 340.

[44] Brig. Gen. Haines, Headquarters New York-Philadelphia Sector, Fort Hamilton, N.Y., to Commanding General, Eastern Defense Command, August 17, 1942; RG 77; NARA - Northeast Region (NY).

[45] Bearss, *The Sandy Hook Defenses*, p. 340.

[46] Preservation and Repair, Miscellaneous; folder 16, box 35, Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

[47] Capt. R. Wilkinson to Chief of Engineers, Jan. 1, 1929; Preservation and Repair, Miscellaneous; folder 16, box 35, Correspondence Relating to Fortification Projects 1907 -1930; Entry 802; RG 77; NARA - Northeast Region (NY).

1940 - 1945

U.S. military strategy at the beginning of World War II included a new plan for the harbor defenses of the continental United States.[48] It had become evident that guns mounted on disappearing carriages were not capable of the same speed and range of fire of similar-size guns mounted *en barbette*. Guns mounted *en barbette* fired over parapet walls, and were typically mounted on carriages that were protected by an armored enclosure, and in some cases a gun shield.[49] This design allowed the gun to be serviced more quickly than a gun on a disappearing carriage, and also provided a greater field of fire. Battery Gunnison's 6-inch guns used disappearing carriages, and so the "Modernization of Harbor Defense Projects, Continental United States" authorized the abandonment of that battery on September 27, 1940.[50]

Nevertheless, the Emplacement Book for Battery Gunnison indicates that its 6-inch gun emplacements on disappearing carriages remained active into 1942. The 1940 modernization project also called for a review of the effectiveness of Battery Peck. Battery Peck's 6-inch rapid-fire guns, Model 1900, did use barbette pedestal mounts. However, the location of Battery Peck provided only limited coverage of the southern approach to New York Harbor via the Ambrose Channel, and the plotting room of the battery was not large enough to allow the installation of necessary new equipment. Apparently Battery Gunnison was kept active while the Local Board, Harbor Defenses of New York determined how to effectively utilize the resources at Fort Hancock.

The Local Board, Harbor Defenses of New York, met at Fort Hancock on July 28, 1942, to determine whether the barbette guns at Battery Peck could be relocated. One possible solution discussed by the board was to remove the existing guns from Battery Gunnison and construct new platforms for mounting Battery Peck's guns at Gunnison.

The board's initial recommendations called for the transfer of the guns at Battery Peck to Battery Halleck.[51] However, Brig. Gen. R.E. Haines, Commanding, Headquarters, New York – Philadelphia Sector, Fort Hamilton, N.Y., also reviewed the proposal to relocate Battery Peck's guns. Haines noted that Battery Gunnison was well sited to command the approaches to New York Harbor, and that the emplacements at Gunnison could be modified to accommodate Battery Peck's 6-inch guns mounted on barbette carriages. Haines also noted that if the War Department should modify its policy of abandoning all disappearing-carriage batteries, then Battery Gunnison as constituted should be kept in the Harbor Defense Project to "ameliorate the situation caused by the limitations of Battery Peck."[52] The "indorsement"of Brig. Gen. Haines's letter by Lt. Col. S.E. Senior, Asst. Adjutant General,

---

[48] Emanuel Raymond Lewis, *Seacoast Fortifications of the United States: An Introductory History (*Washington, D.C.: Smithsonian Press, 1970), p. 116.

[49] Http://en.wikipedia.org/wiki/Barbette.

[50] Fort Record Book (revised Nov. 4, 1942), p. 27c.

[51] Brig. Gen. Philip Gage, President, Commanding General, Local Board, Harbor Defenses of New York, July 28, 1942; RG 77; NARA - Northeast Region (NY).

[52] Brig. Gen. Haines, Headquarters New York-Philadelphia Sector, Fort Hamilton, N.Y., to Commanding General, Eastern Defense Command, August 17, 1942; RG 77; NARA - Northeast Region (NY).

recommended that if the relocation of Battery Peck was not possible, the battery should be placed in "Class C" caretaker status, and that Battery Gunnison should be placed in "Class A" status.[53] The importance of the site at Battery Gunnison, and the need to modernize the emplacements there, was apparently recognized by the War Department. Recommendations to relocate the 6-inch guns on barbette mounts from Battery Peck to Battery Gunnison were approved on February 22, 1943.[54]

After its rearmament, Battery Gunnison was assigned to Harbor Entrance Control Post #1 atop Battery Potter.[55] As part of the harbor entrance control system, Battery Gunnison served as an active part of the harbor entrance control system from 1943 through 1945. During this period, Gunnison was operated as an Examination Battery.[56] The primary function of the Examination Battery was to track targets identified by the Advanced Harbor Entrance Control Post #1 and to fire upon the targets when ordered. The orders were typically given as instructions to fire "bring-to" shots with inert ammunition. This was intended to stop the ship so that proper clearance could be given for it to continue into New York Harbor. The orders for destructive fire were "Destruction fire with armor piercing (high explosive) ammunition begin firing."[57] The documents reviewed indicated that Battery Gunnison fired "bring to" shots on two occasions in 1943.[58]

New Battery Peck

Brig. Gen. Haines's letter included an "informal estimate" for converting Battery Gunnison that totaled $24,380. Among other items, the estimate included raising the emplacement platforms, gas-proofing the plotting room, cutting a doorway through the partition in the plotting room (thus joining the two smaller plotting rooms), and installing two shell hoists.[59]

Gunnison's original 6-inch guns, Model 1903, serial nos. 5 and 34, and the disappearing carriages, Model 1903, serial nos. 52 and 57, were dismounted and removed from the battery to allow the modifications to commence. The guns were shipped to the Watervliet Arsenal on May 10, 1943, and the carriages were dismantled by Samuels Sons Iron and Steel Company, Brooklyn, N.Y., and sold as salvage on November 2, 1944.[60] This marked the end of Battery Gunnison's function as an Endicott System battery, and the beginning of the New Battery Peck.

---

[53] Haines to Commanding General, Eastern Defense Command, August 17, 1942; also Lt. Col. S.E. Senior, Asst. Adjutant General, Nov. 9, 1942, 5th Ind.; RG 77; NARA - Northeast Region (NY).

[54] Fort Record Book (revised Nov. 4, 1942), p. 27c.

[55] Major C.G. Bovis, Coast Artillery Corps, "History of HECP [Harbor Entrance Control Post], Fort Wadsworth, New York." Copy at Gateway NRA, Sandy Hook.

[56] Michael Murray, Army Ground Forces Association, citing "History of the New York - Philadelphia Sector."

[57] "History of HECP"; Enclosure "M", p. 1.

[58] "History of HECP"; Section V, pp. 11 – 12.

[59] Haines to Commanding General, Eastern Defense Command, August 17, 1942.

[60] Battery Gunnison Emplacement Book.

Plans for the modifications to Battery Gunnison dated February 16, 1943, depicted the alterations and additions to the battery in eight sheets of drawings. The drawings showed general plans as well as alterations to the emplacement platforms, including the new plotting room, gas-proof doors and shutters, and ammunition hoists, and other details for the modernization of Battery Gunnison (figs. 197-199).[61]

One major modification necessary to emplace Peck's 6-inch guns on barbette mounts at Battery Gunnison was to raise the semicircular platform of each existing emplacement by approximately 6 feet. The outer walls of the original loading platform were retained, but the ammunition recesses were filled in with reinforcing bars and concrete. A retaining wall was built above the existing semicircular wall of each emplacement. The plans indicate that the new retaining walls were constructed with a footing 3 feet 6 inches deep and 1 foot thick; the walls themselves were 1 foot 3 inches thick. The new retaining walls supported the concrete gun platform of the modernized emplacement.

The new concrete gun platform consisted of two areas. One was a level area around the perimeter of the gun platform, and the other was the area on which the gun carriages were mounted. The level area of the platform was constructed with a concrete slab laid on top of compact fill that was added over the original platform of the disappearing gun. The retaining wall held the fill in place and formed the outer wall of the new platform. The existing gun wells were filled with concrete to support the area of the platform where the gun carriages were mounted. This section of the platform was raised approximately 1 foot above the level of the perimeter platform, and the outer edges sloped down to the level of the gun platform.

The alteration of the gun platforms also required the removal of concrete from a large section of the existing parapet wall. The plans indicate that a section 4 feet 7 inches thick that followed the horizontal arc of the guns rotation was removed from the parapet wall. The section of wall was finished with a smooth parge coat of concrete.

Each new platform was accessed by two cast, reinforced-concrete stairways (fig. 198). A stairway located near the east parapet wall had 12 steps, and another stairway on the west side of the platform had 14 steps and a landing leading to the loading platform. The west stairway was supported by four reinforced-concrete piers on concrete footings. Both stairways were equipped with 1 ½-inch pipe railings that also extended around the perimeter of the new platform.

The efficiency of the modified battery depended partly on the speed of the ammunition delivery system. The ammunition for the original guns at Battery Gunnison had been carried to the emplacements by the Artillery personnel. The new armament would require a more effective form of delivery (fig. 198). This problem was solved by bringing to Battery Gunnison the hand-cranked ammunition hoists that had served the guns when they were at Battery Peck. These were installed on concrete base pads in the 8-foot-wide corridors that led to the shell room.

---

[61] "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Fort Hancock, New Jersey, Feb. 16, 1943," 8 sheets; Corps of Engineers, War Department. Copies at Gateway NRA, Sandy Hook. The descriptions of the alterations are based on the 1943 drawings and observation of existing conditions.

However, getting the ammunition from the shell room to the loading platforms on the roof of the battery required extensive modifications to Battery Gunnison. First, a shaft measuring 2 feet 8 inches by 3 feet 4 ½ inches had to be cut through the 3-foot-thick concrete ceiling of the corridor above each hoist. The top of the shaft, at roof level, was covered by a three-sided "shed" with a roof, all constructed of concrete. Just in front of the shaft opening, a concrete shelf with metal runners was built to help unload the ammunition delivered by the hoist. In addition, a concrete platform was created in front of the shaft opening to provide work space for the personnel unloading the hoist. The platform measured 6 feet to the edge of the roof, and was 10 feet 8 inches wide. A knee-high retaining wall was constructed on either side of the hoist shed, enclosing three sides of the platform; it was open at the roof edge. Ammunition passed from the hoist platform to the loading platform of the emplacement by means of a new concrete bridge. As with the stairways and platform, both sides of each bridge were equipped with a pipe railing.

The modification of Battery Gunnison included some interior alterations, as well. The initial planning of the project proposed cutting a doorway in the partition between the two existing plotting rooms (formerly the guard room and the office, Rooms 102 and 103, respectively). However, the final plan called for removed practically all of the partition, creating a large plotting room with an overall measurement of 20 feet 9 inches wide by 22 feet long. The 1943 plans indicate that a new concrete floor was laid in the plotting room after the partition was removed, and that the original floor drains were sealed (fig. 197). The 2-foot-thick walls that partitioned the new plotting room from the adjacent rooms remained intact, as did the concrete ceiling.

When the new plotting room was created, some of the existing openings of rooms 102 and 103 were altered. On the west wall, the two windows and the north doorway were bricked up, with the exception of a 1-foot-square vent shaft left in the location of the former north doorway. This vent shaft was fitted with a steel gas-proof shutter. The southern doorway on the west wall was widened to 4 feet 2 ½ inches, and a steel gas-proof door was installed here (fig. 199). On the east wall of the new plotting room, the two openings into the shell room were also bricked up; again, a 1-foot-square vent shaft with a steel gas-proof shutter was created in the location of the former southern opening. A new doorway was cut into the north wall of the plotting room, connecting it to the former battery storage room (room 101). This doorway was equipped with a steel door that, according to the plans, was a "semi-gas-proof" door. The original recesses for the "fireplaces" in both the north and south walls were sealed during the alterations to the battery. The south wall of the new plotting room was otherwise unaltered. Once the original openings had been sealed and the new openings equipped with gas-proof doors and shutters, the new plotting room provided a gas-proof environment for the Artillery personnel.

Additional alterations to Battery Gunnison at that time included the creation of an air lock in the former storage battery room (room 101), and the conversion of that room for storage of service equipment for chemical warfare. The air lock measured 4 feet 6 inches square on the interior, and was constructed in the southeast corner of the room. The air lock was constructed of brick, and the doorway from the storage room was equipped with a steel gas-proof door. The original window in the storage battery room was sealed with bricks, but the original steel door was left intact. The plans indicate that the room was also used as the heater room. For that purpose, a new flue was cut through the ceiling, and a new chimney was constructed at the roof level. Along with other alterations to the new plotting room, the air lock ensured that the plotting room remained impervious to a gas attack.

The gas-proof system installed at Battery Gunnison required a means of venting the plotting room and the air lock. A new system consisting of vent pipes 4 inches in diameter and a blower were installed at the battery to exhaust air and bring in fresh air. The pipes were hung from the ceiling in the plotting room and secured to the west exterior wall. These pipes led to the "intake" stacks, which were installed at the northwest and southwest corners of the main block of the battery.

Improvements to Battery Gunnison at the time also included updating some of the electrical service, and the installation of a hot-water heating system. The plans suggest that the improvements to the electrical system occurred only in room 101 and the new plotting room, but that they included the installation of light fixtures along the perimeter railing of each emplacement. The new boiler installed in room 101 was connected to four radiators in the new plotting room. The other rooms of the battery remained unheated.

The alterations and additions to Battery Gunnison were completed by May 1943,[62] and the plans were "certified as constructed" on October 21, 1943.[63] After the alterations were completed, the armament from Battery Peck was transferred to Battery Gunnison. This included the two 6-inch guns, Model 1900, serial nos. 27 and 28, and their barbette carriages, Model 1900, serial nos. 12 and 17. The modernized battery was designated as New Battery Peck (fig. 200). It featured shell hoists, a large gas-proof plotting room, and updated systems. The battery was no longer assigned to the Mine Command, but was now part of the defenses against motor torpedo boats.[64]

During this same period, additional support structures for Battery Gunnison and the defenses of Sandy Hook were constructed. These were depicted in one of the World War II maps of Fort Hancock (fig. 202).

1945 – 1974

The rapid reduction in the armed forces and defense spending after victory in World War II led to the deactivation and removal of most of the coastal defense guns at Sandy Hook. However, the 6-inch guns at New Battery Peck/Battery Gunnison were retained until 1948, when they were replaced by a pair of similar 6-inch guns that were removed from Battery Livingston at Fort Hamilton and mounted on the existing barbette carriages.[65] These guns remained in place until the mid-1960s, when the guns and carriages were moved to a Smithsonian Institution facility at Silver Hill, Maryland. It was intended that they would be installed in a new Armed Forces Museum. However, plans for the museum were

[62] Bearss, *The Sandy Hook Defenses*, p. 343.
[63] "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions."
[64] Bearss, *The Sandy Hook Defenses*, p. 343.
[65] Bearss, *The Sandy Hook Defenses*, p. 343.

subsequently abandoned, and the 6-inch guns and carriages were returned to Fort Hancock on February 19, 1975, and later remounted at Battery Gunnison.[66]

Battery Gunnison was maintained by the Artillery Corps until Fort Hancock was turned over to the Department of the Interior in 1974. The concrete bridge from the shell hoist to the gun platform at the north emplacement was demolished prior to the transfer of the battery from the U.S. military to the National Park Service.

1974 – Present

The National Park Service has maintained and preserved Battery Gunnison since 1975. Soon after acquiring Fort Hancock, the park determined that Battery Gunnison should be restored, and that it should have its 6-inch guns and carriages reinstalled and painted olive drab green to match its World War II color (fig. 201).[67] Since that time, the park has maintained Battery Gunnison as the only armed emplacement at Sandy Hook.

Battery Gunnison's location at the head of Gunnison Beach, and its consequent accessibility for interpretive programs, make it an important feature of the Coastal Fortification Zone at Sandy Hook, which is zoned for resource protection.[68]

Though Battery Gunnison was not one of the specific batteries investigated by the 1990 project "Stabilization of Historic Concrete Batteries at Fort Hancock," the effort was designed to provide data that could be applied to all of the batteries at Fort Hancock.[69] The technical information and the recommendations of the report have been taken in to consideration in the maintenance of Battery Gunnison.

The National Park Service demolished the concrete bridge from the south emplacement's loading platform to the adjacent shell-hoist shed on the roof of the battery in 2001 due to safety hazards. In 2003 the park addressed additional safety concerns; one project included the replacement of the metal pipe railing on the stairways of the battery emplacements and around the perimeter of the gun platforms of each emplacement. The park installed new rolling doors in the entrance doorways to the interior of the battery, and installed new lighting inside the battery in 2003.

---

[66] Bearss, *Historic Resource Study, Fort Hancock, 1948-1974, Gateway National Recreation Area, Sandy Hook Unit, New Jersey* (Denver: U.S. Department of the Interior, National Park Service, November 1982), p. 3; also Park Historian Hoffman.

[67] Jack E. Stark, NARO Regional Director, to Superintendent, Gateway NRA, July 7, 1977. Copy at Northeast Region offices, 115 John Street, Lowell, MA.

[68] *General Management Plan Amendment: Development Concept Plan and Interpretation Prospectus: Sandy Hook Unit, Gateway National Recreation Area, New York/New Jersey* (U.S. Department of the Interior, National Park Service, January 1990), p. 13.

[69] Todd Rutenbeck, *Stabilization Investigations, Historic Concrete Batteries, Fort Hancock, Sandy Hook Unit, Gateway NRA, New Jersey* (Denver: Bureau of Reclamation, June 1990).

Since 2003 a volunteer group, the Army Ground Forces Association, has been conducting living-history demonstrations and performing maintenance at Battery Gunnison. The group has painted the interior rooms of the battery, and has repaired the north shell hoist.

Battery Gunnison is included in the park's plan to rehabilitate, preserve, and interpret significant Endicott System gun batteries at Fort Hancock. The Project Management Information System states that the repairs at Battery Gunnison will focus on stabilizing spalling concrete and deteriorated walkways. These repairs will address critical visitor safety concerns, and allow increased access to Battery Gunnison.[70]

[70] Project Information Management System (PMIS) 57952. NPS website http://165.83.198.10/pmis_search_projectdetail.cfm.

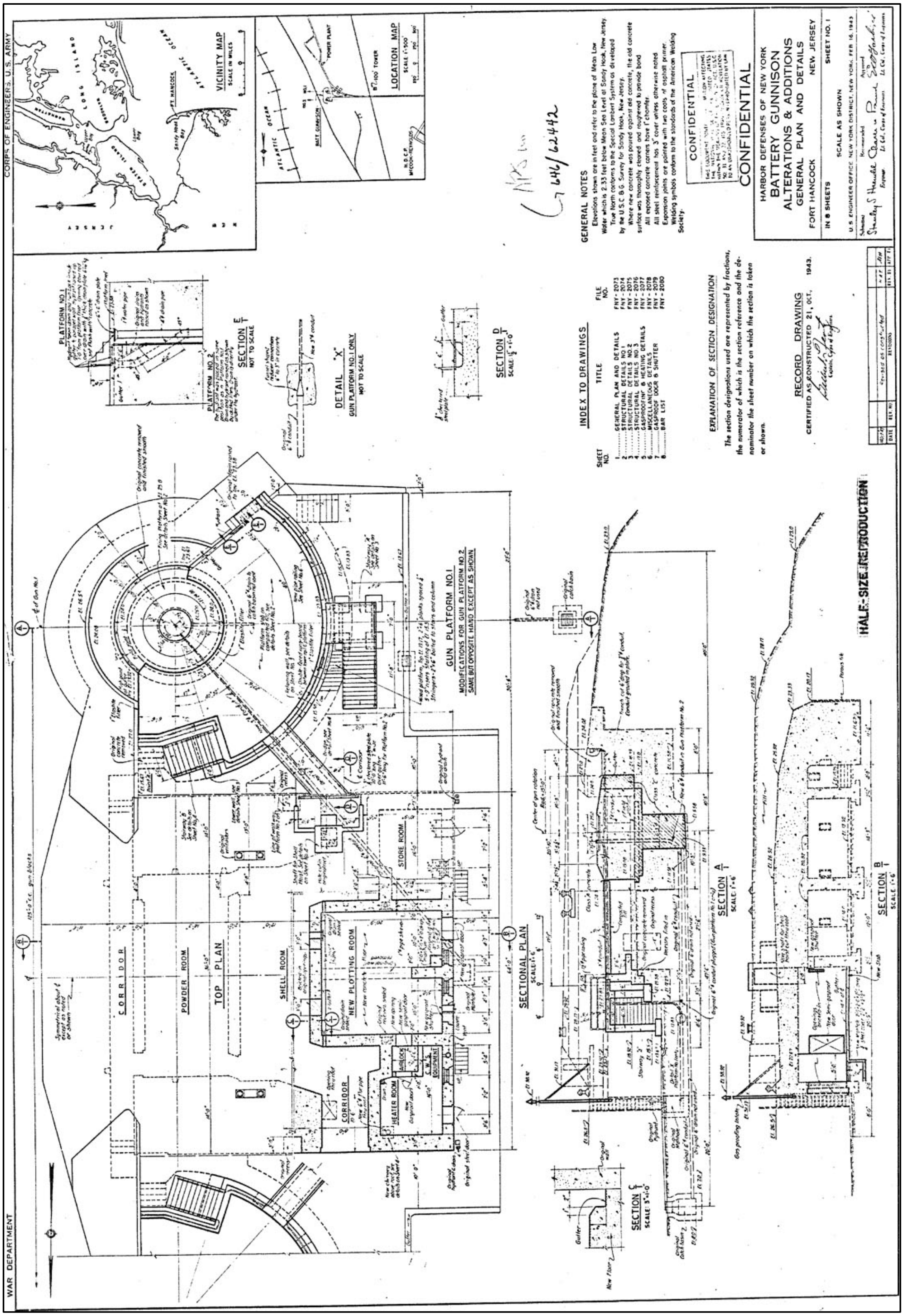


Figure 197. "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Fort Hancock, New Jersey, Feb. 16, 1943." Sheet no. 1 of 8.

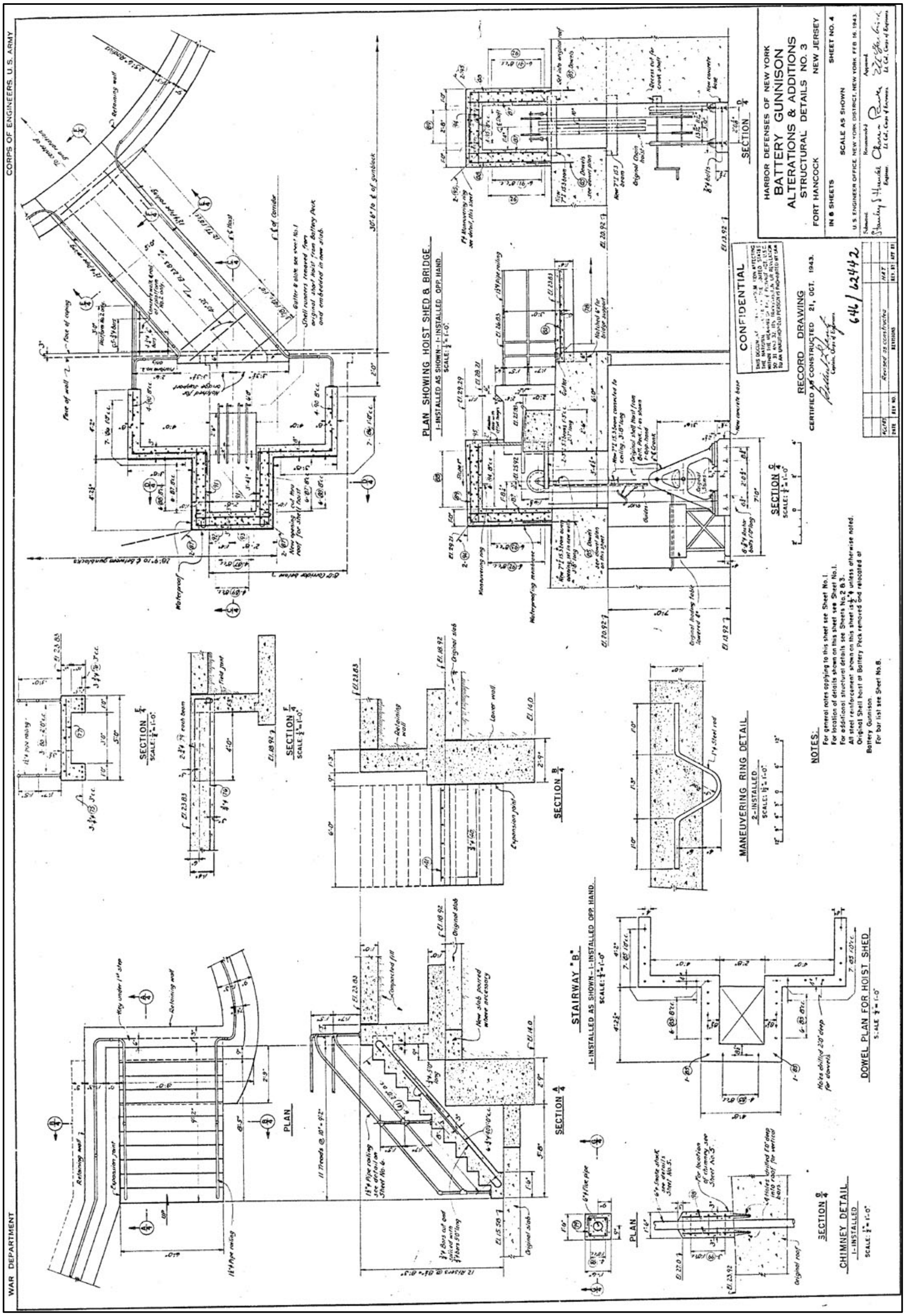


Figure 198. "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Structural Details No. 3, Fort Hancock, New Jersey, Feb. 16, 1943." Sheet no. 4 of 8.

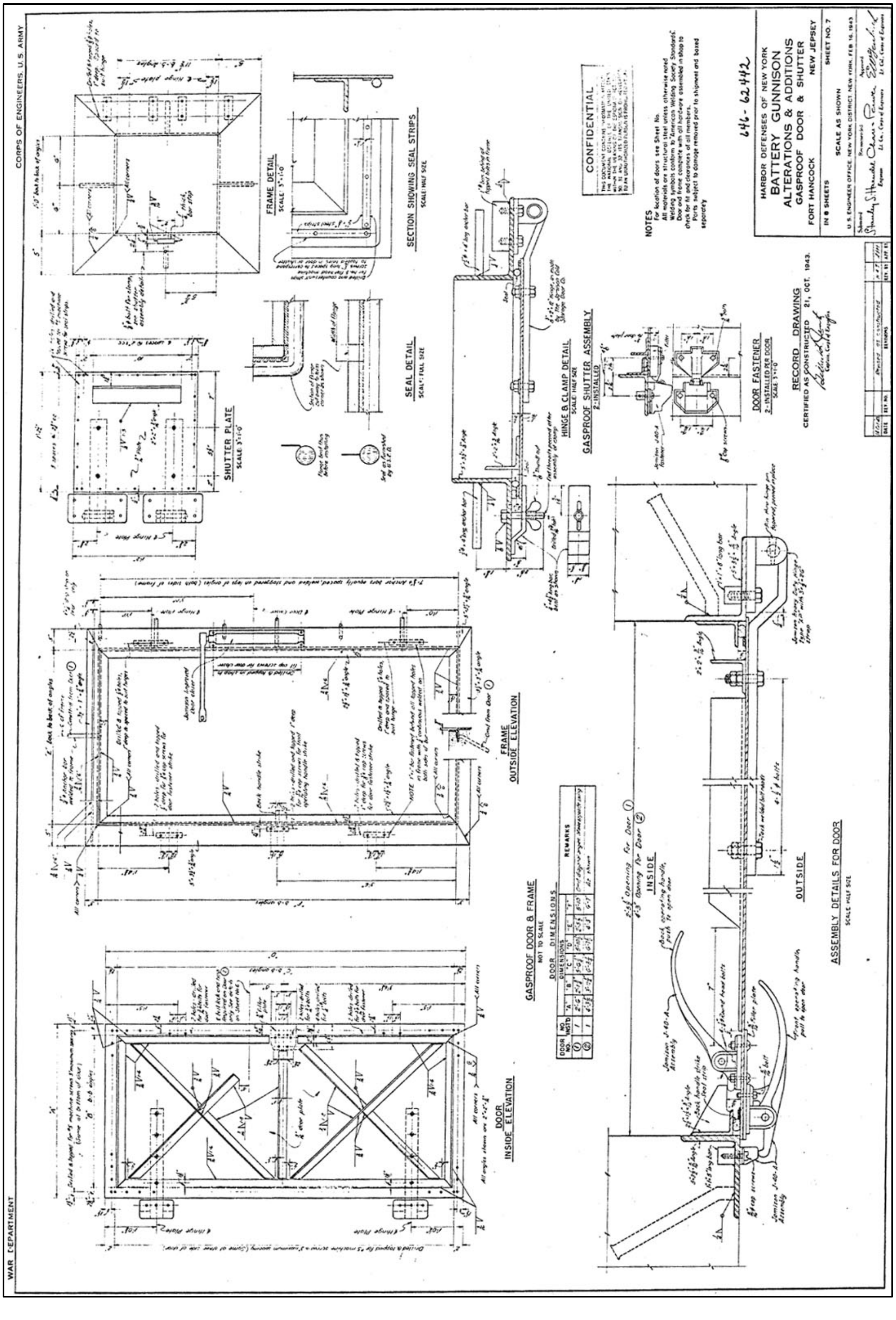


Figure 199. "Harbor Defenses of New York, Battery Gunnison, Alterations and Additions, Gasproof Door and Shutter, Fort Hancock, New Jersey, Feb. 16, 1943." Sheet no. 7 of 8.

Figure 200. Battery Gunnison, gun emplacement with 6-inch rapid-fire gun on barbette carriage.

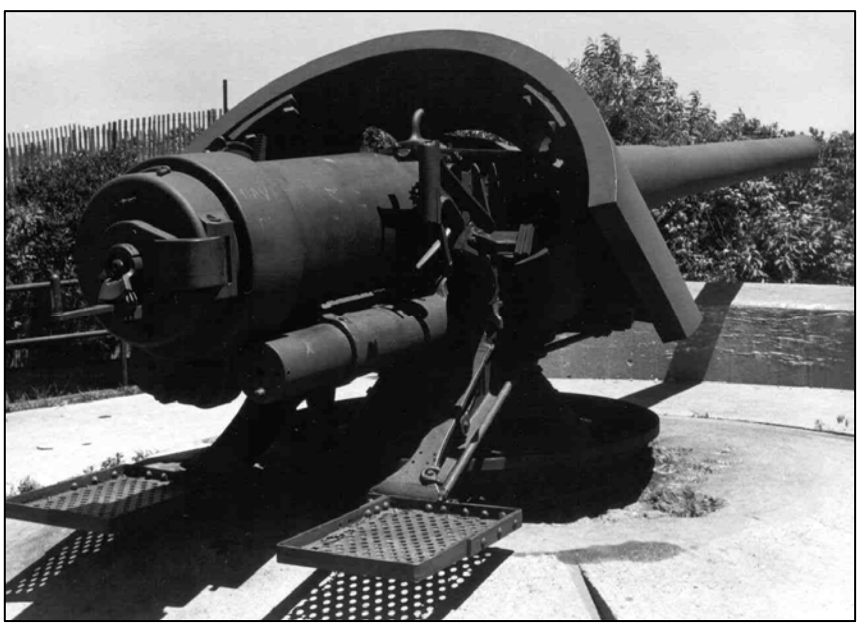


Figure 201. Battery Gunnison, gun emplacement after reinstallation of 6-inch guns on barbette carriages by park, 1977.

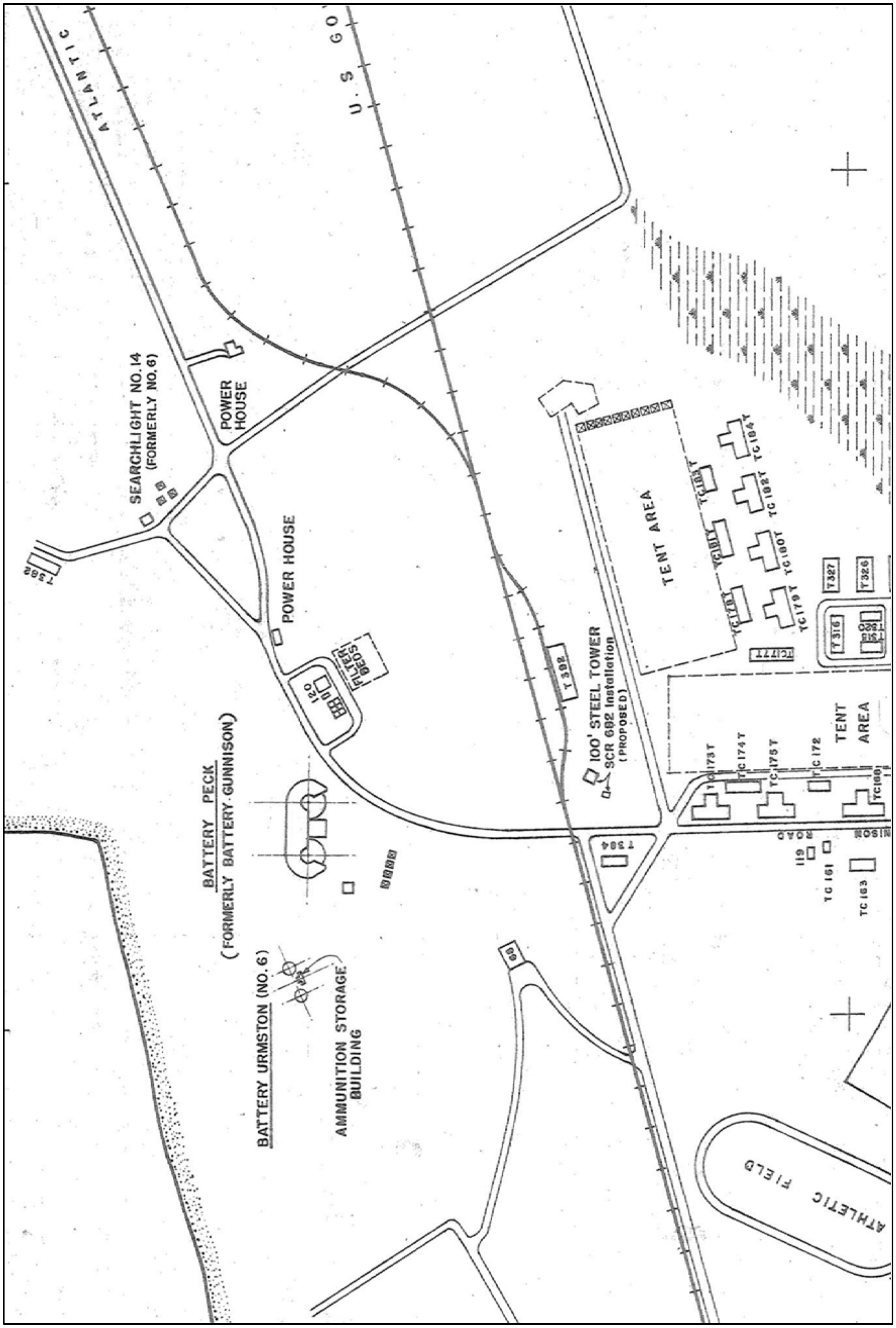


Figure 202. Detail of Battery Gunnison/New Battery Peck and surrounding structures during World War II.

CURRENT PHYSICAL DESCRIPTION

Introduction

The following physical description of Battery Gunnison is meant to augment the descriptions in the preceding sections "Original Appearance" and "Alterations." The extant elements of the battery are both original features and alterations that date to the modernization of the battery in 1943 and thereafter. Those descriptions should be considered as part of the current physical description, and will not be reiterated here.

A plan of Battery Gunnison with room numbers is provided as a reference for the interior rooms of the battery (fig. 195). The south emplacement is emplacement no. 1, and the north emplacement is emplacement no. 2. The photographs included with this section are intended to illustrate the current physical description. An existing condition assessment of Battery Gunnison was the subject of a separate report, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*.[71] Therefore, a section on existing conditions was not included with this report. However, it should be noted that the current condition is good, as documented in many of the photographs provided in this report. The interior rooms of the battery appear to be dry and well-maintained. The exterior of Battery Gunnison does have areas of deteriorated and spalling concrete, but the stabilization of the battery should address these issues and make the battery safe and accessible.

Battery Gunnison – Exterior Elements

Overview

The overall configuration of Battery Gunnison retains the D-shape of the original structure. The eastern portions of the battery remain buried in sand and covered with vegetation (fig. 203). The natural cover of the battery extends up to the parapet wall and covers the roof of the main block of the battery. The natural cover appears to be stable, but may be subject to erosion. In some cases, the vegetation has become overgrown and obstructs the original range of the battery.

---

[71] Einhorn, Yaffee, *Prescott, Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery, Sandy Hook Unit, Gateway NRA, New Jersey* (May 2005), section 2, pp. 1-2 and 5.

As described in the section on alterations, portions of the concrete parapet wall were removed when the guns from Battery Peck were moved to Battery Gunnison (fig. 204). With the exception of these alterations, the parapet wall appears to retain its original form. Some spalling has occurred, and reinforcing bars are exposed in some sections. This condition exists primarily along the curved section in front of the guns, which is the portion of the wall that was altered in 1943.

A concrete slab platform that forms the foundation of Battery Gunnison extends west of the main block. Based on the plans reviewed, the platform appears to be approximately 6 inches thick and is constructed of reinforced concrete. The platform forms the walkway around the perimeter of the main block, and extends along the west side of each emplacement. The walkway appears to be stable but cracked, and vegetation has grown up in many of the cracks.

Emplacement No. 1

Emplacement no. 1, at the south end of Battery Gunnison, is comprised of some original elements and some 1943 alterations (fig. 205). The base of the emplacement is a semicircular concrete slab that is 18 inches above the foundation platform; this is accessed by two concrete steps at the junction of the base and the traverse of the battery. From this concrete base, there is access to the doorway into the powder passage (room 107) and to the east stairway of the emplacement.

The semicircular retaining wall was constructed on the previously described base. The wall is comprised of the original wall and the sections of retaining wall added in 1943. This reinforced-concrete structure rises approximately 10 feet above the level of the lower platform and forms the outer wall of the emplacement. The wall shows signs of efflorescence and spalling.

The concrete retaining wall supports the gun platforms of the emplacement. As previously described, the perimeter of the gun platform is a concrete slab over compacted fill. The area of the platform where the gun carriages are mounted rises above the perimeter of the platform. It also is constructed of reinforced concrete. The pedestal-mounted barbette carriage for the gun is centered on the raised part of the gun platform, and the 6-inch gun is mounted on the carriage. The gun platform has pipe railing extending around its perimeter that was installed by the National Park Service.

The platform of the emplacement is accessed by two concrete stairways. On the west side of the emplacement is a freestanding cast-concrete stairway that leads from the perimeter platform to a landing at the level of the loading platform. The stairway landing is supported by four reinforced-concrete columns that are 1 foot thick and which rest on 3-foot-square footings. The footings and columns closest to the retaining wall were built on top of the emplacement's base level, and the outer footings and columns extend from the perimeter platform level. The stairway has 1 ½ -inch pipe railing on both sides that was installed by the National Park Service; this is connected to the perimeter pipe railing at the level of the gun platform.

The east stairway leads up from the emplacement's base level and was attached at the top of the retaining wall. This stairway was also constructed from cast concrete and equipped with pipe railings on either side.

The cast-concrete bridge that had connected the loading platform of the emplacement with the shell-hoist shed on the roof of the battery was demolished by the National Park Service in 2001.

Emplacement No. 2

Emplacement no. 2 (fig. 206), at the north end of Battery Gunnison, is a mirror image of emplacement no. 1, and it retains the same elements as the southern emplacement. The northern emplacement has similar conditions of spalling concrete and some vegetative growth. Both emplacements at Battery Gunnison appear to be stable. The emplacements retain their integrity as the modernized 1943 battery, and are currently armed with 6-inch guns mounted *en barbette* (fig. 207).

The exterior walls of the traverse of the battery have not been extensively altered since the 1943 modernization. The west wall retains the vestiges of the original openings of the battery (fig. 208). Three of the four windows were sealed with brick in 1943, as was one of the doorways. The north and south doorways are in their original locations, and retain their original steel doors. The one remaining doorway near the center of the battery was altered in 1943, and its extant steel door dates from that period. All of the steel doors are difficult to operate. The only original window is at the south end of the battery; it retains its original steel shutters. This elevation was originally constructed with a concrete bas-relief sign that read "BATTERY JOHN GUNNISON." However, the John Gunnison portion of the sign was chipped away when the battery was redesignated New Battery Peck in 1943.

The west wall has a large area of rust staining under the supports for the battery commander station, and other smaller areas of rust staining, as well. There is efflorescence below the two center windows and in other portions of the wall. Both the north and south corners show signs of water problems that are related to the roof drainage system. Overall, the west wall appears to be stable, with only minor spalling at the corners.

The elements of the north and south exterior walls mirror each other and are in similar condition. Each of the two 8-foot-wide doorways to the interior passages of the battery is equipped with a modern roll-up door that was installed by the park. The original steel-grate double doors are intact behind the modern door. Each wall's telephone recess is intact, and its speaking-tube fixtures are extant (figs. 209-210). The plans from 1943 noted that some of the speaking tubes were sealed, but these tubes were not tested during the site visit. The steel door for the telephone recess is no longer in place. East of the telephone recess, the recess for the original hydrant remains. Beyond that, the recess in the wall for the iron door from the powder passage is also intact. Along the top of the wall, three splayed recesses for light fixtures are extant, but they are no longer used for lighting. The cornice of the wall is formed by a 6-inch-wide coping that runs the length of the wall, and also forms the edge of the roof.

The north and south walls of the main block appear to be in good condition. There are some areas of water staining on the walls and cornice, which appear to be associated with roof drainage problems (fig. 211).

Roof

The roof of the battery remains covered with sand and low-growing vegetation (fig. 204). The natural cover of the roof appears to be stable, but may be subject to erosion. It appears that the thick concrete roof structure below the cover is intact and stable. The concrete vent chimneys on the north and south sides of the roof are extant, but the vent caps are missing. Other chimneys rising from the interior of the battery appear to be sealed. The north and south edges of the roof structure were constructed with gutters and drains in efforts to keep the interior of the battery dry, and to conduct the water away from the structure (fig. 212). This drainage system is not working properly, and there is standing water in the gutters. As previously noted, the water is also overflowing the gutters and running down the exterior walls, causing water stains and standing water at the base of the walls.

The remains of the battery commander station are situated on the west side of the battery at the roof level. The wooden elements of the station are no longer extant. The reinforced-concrete walls that form the lower sections of the north, east, and south elevations of the structure are intact. The floor of the station is intact, including the cantilevered section that extends beyond the west wall. The steel I-beams that support the cantilevered section of floor are also intact, and are causing rust stains on the west wall. The iron stairway that provided access from the ground level was removed by the National Park Service circa 1976.

The concrete "sheds" over the two shell hoists on the roof of Battery Gunnison (fig. 213) date to 1943. Their concrete walls and roofs remain, as do the concrete retaining knee walls on either side of the sheds. The concrete shelves in front of the hoist openings are deteriorated; the metal runners they once supported are not extant. The interior walls of the shell-hoist shafts are painted white.

Battery Gunnison – Interior Elements

The interior of Battery Gunnison is relatively unchanged since the 1943 alterations and additions to the battery. The interior of the battery appears to be stable, and the rooms are clean and well-maintained. All of the interior rooms at Battery Gunnison are currently wired with metal conduit pipes and utility light fixtures with sealed globes that are protected with wire cages. Overall, the interior rooms appear to be dry, and they do not exhibit the same levels of moisture found in other batteries in the park. The volunteer reenactment group, the Army Ground Forces Association, has been responsible for maintaining Battery Gunnison since 2003.

Along the west side of the battery, the interior rooms currently consist of the storage room for chemical-weapons service equipment (room 101), the 1943 plotting room (rooms 102 and 103), and the store room (104). Room 101 is currently used as a general storage room by both the park and the Army Ground Forces Association. The 1943 air lock is intact and complete with its gas-proof doorway (fig. 214). The plotting room can still be accessed from the exterior through a doorway in the west wall, which was upgraded to a gas-proof doorway in 1943. The plotting room is also accessible from room 101 through the air lock (fig. 215). The concrete floors, walls, and ceiling retain their 1943 configuration, along with some original elements, as described previously. The original windows and one of the original doorways were sealed with bricks in 1943, but these former openings are still evident. They retain their 1943 alterations, including the 1-foot-square vents with steel shutters. The pipes for the 1943 ventilation system that hung from the ceiling of the plotting room have been recreated for display and interpretive purposes. The plotting room is currently used by the reenacting association, and has been equipped with a plotting board and various World War II communications equipment. The store room is used by the park and the association to store supplies, paint, and other material for the maintenance of the battery and the guns. The room retains its original configuration, as well as the original iron grating in the window and the original steel shutters on the exterior of the window. The original steel door to this room is also extant.

The three rooms along the west side of the battery are well-maintained and have been recently painted. The floors remain unfinished concrete. The walls are currently painted white with a black base. The black paint is applied from the floor level to chair-rail level – approximately 3 feet above the floor. The upper portion of the walls and the entire ceiling are painted white. The steel doors and shutters are painted black.

The corridors that lead from the north and south exterior doorways to the shell room (room 105) in the interior of the battery retain the 1943 features previously described. The shell hoists that were installed in 1943 for raising the ammunition to the roof level are extant in both corridors. However, the hoist mechanism in the south corridor has been partially dismantled. The hoist mechanism in the north corridor is still operative (fig. 216), and its steel components have been painted green.

The shell room has not been significantly changed since the 1943 alterations (fig. 217). The concrete floor, walls, and ceiling appear to be stable and are well-maintained. The floor is unfinished and features a perimeter drain. The walls and ceiling are painted white with a black baseboard-height strip at the bottom of the wall. The corners of the room are painted with a black vertical strip that mimics a corner board. The steel doorway surrounds and doors, as well as the other steel elements in the room, are painted black. The room retains some original features, including the recesses for electrical light fixtures (the lights are not extant) and the brass fixtures for the speaker tubes leading to the emplacement telephone recesses. The doorways to the powder room retain the gas-proof doors that were installed in 1943.

The cartridge or powder room (room 106) also retains some original elements and 1943 alterations (fig. 218). The floor, walls, and ceilings of the room are well-maintained and appear to be stable. The original recesses for light fixtures remain, but the fixtures do not. The powder room is painted in the same manner as the adjacent shell room. The east-wall doorways to the powder passage are equipped with gas-proof steel doors that date to the 1943 alterations.

The powder passage (room 107) remains relatively unchanged since the original construction of Battery Gunnison. The alterations to the battery in 1943 did not affect this area, and the concrete walls, floors, and ceiling retain their 1904 configuration. The walls and ceiling have been painted in a manner similar to the shell room, but are otherwise unchanged. The original recesses for light fixtures are extant, but the modern lighting equipment does not use them, being mounted to the ceiling. The steel rack attached to the east wall appears to date to the original period of construction, and probably held ramming rods and gun-barrel cleaning rods. The north and south ends of the powder passage each retain the three concrete steps that ascend to exterior doorways located next to the east ends of the north and south walls of the traverse (fig. 205). As previously described, the doorways allowed ammunition to be carried out of the powder passage and up to the loading platforms of the guns. The doorways retain their original steel-grating doors and the exterior steel doors that open into the recesses in the north and south walls of the traverse.

In summary, the interior spaces of Battery Gunnison retain many original elements and 1943 alterations. The rooms appear to be dry and well-maintained. Stabilization of the exterior of the battery will ensure the continued stable condition of the interior rooms of the battery.

Figure 203. Battery Gunnison, view of sand embankment and north gun emplacement, looking south, 2006.

Figure 204. Battery Gunnison, view of north emplacement from roof of traverse, 2006.

Figure 205. Battery Gunnison, view of south emplacement, looking east, 2006. Note doorway to powder passage, located between traverse (at left) and emplacement (at right).

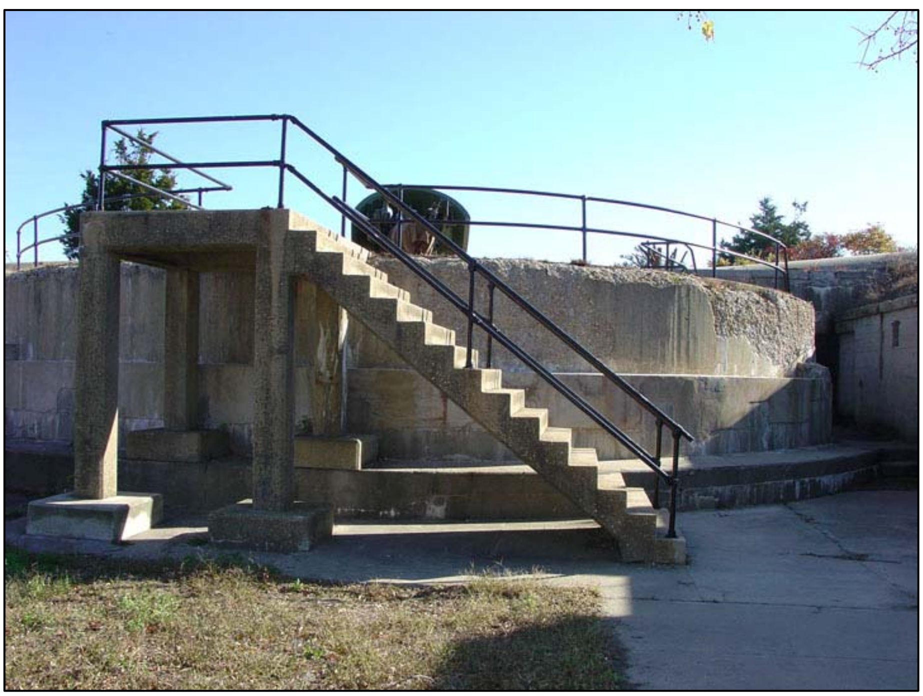


Figure 206. Battery Gunnison, view of north emplacement retaining wall and west stairway, looking east, 2006.

Figure 207. Battery Gunnison, south gun mounted on barbette carriage, 2006.

Figure 208. Battery Gunnison, west and south elevations of traverse of battery, 2006.

Figure 209. Battery Gunnison, south-elevation "telephone" station; shows brass fixtures for speaking-tube system on east wall of booth, 2006.

Figure 210. Battery Gunnison, brass fixture for speaking-tube system connecting to the shell room, 2006.

Figure 211. Battery Gunnison, southwest corner of battery; shows cornice coping, down- spout, and water damage, 2006.

Figure 212. Battery Gunnison, gutter at south edge of roof, 2006.

Figure 213. Battery Gunnison, 1943 shell-hoist shed for south emplacement, 2006.

Figure 214. Battery Gunnison, 1943 air lock in storage room (room 101) for chemical-weapons service equipment, 2006.

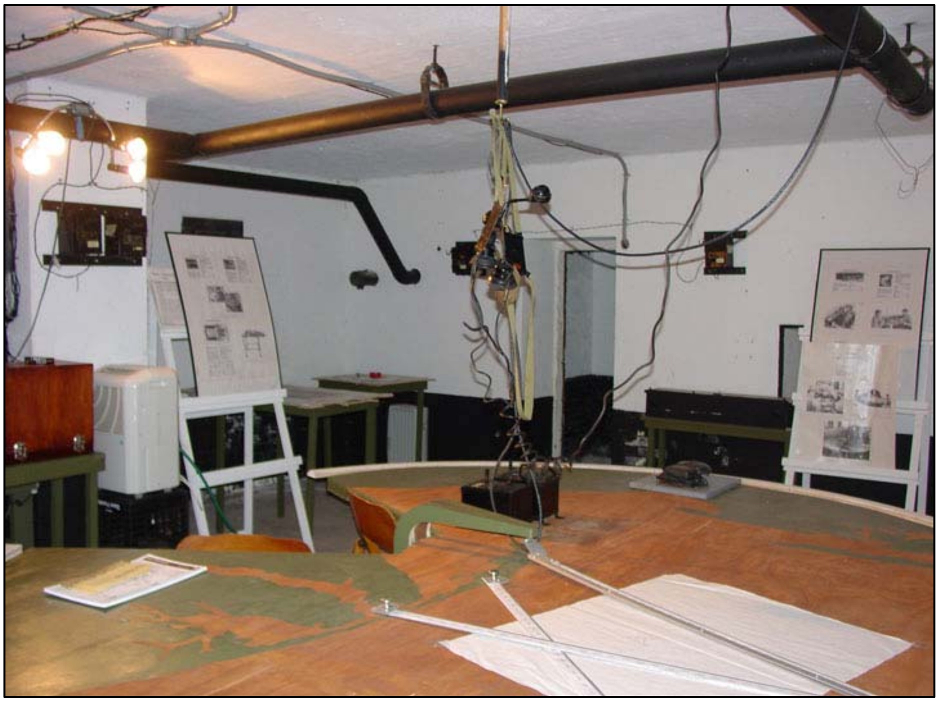


Figure 215. Battery Gunnison, 1943 plotting room, looking northwest, 2006.

Figure 216. Battery Gunnison, shell hoist for north emplacement, 2006.

Figure 217. Battery Gunnison, shell room (room 105), looking southeast, 2006.

Figure 218. Battery Gunnison, cartridge/powder room (room 106), looking south, 2006.

CHARACTER-DEFINING FEATURES AND RECOMMENDATIONS

INTRODUCTION

A historic structure may be significant for its architectural features and/or its association with historic events and persons. The character-defining features (CDFs) of a structure are those visual features and elements that define the structure and contribute to its historic integrity. To retain the historic integrity of a structure, it is important to retain and preserve its CDFs.

Battery Potter, the Mortar Battery, and Battery Gunnison are all part of the Coastal Fortification Zone within the Fort Hancock Gateway Village, and will play a role there in the interpretation of the coastal defenses of the United States and Sandy Hook. The proposed treatment for Battery Potter, the Mortar Battery, and Battery Gunnison, in accordance with the GMP and GMP Amendment, is rehabilitation and interpretation.[1] The rehabilitation of a structure includes the retention of CDFs. *The Secretary of the Interior's Standards for Rehabilitation* address this in the definition of "rehabilitation," which is "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values."[2] The Secretary of the Interior further addresses rehabilitation in the following standards:

1. A property will be used as it was historically, or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.

2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.

3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.

5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

---

[1] *General Management Plan Amendment: Development Concept Plan and Interpretation Prospectus: Sandy Hook Unit, Gateway National Recreation Area, New York/New Jersey* (U.S. Department of the Interior, National Park Service, January 1990), pp. 9 and 13.

[2] Kay D. Weeks and Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* (Washington, D.C.: U.S. Department of the Interior, National Park Service, 1995), p. 61.

7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.[3]

The following sections will identify the character-defining features and make recommendations for the rehabilitation of Battery Potter, the Mortar Battery, and Battery Gunnison. Rehabilitation efforts are proposed in a project submitted to the NPS's Project Management Information Systems (PMIS): "Repair Structural Elements for Safe Visitor Access at Batteries Gunnison, Potter & Mortar – Sandy Hook" (PMIS #57952). The work would also provide increased visitor access, and enhance the park's historic attractions and programs.[4]

A separate report, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*, was prepared in support of the PMIS rehabilitation project. This report includes recommendations for the stabilization of Battery Potter, the Mortar Battery, and Battery Gunnison. The recommendations deal with the issues of masonry stabilization, water infiltration, drainage, ventilation, erosion, vegetation, lighting, and hazardous materials and conditions.[5] Upon review, the recommendations of that report do appear to conform to *The Secretary of the Interior's Standards for Rehabilitation*, and would assist in the stabilization of the historic gun batteries at Fort Hancock.

This HSR does not contain a section on landscape characteristics. However, they are important to the history and context of the gun batteries. Other reports generated on this subject for Gateway National Recreation Area, Sandy Hook Unit, should be consulted prior to any work on the site.[6] In addition, a project entitled "Prepare Sandy Hook Cultural Landscape Plan for Batteries at Sandy Hook," PMIS #10288, has been funded and is expected to begin in the fall of 2007.

---

[3] NPS website http://www.cr.nps.gov/hps/tps/stanguide/rehab/rehab_standards.htm.

[4] PMIS Project Detail Sheet, PMIS #57952. NPS website http://165.83.198.10/pmis_search_projectdetail.cfm.

[5] Einhorn, Yaffee, Prescott, *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery, Sandy Hook Unit, Gateway NRA, New Jersey* (May 2005), section 2, pp. 1-4.

[6] These include but are not limited to the following: *Cultural Landscape Treatment Plan for Fort Hancock*, by Lisa Nowak and H. Elliot Foulds; *Cultural Landscape Report for Proving Ground and Wartime Expansion Areas*, by Norma E. Williams; and *Historic Landscape Assessment for Fort Hancock*, by H. Elliot Foulds.

BATTERY POTTER

Character-Defining Features

Exterior Elements

Design and Context

- The overall massing and configuration of the D-shaped concrete battery.
- The sand embankments that surround the battery, and the native vegetation that held the sand in place and served as camouflage, including marsh sod, native heath, and cedars.
- The overall design of Battery Potter as the first Endicott System "Gun-lift Battery," including the arrangement of the two emplacements.
- The "defensible entrance" of Battery Potter, including the fortress-like design with its gun ports and gun loops with embrasures.
- The *chemin de ronde,* as part of the defenses for Battery Potter, and as an integral part of the masonry construction.
- Extant features of the ammunition-delivery system, including overhead trolleys in shot magazines, narrow-gauge rail road tracks, and turntables, as well as openings in loading galleries for ammunition lifts.
- Extant features of the stabilized ruins of the primary fire-control stations, including the layout of the stations on the terreplein of Battery Potter, the standard design features of the stations, and the extant elements of the fire-control station for the Mortar Battery.

Materials

- Massive battery structure constructed of concrete made with "Rosendale" natural cement.
- The granite blocks used to construct the defensible entrance, and used on the cornice of the exterior walls; additional significance because they were reused from the "Fort at Sandy Hook."

- The exterior doors, including the steel-grate doors and gates, and the steel-clad wooden doors.

- The concrete-slab foundation for the former Mortar Battery's fire-control station, situated in the southwest corner of the battery's terreplein.

- The concrete piers for "Type A" range-finding instruments, on the concrete slab foundation of the former fire-control station for the Mortar Battery.

- The exterior cast-iron stairway added in 1915 to provide additional access to the terreplein of Battery Potter.

- The terraced concrete platform near the northwest corner of the battery's terreplein that was initially used as a range-finding pier, and was later used to launch weather balloons.

- The steel signal tower on the north side of the *chemin de rounde*.

Interior Elements

Plan

- The layout of interior galleries, rooms, and magazines – including the long transverse galleries and the expansive main gallery/boiler room and accumulator room – which conveys the function of the spaces, and the use of the two halves of the battery relative to the north and south emplacements.

- The design and elements of the loading galleries on the second story, especially the change in design from the north emplacement, which was constructed with an inclined arch ceiling, to the south emplacement, which was constructed with a flat ceiling using steel I-beams.

- The unique features that were built to accommodate the gun-lift mechanism, including niches in the walls of the first-story magazines and the second-story casemates that allowed access to the large bolts holding the gun-lift guide rails in place.

- The interior plan of the defensible entrance and the elements related to the defense of the battery, including gun loops with embrasures and gun ports with mounting shelves for Gatling guns.

Floors

- The flagstone floors in sections of the first story, and in the loading galleries on the second story.

- The extant elements of the ammunition-delivery tracks, including the rails and turntables in the galleries, and especially the gun metal/bronze turntables and rails in the magazine galleries.

Walls

- The niches in the concrete walls for the auxiliary lantern lighting, which had initially been planned as the primary light source for the battery.

- The granite walls in the second-story loading galleries.

- The granite blocks used in construction of the north and south gun-lift shafts, to better anchor the bolts for the mechanism.

Ceilings

- The vaulted concrete ceilings, which are characteristic of the construction methods.

- The granite ceiling of the north loading gallery, constructed with an inclined vault.

- The ceiling of the south loading gallery, which is by contrast supported with steel I-beams.

Doorways

- The arched doorways and arched wooden doors, including the double doors in the magazine galleries, and the single doors for the magazines and casemates.

Stairways

- Both of the north and south stairways from the first story to the second story, including the cast-iron stairways, which appear to be original.

- The spiral stairway from the second-story gallery to the terreplein, including the cast-iron spiral stairway.

Miscellaneous

- Elements of the ammunition hoist and overhead trolleys in the shell magazines.

- The remaining elements of the steam-powered boilers that powered the gun lifts, including the circular shaft in the concrete ceiling of the main gallery/boiler room (room 111) for the smokestack, and the extant water pipes on the north side of the main gallery.

Recommendations

PMIS #57952, "Repair Structural Elements for Safe Visitor Access at Batteries Gunnison, Potter & Mortar – Sandy Hook," notes that the rehabilitation of Battery Potter will include repairs to deteriorated and spalling concrete, as well as rehabilitation of the safety railings and the addition of platforms to the terreplein. The following recommendations specifically address the CDFs of Battery Potter identified in the preceding section. These recommendations should be used to guide the proposed rehabilitation, and continued use and interpretation, of Battery Potter.

Exterior Elements

- Retain and preserve the overall massing and configuration of the D-shaped concrete battery and the north and south emplacements. This should include the stabilization of spalling concrete surfaces, and the removal of vegetation growing on the concrete surfaces. The stabilization should take in to account that "Rosendale" cement was a primary component of the concrete, and repairs should be compatible with the character of that concrete.

- Erosion of the sand embankment has historically been a problem. Efforts to control the erosion should include replacing areas of loss with new sand, and management of the vegetation growing on the embankments. Where possible, the sand embankments should be rehabilitated to match the original grade and appearance. Overgrown vegetation should be removed, and new vegetation should be planted to match the historic plant materials where possible. The upcoming cultural landscape report (PMIS #10288) should address the best way to maintain and preserve the embankments that surround Battery Potter.

- The granite-block defensible entrance of Battery Potter should be retained and rehabilitated. The preservation of the façade should include repointing of the granite blocks following the recommendations of the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*. The roof of the defensible entrance also requires repairs and possibly replacement. The repairs should be performed with materials that resemble the original materials, but provide a better seal against water infiltration. The recommendation of the *Structural Analysis and*

Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery should be followed in this regard. The steel grate and gates and steel-clad wooden doors installed in the entrance doorway of the defensible entrance should be preserved.

- If feasible, the park should reinstall the "BATTERY POTTER" lettering over the steel gates of the defensible entrance. The 1904 bronze letters were a significant feature signifying the designation of the battery as "Battery Potter." The letters should be replaced with replica bronze letters based on the extant letters in the park's collection. Alternatively, the letters could be replicated using fiberglass (or "sign foam") painted to match the bronze letters.

- The rehabilitation and preservation of the masonry should include the retention of the *chemin de ronde* and the parapet wall. The vegetation growing in the perimeter walkway should be removed, and the spalling concrete of the parapet wall repaired. The stabilization of this feature may require the addition of drains at the base of the parapet wall.

- To reduce water infiltration into the interior of the battery, the terreplein and the roof of the superior slope should be repaired and possibly replaced. The repairs should be performed with materials that resemble the original materials but provide a better seal against water infiltration. The recommendation of the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery* should be followed in this regard. In addition, drainage from the roof should be promoted by clearing existing drains and pitching the new roofs towards the sides of the battery.

- The remaining portions of the primary fire-control stations are in ruinous condition. However, these structures are an important part of the history of Battery Potter, and significant to the interpretation of the battery and the coastal defenses. The condition of these structures continues to deteriorate, and interim efforts to stabilize and mothball them as advised by the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery* should be undertaken as soon as possible. The remains of the stations on the terreplein of Battery Potter should be retained and stabilized. If feasible, one or two of the stations should be rehabilitated for interpretive purposes. The extant elements of the Mortar Battery fire-control station building should also be stabilized and preserved.

- The exterior cast-iron stairway added to the southeast corner of the battery is in good condition and should be retained. The rehabilitation of the stairway should preserve the original elements of the stairway, and any elements added for stability and/or safety should be executed in compatible materials matching the existing design.

- Related structures west of Battery Potter, including the central power house and coal shed, and the two switchboard buildings, should be rehabilitated and preserved.

Interior Elements

- The interior of Battery Potter is subject to high humidity. Efforts to reduce this should include the previous recommendations to reduce water infiltration, and to improve air flow and ventilation within the battery. The ventilation recommended in the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery* would improve the air flow through the battery. The interior humidity levels should be monitored; additional vents could be added on the terreplein if necessary.

Plan

- The interior plan of Battery Potter should be retained and preserved, including the elements unique to the gun-lift mechanism and the defensible entrance. The rehabilitation of the interior spaces should not include the construction of any walls that would partition these rooms or affect the original plan of the interior.

- The plan and the extant elements of the loading galleries on the second story should be retained and preserved. The north loading gallery was altered to accommodate a stairway to the roof, but it still retains most of its original configuration and should be preserved. The south gallery retains original elements and should be preserved, including the iron ladder to the loading gallery. Access to the south loading gallery should be limited, since the iron ladder is severely corroded, and there are no safety railings at the loading-platform level.

Floors

- The floors on the first story of the battery include sections of flagstone, as well as extant elements of the ammunition-delivery tracks. These elements should be retained and preserved. Extant sections of track should be left in place; it is not necessary to replace missing sections. Repairs to the flagstone should be done with compatible materials.

Walls and Ceilings

- The interior walls and ceilings should be preserved, including the granite elements of the loading galleries. Repairs to the concrete should take into consideration the characteristics of the existing materials, and should be done with compatible materials. The lighting niches should not be covered. Rehabilitation of the granite surfaces should be confined to cleaning and repointing with a compatible mortar.

Doorways

- The arched doorways and the extant arched wooden doors in the interior of Battery Potter should be retained and preserved. Any repairs to the doors should be performed with in-kind materials. If feasible, the extant doors that are currently not hanging in the doorways should be rehabilitated and installed in their corresponding doorways.

Stairways

- The stairways from the first to the second story, and the spiral stairway from the second floor to the terreplein, should be retained and rehabilitated. The cast-iron elements of all the stairways appear to be original and should be rehabilitated. The spiral stairway should be rehabilitated and preserved for the interpretation of the site. However, the stairway should remain closed to the public, but accessible for viewing and interpretation. In addition, the iron ladder leading to the south loading gallery is the only extant element of its kind at the battery, and should be retained and preserved.

- The concrete stairway from the north loading gallery to the roof should be preserved and rehabilitated to maintain access to the roof from the interior of the battery.

Miscellaneous

- The extant elements of the ammunition-delivery system should be retained and rehabilitated. This includes sections of the railroad track and turntables, as well as the overhead trolleys in the shell magazines. The elements of the overhead trolleys should be rehabilitated as recommended by the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery.*

Accessibility

Compliance with ADA accessibility requirements should be part of the rehabilitation of Battery Potter. The existing structure can accommodate some of these needs, and portions of the battery can be made accessible. The following recommendations should guide the placement of ADA accessible facilities.

- The first story of Battery Potter should remain accessible. The existing concrete walkways should be improved to provide a stable surface from the parking lot to the battery. The first-story floors of the battery should be rehabilitated to provide an even surface for improved accessibility.

- Additional interpretive panels that describe the second story and terreplein level should be installed at the first story.

MORTAR BATTERY

Character-Defining Features

Exterior Elements

Design and Context

- The overall mass and design of the Mortar Battery as the prototype mortar battery of the Endicott System.

- The sand embankments covering the battery, and the native vegetation placed to hold the sand and camouflage the battery.

- The counterscarp wall as a defense for the battery, including the southwest counterscarp gallery.

- The general layout of the Mortar Battery, with the north and south ends that are mirror images of one another.

- The design of the mortar pits, including the layout for mortars on rotating carriages, and the sloped upper crest of the concrete walls.

- The telephone booths situated above the entrance gallery into each mortar pit, and the battery commander stations situated on the top of the battery, which are all relevant to the development of the Mortar Battery and the interpretation of the site.

- Elements of the antiaircraft defenses installed on the superior slope of the Mortar Battery, including three emplacements for 3-inch antiaircraft guns, and the concrete platforms for the .50-caliber machine-gun mounts. (One such platform has been located; three others may be extant.)

Materials

- The concrete structure, constructed of “Rosendale” natural cement.

- The sand cover and slopes, and native vegetation planted on the slopes, which were part of the original design and construction.

- The extant elements of the ammunition-delivery tracks in the entrance galleries and mortar pits.

- The extant steel brackets for implement racks on north wall of northwest mortar pit.

- The steel doors located in the doorways to the transverse galleries, which were altered during the 1944 changes to the battery, but which still display their original configuration.

Interior Elements

Plan

- The design and layout of the interior galleries and magazines, which performed important functions at the Mortar Battery.

- The interior plan, which reflects the division of the north and south ends of the battery.

- The interior plan of the switchboard room (room 112), and modifications to the interior galleries and magazines that reflect the change in use to the Harbor Defense Command Post during World War II.

- The north and south air locks, which underscore the change in use of the Mortar Battery, and illustrate the method of gas-proofing it, during World War II.

Floors

- The extant elements of the ammunition-delivery tracks in the south transverse gallery.

Walls

- The tile partition walls of the 1922 switchboard room in the north longitudinal gallery.

- The brick partition walls of the south air lock, and the adjacent partition at the southern end of the longitudinal gallery. Also the brick partition walls of the north air lock.

Ceilings

- The vaulted concrete ceilings, which are characteristic of the construction methods.

Doorways

- The gas-proof doorways and doors in the north and south air locks.

Recommendations

PMIS #57952 notes that the rehabilitation of the Mortar Battery will include the removal of invasive vegetation and the stabilization of concrete surfaces. The rehabilitation will also include the removal of hazardous materials and conditions from the interior of the battery. The PMIS statement also provides for the reestablishment of the elevated walkway along the top of the battery. At this time, the park has not made a final decision regarding the feasibility and safety of a walkway along the top of the battery. This issue should be further studied and addressed in the upcoming cultural landscape report (PMIS #10288). The following recommendations specifically address the CDFs of the Mortar Battery identified in the preceding section. These recommendations should be used to guide the proposed rehabilitation, and continued use and interpretation, of the Mortar Battery.

Exterior Elements

Design and Context

- The general plan and layout of the Mortar Battery should be retained and preserved as representative of the first battery of its type constructed for the Endicott System. The extant sections of the counterscarp wall and counterscarp galleries should be preserved, as well as the layout of the north and south ends of the battery, including the placement of the guns and carriages within each pit.

- The telephone booths and the battery commander stations should be retained and preserved. These structures appear to be stable, and should require minimal rehabilitation. Repairs to these structures should be performed with in-kind materials that are compatible with the original reinforced concrete. Extant steel doors currently resting against the exterior of the stations should be rehabilitated and rehung.

- Extant elements of the antiaircraft defenses should be retained and preserved.

Materials

- The rehabilitation of the Mortar Battery should include the stabilization of spalling concrete surfaces and the removal of vegetation growing on the concrete surfaces. The stabilization should take in to account that "Rosendale" cement was a primary component of the concrete, and repairs should be compatible with the character of that concrete.

- The sand and sod cover of the upper slopes and top of the battery should be stabilized and maintained. Erosion of the slopes has historically been a problem, and documents indicate that the sod was often replaced. Efforts to control the erosion should include replacing areas of loss with new sand and sod, and management of the vegetation growing on the embankments. The upcoming cultural landscape report (PMIS #10288) should address the best way to maintain and preserve the sand cover and vegetation at the Mortar Battery.

- Extant sections of the ammunition-delivery tracks in the entrance galleries and mortar pits should be retained.

- The rehabilitation of the Mortar Battery should include the retention of the steel doors hanging at the doorways to the transverse galleries. Repairs to the doors should be performed in-kind.

Interior Elements

Plan

- The overall plans and layout of the interior galleries and rooms of the Mortar Battery should be retained. The rehabilitation of the interior of the battery should preserve the original spaces, and also any later changes identified as CDFs. If the abatement of hazardous materials requires the removal of later elements, this work should be performed with attention and sensitivity to original materials and CDFs.

- The north and south air locks should be retained and rehabilitated. The preservation of these features should include the retention of the gas-proof doorways and steel doors. Any repairs to the elements of the air locks should be done with compatible materials. If the rehabilitation requires repointing of the brick walls, the mortar should be compatible with the existing materials.

Floors

- Extant sections of the ammunition-delivery tracks in the south transverse gallery should be retained and preserved.

Walls

- Some of the later partitions should be retained, including the tile walls of the switchboard room in the north longitudinal gallery, and the brick walls of the south air lock and the adjacent partition at the southern end of the longitudinal gallery. The partitions for the north air lock should also be retained. Any repairs to the interior wall surfaces should be performed with in-kind materials. The removal of hazardous material should avoid damaging the CDFs identified in the preceding section.

Ceilings

- The vaulted concrete ceilings of the Mortar Battery should be retained and rehabilitated. The rehabilitation of the arched ceilings should include the removal of deteriorated sections of the later ventilation system, as well as the removal of hazardous materials. The removal of hazardous materials on the ceilings should be performed in a manner that does not damage the concrete ceilings. Repairs to the concrete ceilings should be performed with compatible materials.

Accessibility

Compliance with ADA accessibility requirements should be part of the rehabilitation of the Mortar Battery. The existing structure can accommodate these needs, and the following recommendations should guide the placement of ADA accessible facilities.

- The gravel walkways into the Mortar Battery should be improved to provide a stable hard surface for improved accessibility. In addition, the concrete floors in the mortar pits should be stabilized and rehabilitated to provide safe access to the interior portions of the battery.

- The existing doorways in the north and south air locks of the battery should be wide enough provide adequate access to the interior of the battery. The thresholds of the air locks are approximately 6 inches above the floor level. Ramps should be installed to allow access over these thresholds to the interior of the battery.

BATTERY GUNNISON

Character-Defining Features

Exterior Elements

Design and Context

- The siting of Battery Gunnison relative to the range of the battery over the southern approach to New York Harbor.

- The overall design and layout of Battery Gunnison as a typical Endicott System battery with two disappearing gun emplacements and a traverse, which was covered by sand embankments and native vegetation.

- The extant concrete walls of the battery commander station.

- Extant elements of the communication system, including the “telephone” niches in the south and north walls of the traverse, the brass fittings for the speaker tubes, and the telephone boxes in the north and south emplacements.

- The 1943 alterations to the gun emplacements to modernize the battery and accommodate the 6-inch barbette-mounted guns.

- The south and north emplacements at Battery Gunnison, including the 6-inch guns mounted on barbette carriages.

Walls

- The exterior reinforced concrete walls of the battery, including the parapet walls and the walls of the traverse, including the niches for water hydrants.

- The bas-relief signs for the battery cast in the original concrete: one reading “ERETCTED 1907,” the other reading “BATTERY GUNNISON,” in which “Gunnison” has been carved away, presumably when the battery became New Battery Peck.

- The retaining walls of the loading platforms for both the south and north emplacements, including the extant features of the original walls and the 1943 additions.

Fenestration

- The windows and doorways in Battery Gunnison, which show original design and 1943 alterations.

- The steel doors in original and altered doorways, including original doors of steel grating and steel-plate doors, as well as the exterior gas-proof door to the plotting room.

- The steel shutters in windows and vents, including the original shutters on the southernmost west-wall window, and the 1943 gas-proof shutters on the vents.

Stairways

- The concrete stairways at both the south and north emplacements, including the extant elements of the stairway to the original loading platform, and the stairways to the 1943 loading platforms.

Walkways

- The concrete platform that forms the walkway along the west side of the battery.

Interior Elements

Plan

- The overall layout of interior rooms at Battery Gunnison, which includes original spaces and 1943 alterations.

Floors

- The concrete floors with a perimeter drainage system.

Walls

- The concrete walls with splayed recesses for light fixtures.

- The brick walls of the air lock.

- The extant steel implement racks on the walls of the powder passage (room 107).

Doorways

- The interior doorways between the shell room (room 105), the powder room (room 106), and the powder passage (room 107), including the 1943 gas-proof doors and extant evidence of original doors.

- The gas-proof doorways and doors between room 101, the air lock, and the plotting room.

Utilities

- The extant elements of the speaking-tube system, including brass fixtures in the telephone recesses of the traverse, battery commander station, and shell room.

- The shell hoists located in the north and south corridors, especially the north shell hoist, which has been restored to working order and greatly aids in the interpretation of Battery Gunnison.

Recommendations

PMIS statement 57952 notes that the rehabilitation of Battery Gunnison will include repairs to deteriorated and spalling concrete, and the rehabilitation of the walkways at the battery. The following recommendations specifically address the CDFs of Battery Gunnison identified in the preceding section. These recommendations should be used to guide the proposed rehabilitation, and continued use and interpretation, of Battery Gunnison as the only armed battery within Fort Hancock.

Exterior Elements

Design and Context

- The overall design and location of Battery Gunnison should be retained and preserved. This should include the layout of the north and south emplacements, the arrangement of the traverse (main block) of the battery between the two emplacements, and the recessed "telephone" stations along the exterior walls.

- The preservation of Battery Gunnison should include the rehabilitation of the concrete structure, and the management of vegetation growth on and around the battery. A landscape preservation professional should be consulted on the best way to maintain and preserve the sand embankments and vegetation that surround Battery Gunnison.

- The preservation of the battery should also include the retention of the extant elements of the battery commander station situated on the roof of the battery. If feasible, the missing elements of the station should be replaced to enhance the interpretation of the site.

- The 1943 alterations to the gun emplacements during the modernization of the battery should be retained and preserved. The preservation of the north and south emplacements should include the retention of the 6-inch guns mounted on barbette carriages. The preservation of these elements should include the rehabilitation of the concrete surfaces, and the continued maintenance of the guns and carriages. The 1943 improvements to the ammunition-delivery system at the battery included the construction of a concrete bridge between the traverse and each emplacement. The bridges deteriorated and were removed for safety reasons. If feasible, the bridges should be replicated based on historic photographs and plans, to enhance the interpretation of the site.

Walls

- Exterior reinforced-concrete parapet walls and the walls of the traverse of the battery should be retained and rehabilitated. Repairs to the concrete elements should be performed with in-kind materials, and should be compatible with the original materials. The rehabilitation of the exterior concrete walls should follow the recommendations of the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*.

- The preservation and rehabilitation of exterior concrete elements at Battery Gunnison should encompass original elements and also the 1943 additions to the retaining walls of the loading platforms for both the south and north emplacements. The rehabilitation of these elements should be performed as previously recommended.

Fenestration

- The windows and doorways at Battery Gunnison should be preserved and rehabilitated. The preservation of these elements should retain the extant original features as well as the 1943 alterations. All extant steel doors and shutters should be retained and rehabilitated. Repairs to these elements should include the application of rust-inhibiting coatings, and should be performed with compatible materials. Regular maintenance on the steel elements is recommended.

Stairways

- The concrete stairways at both the south and north emplacements should be retained and preserved, including the extant elements of the stairway to the original loading platform and the stairways to the 1943 loading platforms. The stairways leading to the loading platforms and the structure supporting the stairways should be stabilized and repaired. The repairs should be performed as recommended in the *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery*.

- If feasible, the metal double stairway leading up to the battery commander station should be reconstructed based on documentary and photographic evidence, to enhance interpretation.

Walkways

- The concrete platform that forms the walkway along the west side of the battery should be retained and rehabilitated. The rehabilitation should include the removal of vegetation growing between the cracks and against the battery walls, and repairs to the cracked and spalled concrete. Repairs to the concrete should be performed with in-kind materials.

- If feasible, the concrete bridges at both emplacements that connect the gun platforms to the shell-hoist platforms on the roof of the traverse should be reconstructed based on documentary and photographic evidence.

Interior Elements

Plan

- The existing plan of the interior rooms at Battery Gunnison, which includes original spaces and 1943 alterations, should be retained and preserved. Existing partitions should not be removed, nor should additional partitions be constructed. The rehabilitation of the battery and the retention of the existing plan allows for the interpretation of both the original battery and the modernization of the battery in 1943.

Floors

- The existing concrete floors with the perimeter drainage system should be retained and preserved. The floors appear to be in stable condition, and the rehabilitation of the battery should require minimal work on the floors. In addition, the extant drain covers should be retained and rehabilitated, and any missing drain covers should be replaced in kind.

Walls

- The interior walls of Battery Gunnison, including the concrete walls and the brick walls, should be retained and preserved. The preservation of the walls should include the retention of the splayed recesses for light fixtures and other original elements. Repairs to the interior walls should be performed with compatible materials.

- The interior wall and ceiling finishes were not analyzed for this report. However, the finishes appear to be compatible with the wall and ceiling materials, and are an important part of the maintenance of the interior spaces. It is recommended that the interior finishes be maintained.

Doorways

- The interior doorways and steel doors, including original elements and 1943 alterations, should be retained and preserved. The rehabilitation of these elements should include repairs with compatible materials. The steel elements of the doorways and doors should be regularly maintained and coated with rust-inhibiting coatings.

Utilities

- The extant elements of the speaking-tube system, including the brass fixtures in the telephone booths, the battery commander station, and the shell room, should be retained and preserved.

- The shell hoists located in the north and south corridors should be retained and preserved. The north shell hoist should continue to be maintained in working order. The shell hoist for the south corridor, currently in the museum collection, should be rehabilitated and placed on site. In addition, the park has in its museum collections ammunition tables for the shell hoists, which should be returned to the site to enhance interpretation.

Accessibility

Compliance with ADA accessibility requirements should be part of the rehabilitation of Battery Gunnison. The existing structure can accommodate these needs; the following recommendations should guide the placement of ADA accessible facilities.

- The concrete walkways around the perimeter of Battery Gunnison should be rehabilitated to provide a stable surface and improved access to the battery.

- The shell magazine and the powder room are currently accessible, and should remain accessible when the battery is open.

- Additional interpretive panels should be installed to describe the plotting room, the gun emplacements, and other inaccessible portions of the battery.

BIBLIOGRAPHY

PRIMARY SOURCES

Records of the Office of the Chief of Engineers, Record Group (RG) 77:

Fort at Sandy Hook, N.J.; General Correspondence, 1890 – 1892. Entry 96; RG 77; NAB.

General Correspondence and Record Cards, 1893-94. Entry 98; RG 77; NAB.

Name & Subject Index to Series 103 (Document Files),Sandy Hook (N.J.) Part I (1894-1903) and Part II (1904-1919), Sandy Hook (N.J.) Proving Ground; Commanding Officer and Proof Officers, Part I (1894-1910) and Part II (1910-1917). Entry 99; RG 77; NAB.

General Correspondence, 1894-1923. Entry 103; RG 77; NAB.

Correspondence, Blueprints, and Reports Relating to Defense, 1873 – 1918. Entry 225; RG 77; NAB.

Press Copies of Letters Sent by John Newton (Nov. 1868- Sept. 1877), H. M. Benham (Jan. 1880- July 1882), and G.L. Gillespie (July 1882-May 1884) relating to Fortification Projects, 1868-1877, 1880-1884. Entry 797; RG 77; NARA - Northeast Region (NY).

Press Copies of Letters Sent by John Newton relating to River and Harbor Projects and Fortifications, Dec. 1870- June 1873; April 1875 – October 1884. Entry 756; RG 77; NARA - Northeast Region (NY).

Letters and Reports Sent Relating to New York River And Harbor Projects And Fortifications, 1871-1889. Entry 762; RG 77; NARA - Northeast Region (NY).

Registers of Letters Received by John Newton and his successors relating to Rivers and Harbors and Fortifications, January 1871-March 1889. Entry 779; RG 77; NARA - Northeast-NYC.

Letters and Reports Received Relating to River and Harbor Projects, January 1871-March 1889. Entry 782; RG 77; NARA – Northeast Region (NY).

Letters and Reports Sent relating to Fortifications, 1878-1886. Entry 795; RG 77; NARA- Northeast Region (NY).

Correspondence Relating to Fortification Projects 1907 -1930. Entry 802; RG 77; NARA - Northeast Region (NY).

Press Copies of Letters Sent Relating to Fort Hancock. July 1889 – Dec. 1906. 4 Vols. (arranged chronologically). Entry 814; RG 77; NARA - Northeast Region (NY).

Letters and Reports Sent Relating to Gun and Mortar Batteries at Sandy Hook. 5 Vols. Entry 815; RG 77; NARA - Northeast Region (NY).

Letters Received relating to Fort Hamilton and Sandy Hook, 1901-1906. Entry 829; RG 77; NARA - Northeast Region (NY).

Lift Gun Battery, Sandy Hook, New Jersey (New York: United States Engineer Bureau). Bound volume of monthly reports from Sept. 1891 through March 1894 sent from Corps of Engineers at Sandy Hook to Col. Gillespie at the N.Y. Engineer Office. The New York Public Library, Call # VWN.

Miscellaneous Reports, 1892 - 1894, Engineer Bureau, Sandy Hook, New Jersey (New York: United States Engineer Bureau). Bound volume of miscellaneous reports and annual reports from 1891 through 1894 sent from Corps of Engineers at Sandy Hook to Col. Gillespie at the N.Y. Engineer Office. The New York Public Library, Call # VWN.

Mortar Battery, Sandy Hook, New Jersey (New York: United States Engineer Bureau). Bound volume of monthly reports from August 1891 through March 1894 sent from Corps of Engineers at Sandy Hook to Col. Gillespie at the N.Y. Engineer Office. The New York Public Library, Call # VWN.

Records of the Office of the Quarter Master General, Consolidated Correspondence File 1794 – 1915. Record Group (RG) 92:

Sandy Hook, N.J. Box #982; RG 92; NAB.

Fort Hancock, N.J. RG 92; NAB.

Records of U.S. Army Coast Artillery Districts and Defenses. Record Group (RG) 392:

Emplacement Books for Gun Batteries at Fort Hancock, N.J. Entry 222; RG 392; NARA - Northeast Region (NY).

Fort Record Book, Fort Hancock, N.J. Entry 224; RG 392; NARA - Northeast Region (NY).

Documents relating to the Gun Lift Battery, Sandy Hook, N.J. Entry 224; RG 392; NARA - Northeast Region (NY).

"History of Fort Hancock and of the Defenses of Sandy Hook," 1939. Entry 317; RG 392; NARA - Northeast Region (NY).

Major C.G. Bovis, Coastal Artillery Corps. "History of HECP [Harbor Entrance Control Post], Fort Wadsworth, New York." Copy at Gateway NRA, Sandy Hook.

"Report of Completed Works – Seacoast Fortifications, Sandy Hook, Fort Hancock, N.J. July 1, 1921, corrected May, 1944." RG 392; NARA - Northeast Region (NY).

Photographic records consulted:

Records of the Office of the Chief of Engineers, Record Group 77:

Fort Hancock and Sandy Hook, New Jersey. RG 77 F, box 2 of 38; NACP.

Fort Hancock and Sandy Hook, New Jersey. RG 77 F, box 5 of 38; NACP.

Cartographic records consulted:

Records of the Office of the Quarter Master General, Record Group 92:

Fort Hancock and Sandy Hook Proving Ground. 89 Records. RG 92; NACP.

SECONDARY SOURCES

Bearss, Edwin C. *Historic Resource Study, The Sandy Hook Defenses, 1857 – 1948, Gateway National Recreation Area, Sandy Hook Unit, New Jersey*. Denver: U.S. Department of the Interior, National Park Service, September 1983.

-----. *Historic Resource Study, Fort Hancock, 1895-1948, Gateway National Recreation Area, New York/New Jersey*. Denver: U.S. Department of the Interior, National Park Service, May 1981.

-----. *Historic Resource Study, Fort Hancock, 1948-1974, Gateway National Recreation Area, Sandy Hook Unit, New Jersey*. Denver: U.S. Department of the Interior, National Park Service, November 1982.

Bender, Donald E. *The Nike Missile System, A Concise Historical Overview.* Http://alpha.fdu.edu/~bender/N-view.html.

Chadwick, Ian. *Henry Hudson: Henry Hudson's Third Voyage 1609: The New World.* Http://www.ianchadwick.com/hudson/hudson_03.htm.

Clough, Harbour & Associates LLP. *Section 02080 Asbestos Removal, Gateway National Recreation Area, Sandy Hook Unit, Batteries Mortar & Potter*. Albany, NY: Clough, Harbour & Associates LLP for Einhorn, Yaffee, Prescott, September 2005.

A Dictionary of Military Architecture Fortification and Fieldworks from the Iron Age to the Eighteenth Century. Http://www.angelfire.com/wy/svenskildbiter/madict.html.

"History of DuPont and the Government." Http://www2.dupont.com/Government/en_US/gsa_contracts/Government_Projects.html.

Edison Coatings, Inc. *History of Rosendale Cement.* Http://www.rosendalecement.net.

Einhorn, Yaffee, Prescott. *Structural Analysis and Historic Characterization Battery Gunnison, Battery Potter, Mortar Battery, Sandy Hook Unit, Gateway NRA, New Jersey*. New York: Einhorn, Yaffee, Prescott, May 2005.

Ennis, Marie, PE. *Structural Conditions Assessment, Mortar Battery Tunnel Complex*, Sandy Hook, New Jersey. New York: Einhorn, Yaffee, Prescott, February 2006.

Environmental Assessment, Adaptive Use of Fort Hancock and the Sandy Hook Proving Ground Historic District. U.S. Department of the Interior, National Park Service in association with Sandy Hook Partners LLC, February 2002; revised July 2003.

Freeman, Joe C., et al. *Seacoast Fortifications Preservation Manual*. San Francisco, CA: Golden Gate National Recreation Area, 1999.

General Management Plan Amendment: Development Concept Plan and Interpretation Prospectus: Sandy Hook Unit, Gateway National Recreation Area, New York/New Jersey. U.S. Department of the Interior, National Park Service, January 1990.

General Management Plan, Gateway National Recreation Area, New York / New Jersey. U.S. Department of the Interior, National Park Service, August 1979.

Greenwood, Richard E. "Fort Hancock and the Sandy Hook Proving Ground Historic District," *National Register of Historic Places Inventory - Nomination Form,* June 28, 1976.

------. "Fort Hancock and the Sandy Hook Proving Ground Historic District," *National Register of Historic Places Inventory - Nomination Form*, revised November 9, 1982.

Harris, Cyril M. *American Architecture an Illustrated Encyclopedia*. New York: W.W. Norton & Company, Inc., 1998.

Hoffman, Thomas. *The Defenses of Sandy Hook.* U.S. Department of the Interior, National Park Service, Gateway NRA, Sandy Hook Unit.

-----. *Sandy Hook Lighthouse*. U.S. Department of the Interior, National Park Service, Gateway NRA, Sandy Hook Unit.

King, John P. *The British were the first Europeans in the Highlands.* Http://www.highlandsnj.com/ news/html/NewsDocs/Eurpoean%20Settlers.html.

Kroll, Naomi D., and Sharon K. Ofenstein. *Historic Structure Report, Building 25, Enlisted Men's Barracks, Fort Hancock, New Jersey, Sandy Hook Unit, Gateway National Recreation Area*. Lowell, MA: U.S. Department of the Interior, National Park Service, February 2002.

Lee, James J. III. *Officers Club, Building No. 114, Sandy Hook Unit, Gateway National Recreation Area, Fort Hancock, New Jersey, Historic Structure Report.* Lowell, MA: U.S. Department of the Interior, National Park Service, Northeast Region, Historic Architecture Program, 2006.

Lewis, Emanuel Raymond. *Seacoast Fortifications of the United States: An Introductory History*. Washington D.C.: Smithsonian Press, 1970.

McKee, Harley J. *Introduction to Early American Masonry Stone, Brick, Mortar, and Plaster*. Washington, D.C.: National Trust for Historic Preservation, 1973.

Rose, Theodore F., H.C. Woolman, and T.T. Price. *Historical and Bibliographical Atlas of the New Jersey Coast*. Philadelphia, PA: Woolman & Rose, 1878.

Rutenbeck, Todd. *Stabilization Investigations, Historic Concrete Batteries, Fort Hancock, Sandy Hook Unit, Gateway NRA, New Jersey*. Denver: Bureau of Reclamation, June 1990.

Salter, Edwin, and George C. Beekman. *Old Times in Old Monmouth County, NJ*. Freehold, NJ: James S. Yard, 1890.

Sullivan, Judith Q. *Building 32, Quartermaster's Storehouse, Fort Hancock, New Jersey, Sandy Hook Unit, Gateway National Recreation Area*. Lowell, MA: U.S. Department of the Interior, National Park Service, Historic Architecture Program, 1993.

Weeks, Kay D., and Anne E. Grimmer. *The Secretary of the Interior's Standards for the Treatment of Historic Properties, with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*. Washington, D.C.: U.S. Department of the Interior, National Park Service, 1995.

Williams, Norma E. *Cultural Landscape Report for Proving Ground and Wartime Expansion Areas*. Brookline, MA: U.S. Department of the Interior, National Park Service, Olmsted Center for Landscape Preservation, 1999.

APPENDICES

APPENDIX A.

Fiscal Year 1892 Annual Report for Fort at Sandy Hook, Mortar Battery No. 1, Gun Lift Battery No. 1, Sandy Hook, New Jersey

Lt. J.G. Warren to Lt. Col. George L. Gillespie, June 30, 1892
Fiscal Year 1892 Annual Report, p. 7
<u>Miscellaneous Reports, 1892 - 1894, Engineer Bureau, Sandy Hook, New Jersey</u>
United States Engineer Bureau, New York

U. S. ENGINEER OFFICE,

SANDY HOOK, N. J.,

June 30th, 1892.

LIEUT. COLONEL G. L. GILLESPIE,

Corps of Engineers, U. S. A.,

Army Building,

New York City.

Colonel:

I have the honor to submit herewith a report showing the progress upon the works of construction and improvement which I have carried on under your immediate orders at Sandy Hook, N. J., during the fiscal year ending June 30th, 1892.

I. FORT at SANDY HOOK, N. J.

In charge of Lieut. Col. G. L. **GILLESPIE**, Corps of Engineers, U.S.A.

1st Lieut. J. G. WARREN, Corps of Engineers, Assistant from August 12, 1891.

1st Lieut. HARRY TAYLOR, Corps of Engineers, Assistant until October 1, 1891.

This casemated work, begun in 1857, commands the southern approaches by sea to the Harbor and City of New York, and is also designed to prevent the occupation of Lower New York Bay as an anchorage by an enemy's fleet.

This work, located as shown on the general map, Plate 1, is the most advanced in position of all the defenses of the southern approaches by sea to the harbor and City of New York.

The entrance channel to the northward of the Hook is of sufficient depth at high water for the passage of the largest and most powerful armored vessel yet built or designed.

The occupation by an enemy's fleet of the large bay just within the Hook would prevent all egress from the harbor southward to the sea, and would effectually close the main outlet from the city.

Masonry construction was suspended in 1869, since which time nothing has been done toward carrying out the old plans.

Plans have been prepared for the new works of defense proposed for this site and during the fiscal year ending June 30th, 1891, work was begun on one half-sunken Mortar Battery with ditch defense, for sixteen 12-inch breech loading rifled Mortars, and upon one 12-inch Gun Battery with hydraulic lifts, for two 12-inch breech loading high power steel rifles.

The construction of these works has been continued throughout the year as follows:

II. MORTAR BATTERY No. 1.

The Mortar Battery, situated adjacent to and eastward of the Main Light, one mile south of the extreme northern end of the Hook, as shown on general map, Plate 1, was begun in November, 1890, under instructions of the Chief of Engineers, dated August 8th and September 13th, 1890, in accordance with plans of the Board of Engineers, dated September 28th, 1888.

From the Appropriation made by Act of Congress, approved August 18th, 1890, for Gun and Mortar Batteries, an allotment of $201,000 was made for its construction.

At the close of the last fiscal year the condition of the work was as follows: About 30,000 cubic yards of sand had been excavated, completing the excavation for the gun pits, passage ways, and magazines. No masonry had been constructed, but everything was in readiness for it, the machinery set up and all other preparations made for the rapid and economical manufacture and deposit of concrete.

On July 13th, 1891, the construction of concrete masonry was commenced on the retaining walls of the northeast gun pit; these being completed, the retaining walls of the northwest gun pit and part of those of the north entrance were constructed. In September the work was transferred to the southern end of the battery and continued until December 23rd, when the manufacture of concrete was stopped by cold weather. During the winter months a small force was kept employed at excavating sand for filling in the embankment around the gun pits on the southern end of the battery. On April 11th, 1892, the concrete plant was started again and has been in constant operation since that date. At the close of the fiscal year the concrete masonry of the battery, excepting the floors of the magazines and passages, the sloping concrete surface capping, the retaining walls, and the counterscarp wall and galleries, was completed.

The line of the ditch was cleared of undergrowth and stumps, and graded ready for the foundations of the counterscarp wall.

The progress sheet, Plate II., hereunto appended, shows the masonry constructed during the year and also the progress for each month.

There were constructed during the year, 13,025 cubic yards of concrete; the total number of cubic yards in the completed work will be 23,886.30 c. yds; the masonry is therefore .55 completed.

The work is being done by hired labor; materials are purchased after inviting sealed proposals according to law.

The following contracts are in force:

1. With the Lawrence Cement Company, dated December 29, 1890, (expired January 1st, 1892, extended to August, 1892) approved by the Chief of Engineers, January 12th, 1891, for the delivery of 31,000 barrels of cement, at $1.02 per barrel.

2. With John A. Bouker, dated December 29, 1890 (expired January 1st, 1892, extended to November 1, 1892), approved by the Chief of Engineers January 8th, 1891, for the delivery of 20,000 cubic yards of broken granite, at $1.63 per c. yd.

Under the foregoing contracts there had been delivered up to the close of the fiscal year 18,626 barrels of cement and 11,983 cubic yards of broken stone.

The following tabular statements show in detail the cost of the work, also the average daily number of employes of each class for the year, and the average plant in daily use for the same period:

I. COST of MATERIAL.

	Cement per bbl.	Broken Stone per c. yd.	Sand per c. yd.
On scows or canal boats alongside of dock..........	$1.02	$1.63	
Unloading into cars	.0227	.1211	
Hauling to yard or shed	.0032	.0193	
Storing in yard or shed	.0161	.0273	
Hauling sand	-	-	$0.1181
Cost of material delivered at works	$1.0620	$1.7977	$0.1181

II. COST of MATERIAL and MANUFACTURE of ONE CUBIC YARD of CONCRETE:

Composition: 1 cement, 2 sand, 5 broken stone.

Note: One charge of the mixer is equal to 1.05 c. yds. of masonry in place, machine mixed and deposited by derrick.

	Material.	Manufacture.	Total cost.
Broken stone, 0.92 c. yds.	$1.6539		
Cement, 1.43 bbls.	1.5187		
Sand, 0.37 c. yds.	0.0437		
Charging and running mixer	-	$0.29310	
Delivering under derrick	-	0.08315	
Hoisting	-	0.11224	
Placing and tamping	-	0.22838	
Making and setting up forms	-	0.12286	
Lumber and nails	-	0.06532	
Cost per cubic yard	$3.2163	$0.90505	$4.12135

III. TOTAL COST per One Cubic Yard of Masonry, including Superintendence, Purchase and Maintenance of Plant, Repairs to Buildings and General Work:

Concrete masonry, 13,025 c. yds. at $4.12135	$53,680.58
Excavation	814.92
For purchase and maintenance of plant 13025.00 c. yds. at $0.59597	7,111.26
For work of plasterers finishing walls of magazines and gun pits	166.53
For repairs to buildings	1,605.74
For maintenance of public animals	287.92
For superintendence and office expenses	2,496.95
TOTAL COST	$68,748.15

Masonry constructed during the year, c. yds.: 13,025.00

Total Cost of Masonry constructed: $68748.15

COST per ONE Cubic Yard: $5.27816

IV. COST per ONE Cubic Yard of Masonry, including also the cost of Sand Cover of Embankment and clearing and grading Ditch:

Total cost of masonry constructed	$88,748.15
Cost of excavating, hauling, hoisting and placing 9449. c. yds. sand at $0.22636	2,144.64
For labor of clearing ditch of undergrowth and stumps and for grading	584.03
TOTAL COST	$71,476.82

TOTAL COST per One cubic yard of Masonry ... $5.48766

The cost for one cubic yard of concrete masonry including all the work done since the starting of construction in the last fiscal year is given below:

13025.00 c. yds. masonry and sand embankment constructed at a total cost of $ or $ per one cubic yard.

V. AVERAGE DAILY NUMBER of EMPLOYES of each class for the year:

Overseers	1.5	Blacksmiths	.5
Locomotive Engineer	.17	Plasterers	.17
Engineers	1.5	Painters	.475
Firemen	1.25	Carpenters	4.5
Master Laborers	2.6	Bricklayers	.0006
Watchman	.08	Laborers, daily	40.3
Laborers, monthly	.33	Rigger	.17

VI. AVERAGE PLANT in daily use for the year:

Hoisting engines	1.75	Flat cars	4.75
Stationary engines	.83	Derricks	2.0
Concrete mixers	.75	Horses	2.4
Dump cars	4.4		

Observations made during some unusually high tides in October, 1891, showed that the water in the sand reached a level higher than that assumed when the battery was originally planned. For this reason it was determined to raise the battery two feet, as this could be done at but trifling additional cost, would unquestionably add to the security of the foundations, and at the same time simplify the drainage of the battery and the construction of the mortar platforms.

VII. GUN LIFT BATTERY No. 1.

Gun Lift Battery No. 1, arranged for two 12-inch high power guns, is situated on the east shore of the Hook, 1,100 feet south of the south eastern bastion of the old fort, as shown on general map, Plate 1.

The estimated cost of the masonry and sand covering for a battery of this type containing two guns is $283,000 (Report of Board of Engineers, September 8, 1890).

The estimated cost of a single gun lift, including hydraulic ram and fittings is $61,980, and that of the hydraulic power for not exceeding two lifts is $50,570., making the total estimated cost of the mechanism for a single lift $112,550., or for two lifts $174,530 (letter from Chief of Engineers, February 20, 1890; 1272-1890). Trial may show that for the proper maneuvering of two lifts an additional pump will be required, at an estimated additional cost of $2,590.

The estimated total cost of a completed battery of this type for two guns is therefore $457,530.

Excavations for the foundations of the northern half of the battery began in January, 1891, under instructions from the Chief of Engineers, dated February 20, 1890, and September 13, 1890; and on April 3, 1891, further instructions were received for the construction of the southern half of the battery.

From the appropriations of August 18, 1890 and February 24, 1891, for Gun and Mortar Batteries, allotments of $154,000 and $129,000 respectively, were made for the construction of the masonry and sand covering for one battery complete; and from the appropriation of September 22, 1888, for Armament of Fortifications, an allotment of $112,500 was made for the construction of the mechanism and hydraulic motors for one lift.

At the close of the last fiscal year the condition of the work was as follows:

The excavation for the foundations of the northern half of the battery was completed, also part of that for the southern half, and about 3055.00 c. yds. of concrete had been placed in the foundations of the northern half of the work; the pit for the accumulators was constructed and the curbs for the ammunition hoists were sunk.

The construction of concrete masonry was continued throughout the year, excepting the period from December 23, 1891, to April 13, 1892, during which cold weather prevented masonry construction. At the close of the fiscal year the masonry of the battery had been carried to an average height of 32 feet above the bed of the foundations or to reference (39.0); the sand core between the exterior 20-foot wall and the interior 10-foot wall had been filled and compacted. The settlement was done by the use of water, and averaged about 15 per cent.

The total amount of masonry constructed during the year was 29,875.5 cubic yards; previously reported, 3055.00 cubic yards; total to June 30, 1892, 32,930.50 cubic yards. There remain to be constructed 10,187.5 cubic yards of masonry; the masonry construction is therefore .76 completed.

The masonry and earth construction are in progress by hired labor, after the purchase of materials by sealed proposals, invited according to law.

At the beginning of the fiscal year the following contracts were in force:

1. With the Lawrence Cement Company, dated December 29, 1890 (expired January 1, 1892, extended to August 1, 1892), approved by the Chief of Engineers January 12, 1891, for the delivery of 31,000 barrels of cement, at $1.02 per barrel.
2. With John A. Bouker dated December 29, 1890 (expired January 1, 1892, extended to November 1, 1892), approved by the Chief of Engineers January 8, 1891, for the delivery of 21,000 cubic yards of broken granite, at $1.63 per cubic yard.

3. With John Satterlee, dated March 26, 1891 (expired January 1, 1892, extended to August 1, 1892), approved by the Chief of Engineers, May 1, 1891, for the delivery of 5,000 tons of large stone, at 79 cents per ton. Closed May 18, 1892.

4. With the Continental Iron Works, dated February 29, 1891 (expired January 1, 1892, extended to July 1, 1892), approved by the Chief of Engineers March 6, 1891, for the construction of the mechanism of the hydraulic gun-lift, at an aggregate cost of $93,750.

Supplementary articles of agreement were made with the Continental Iron Works, August 17, 1891 (approved by the Secretary of War September 11, 1891), for certain changes to be made in the different parts of the mechanism at an additional cost of $9,350, and on May 17, 1892, other supplementary articles of agreement were entered into with the Continental Iron Works (approved by the Secretary of War June 29, 1892), for additional parts of the mechanism, tanks for accumulator pit and for supplying the hydraulic system with water, and for the parts of the southern lift which are necessarily built into the masonry and which would not be subject to modification.

Under the foregoing contracts there had been delivered up to the close of the fiscal year 23,695 cubic yards of broken stone, and 34,055 barrels of cement.

The contract with John Satterlee was completed March 17,1892.

The following tabular statements show in detail the cost of the work, also the average daily number of employès of each class during the year and the average plant in daily use for the same period.

I. COST of MATERIAL:

	Cement per bbl.	Broken Stone per c. yd.	Large Stone per ton	Sand per c. yd.
On scows or canal boats alongside of dock	$1.02	$1.63	$0.79	
Unloading into cars	.0227	.1211	.398	
Hauling to yard or shed	.0032	.0193	.101	
Storing in yard or shed	.0183	.0425	-	
Testing cement	.0094	-	-	
Placing large stone in wall	-	-	.197	
Hauling sand	-	-	-	$0.103
Total Cost	$1.0736	$1.8129	$1.484	$0.103

Cost per cubic yard large stone in wall, $3,305.

II. COST of MATERIAL and MANUFACTURE of One Cubic Yard of concrete. Composition: 1 cement, 2 sand, 5 broken stone.

	Material.	Manufacture.	Total cost.
Cement, 1.43 bbls.	$1.5337		
Broken stone, 0.92 c. yds.	1.6785		
Sand, 0.37 c. yds.	.0382		
Charging and running mixer		$0.2538	
Delivering under derrick		.08554	
Hoisting		.13687	
Placing and tamping		.17109	
Making and setting up forms		.16431	
Lumber and nails		.06460	
Cost per cubic yard	$3.2504	$0.8762	$4.1266

NOTE: One charge of the mixer is equal to 1.05 c. yds. of masonry in place, machine mixed and placed by derrick.

III. COST per ONE Cubic Yard of Masonry: Concrete and Large Stone combined.

23815. c. yds.	Concrete masonry at $4,1266	$98,174,979
5512. "	Large stone at $3,305	18,217,160
	Total	$116,392,139

29,766.80 c. yds.	Masonry, concrete and large stone combined at $3,9101	$116,392,139

IV. TOTAL COST per One Cubic Yard Masonry, including Superintendence, Granite Masonry, Purchase and Maintenance of Plant, Repairs to Buildings, Clerk Hire, Office Expenses and General Work.

23,815.00 c. yds.	Concrete masonry at $4.1266......	$98,174.979
5,512.00 "	Masonry of large stones at $3.305	18,217.160
108.70 "	Granite masonry, setting, at $7.46	810.940
270.40 "	Granite, for cutting only, at $32.67	8,889.750
5,127.00 "	Excavation for foundations at $0.251	1,284.660
	For purchase and maintenance of plant and repairs to buildings:....... 29,875.5 c. yds. at $0.7452	22,263.400
	For work of plasterer finishing walls of casemates and galleries	391.470
	For purchase and maintenance of public animals	1,131.450
	For general work	8,555.570
	For office expenses &c.	2,700.510
	For superintendence	2,046.00
	TOTAL COST ...	$164,465.289

Masonry constructed during the year, 29875.5 c. yds.
Total cost of masonry constructed, $164465.289.
COST per ONE Cubic Yard, $5.505.

The cost for One Cubic Yard of masonry including all the work done since the beginning of construction in the last fiscal year is as follows: 32950.5 c. yds. Masonry constructed at a total cost of $ or $ Per One Cubic Yard.

V. AVERAGE daily number of employes of each class for the year:

Overseers	1.2	Laborers, monthly	.75
Clerk	1.	Blacksmiths	1.60
Draughtsman	.83	Plasterers	.17
Recorder	.75	Painters	.70
Cook	.75	Rigger	.08
Locomotive engineer	.7	Carpenters	6.08
Engineers	3.	Bricklayers	.0108
Firemen	1.2	Stone cutters	9.25
Master laborers	3.	Laborers, daily	66.40
Watchman	.17		

VI. AVERAGE plant in daily use for the year:

Locomotives	1.	Dump cars	9.25
Hoisting engines	3.6	Flat cars	8.4
Stationary engines	1.5	Derricks	5.25
Concrete mixers	1.5	Horses	2.25

The cost per unit of concrete and per unit of concrete with large stone, is the cost per unit for the work of the fiscal year only, inclusive of the proportion of the total cost of plant corresponding to proportion of the work completed. The figures have been made and verified with great care as being of possible future value in making estimates for similar work in other localities. An examination of the figures shows the large relative cost of the services of carpenters, lumber, &c., for building the forms, centering for concrete arches &c. In this connection experience here proves that for this purpose clear white pine, dressed both sides, is the best; spruce, used largely in this work, can be utilized but once, the moisture in the concrete causing it to warp badly, so that while the first cost is much less than that of pine, the final expense is increased. Norway pine is but little better.

The cost for mixing and placing is somewhat higher than it should be; this because of the locality, which, while it renders the regular supply of concrete material difficult, necessitates the constant maintenance of a full working force.

During the construction of the work the original plans have been modified from time to time; these modifications, including no radical changes in its general design, were the natural result of experience gained in constructing a work essentially differing from any now in existence.

1. In accordance with suggestion of the Chief of Engineers made on September 16, 1891, during his inspection of the work, it was decided to cap the piers, containing the seats for the locking bolts of the cage, with granite blocks, and to construct the coping around the gun pit at the level of the terreplein, and containing the buffer cylinders of granite also, this to be carried 15 feet to the rear of the rear wall of the pit, and 10 feet on the sides and to the front; this involved the substitution of granite for concrete in the soffit and walls of the loading gallery for a corresponding length. The material for the work was taken from the old stone fort, and an average force of 18 stone cutters was employed in cutting and setting the stones. The condition of the stone work at the close of the year is as follows: The walls and

the arch of the loading gallery are set, also the coping above the arch; the piers for seats of the locking bolts are set, and the stones for the coping of the north lift are finished, and one-third of the amount required for the south lift. The total amount of stone cut and set at the close of the fiscal year is 270.4 c. yds. the cost per yard, including moving the stone, is $33.65; the amount yet to be cut and set is 121.2 c. yds.

2. The pit for the accumulator well, sunk 4 1/2 feet below the level of water in the sand, failed to exclude the water, and numerous expedients having failed to remedy the defect the pit was finally lined with a steel tank, 20 ft. by 10 ft. x 5 ft.

3. On January 19, 1892, plans and estimates for a defensible entrance to the battery were submitted to the Chief of Engineers, approved February   1892, and instructions given for a further study, with a view to providing a flank defense for the entire battery. After mature consideration it was decided that all the conditions requisite to the defense of the work by its garrison would be sufficiently fulfilled by placing a "*chemin de ronde*" at the foot of the superior slope on the curved face of the battery, supplemented by wire entanglements surrounding the work and placed at the foot of the sand slope. In order that the musketry fire from the *chemin de ronde* should be effective, it was necessary to remove a portion of the sand slope covering the exterior wall; to compensate for the loss of cover thus involved, the vertical portion of the exterior wall was raised four feet from reference

(30.0) to (34.0) thus drawing forward the sloping part of the wall and increasing its thickness proportionally.

4. On May 28, 1892, a special report with plans and estimates for a modification in the loading gallery for the southern lift of the battery was submitted to the Chief of Engineers and by him approved. The modification substitutes a horizontal iron cover of I beams and plates for the full centre arch of the original plan, and gives additional head room, equal strength and protection, at a much reduced cost.

The battery, with such of the modifications as are external, is shown in the accompanying isometric drawing, appended and marked "Plate III;" and the masonry constructed during the year, also the progress for each month, is shown on the appended progress sheet, "Plate IV."

The Continental Iron Works commenced the delivery of the parts of the gun lift mechanism at Sandy Hook, October 22, 1891, and during November, 1891, put in place and adjusted the locking bolt seats and their attachments, i. e., the stanchion guide rails, wedge blocks and bases; also the hollow guide rails of the lower section of the gun pit. During the winter months the work of constructing, assembling and testing the several parts of the mechanism was carried on as expeditiously as possible at the yard of the Continental Iron Works, Brooklyn. On February 23, 1892, work was resumed at Sandy Hook, setting and adjusting the accumulators and from that date until the close of the fiscal year has been prosecuted vigorously. On March 10, 1892, the cage with locking-bolt mechanism attached, was inspected at the works in Brooklyn, and the operation of the locking-bolt mechanism tested satisfactorily; the cage was then taken apart and shipped to Sandy Hook March 25, 1892. At the close of the fiscal year all the parts of the mechanism were completed and delivered at the work, and all the parts of the lift mechanism proper were in place. A small amount of work remains to be done in finally adjusting the parts of the ammunition lift and hydraulic rammer, but the contract was completed as far as the condition of the masonry permitted. The delay has been caused by the substitution of granite for concrete, as previously reported, and was in the interest of the government.

It had been expected that the test of the mechanism, with the gun in place, could be made by July 1, 1892, but unforeseen causes have delayed matters so that the test can hardly be made before August 1, 1892.

On June 27, 1892, the accumulators were successfully raised and lowered. Power was furnished by one of the pumps and one boiler, with 72 pounds steam pressure. This trial demonstrated the verticality of the accumulator rams and cylinders, the proper adjustment of the guides and packing, the ample power of the boilers and pumps, and the perfect action of the appliance for regulating the velocity of fall of the accumulators when nearing the lowest point.

The principal cause of delay was the difficulty in making the connection between the platform of the cage and the pintle plate of the gun carriage, designed and manufactured by Messrs. Schneider & Co., Creusot, France, for use in connection with the lift. The under surface of this pintle plate is very irregular, and was probably intended by the maker to be bedded in concrete; it has required over two weeks' constant labor to chip a bed for it on the upper surface of the platform. All the parts of this gun carriage are now on the upper surface of the battery and will be assembled, with the assistance of the Ordnance Department, on or before July 15, 1892.

Preparations have been made for mounting the 12-inch B. L. rifle upon the carriage, as soon as the latter is ready to receive it.

It is but just to the Continental Iron Works to state that, in the execution of their contract they have displayed most creditable zeal; the workmanship and material is of the highest character and they have spared no effort to insure the success of this first American mounting for a modern high power gun.

The engineer barracks, boarding house and other old buildings pertaining to the old fort have been economically repaired and kept in a habitable condition; the seating capacity of the mess room having proved insufficient, the old life saving station turned over to the Engineer Department in 1891 was moved to the boarding house and utilized as an addition to the mess hall.

Under authority from the Chief of Engineers, dated August 27, 1891, a new building for office purposes was erected at a cost of $1,392.57 and furnished at an additional cost of $155.65. The building was erected by hired labor and materials purchased under sealed proposals invited according to law. The site is indicated upon the general map, Plate I.

On   a contract was made with Mr. Rudolph (approved by the Chief of Engineers,   1892), for the construction of a frame dwelling at Sandy Hook, N. J., for general use of the Engineer Department. This building was rendered necessary by the isolated situation. It is often necessary for officers and others connected with the works, to remain over night at Sandy Hook, and while the officers of the Ordnance Department on duty at the Proving Ground, have courteously extended all aid in their power, their quarters were often over-crowded. The building is now inclosed and will be completed on or before August 1, 1892. The site is indicated on the general map, Plate I.

THE PLANT:

The plant for the construction of the foregoing works consists of

1. The wharf plant;

2. The construction railroad connecting the wharf with the sites of the several works;

3. The plant for the manufacture and deposit of concrete at the batteries.

The general arrangement of the entire plant is shown in the accompanying drawings:

General map of northern end of the U. S. Reservation, showing position of works &c., Plate I.

Arrangement of plant at Gun Lift Battery, No. 1., Plate V.

Arrangement of plant at Mortar Battery No. 1., Plate VI.

The Wharf Plant: The wharf plant consists of a pier 30 ft. by 80 ft. connected with the old crib wharf by a bridge 32 ft. by 170 ft.; the whole supported on piles. The southern end of the pier is covered by a store house capable of containing one barge load of about 1,500 barrels of cement, and is designed for use when the hoists are not available, and in wet weather. The southern side of the bridge is provided with one derrick for discharging cement and loading it direct upon the cars; the northern side is provided with two derricks for the handling of broken stone. Steam power is furnished by one Lidgerwood hoisting engine with double friction drum, 6 3/4"x 10" and one single hoisting engine No. 4. The construction road branches in three parallel tracks near the head of the bridge, any one of which can be reached by the derricks.

The rolling stock consists of

1 H. K. Porter & Co. Locomotive No. 20.

18 Rotary Dump Cars (side) 3 cubic yards capacity.

2 Rotary Side Dumping Cars, 1 1/2 cubic yards capacity.

21 Flat Cars.

This plant has handled during the year:

35,677.90 cubic yards broken stone.

52,681. bbls. cement.

8110. tons large stone.

And delivered the same at the works, an average haul of 3150 feet and, in addition, all the lumber and other material which has been used.

The construction track is of 30-pound steel rails.

The plant at the batteries is of the same general design; that at the Gun Lift Battery No. 1, having double the capacity of that at the Mortar Battery.

The drawings are self explanatory.

The concrete material from the wharf is stored: the stone in the bins, the cement in the sheds, as shown in the drawings.

Galleries are run under the stone bins provided, at suitable intervals, with sliding trap doors. A car arranged with compartments, to contain the materials for one charge of concrete runs into the gallery by gravity, and receives through one of the traps the broken stone; it is then hauled by the winch head of the hoisting engine (for derricks No. 1 & 2 at the Gun Lift) under the hopper on the mixing platform, where it receives the cement and sand, thence over the mixer and discharged. The water is supplied from a reservoir containing the exact volume for the charge, through the hollow trunnion of the mixer.

The mixers are cubical boxes four feet on each edge, constructed of 1/4-inch steel and 3-inch angle irons; they are rotated by 3-inch steel shafts passing through diagonally opposite ~~opposite~~ corners and securely fastened by iron castings. To this shaft is keyed a worm wheel of 40 teeth, 1 1/2-inch pitch, operated by a worm of 1 1/2-inch pitch, having five complete turns and bored to fit the worm shaft, 2 1/2 inches diameter.

When this apparatus was first set up difficulty was found in starting the mixers and the engine suffered from the great strain thrown upon it while both mixers were thrown in gear. This trouble was entirely obviated by using a counter shaft with two heavy fly wheels taken from old air compressors, and located as shown on Plate V.

While the results obtained by these mixers have not been quite satisfactory, it is interesting to note that over 42900. cubic yards of concrete were made during the year by the three mixers, and that the average daily delivery by each mixer was about 110 cubic yards. The operating engine used was a Lidgerwood horizontal 8 1/4"x 10" 15 H. P.

The worm gearing is not recommended for this purpose. It is difficult to keep the worm shaft and the mixer shaft properly aligned, and any error in the alignment results in cutting of the gear, which cannot be stopped when once under way. Toothed gearing of a suitable design would be more economical.

The mixers are turned at a speed of 8 turns per minute; 18 turns are given for mixing the charge.

The concrete is discharged from the mixer into concrete boxes and hauled by steam under the derricks for deposit in place, as desired.

IV. TORPEDOES for HARBOR DEFENSE.

Construction of Torpedo Shed at Sandy Hook, N. J.

Plans and estimates submitted April 3. 1891, for the construction of a suitable building for the storage at Sandy Hook, N. J. of the Torpedo material for the submarine defense of the southern entrance of New York harbor, between Sandy Hook and Coney Island were approved by the Secretary of War April 9, 1891, and the sum of $9000.00 was allotted for the work from the appropriation for "Torpedoes for Harbor Defense," Act of February 24, 1891.

The location of the building is shown upon the general map, Plate I.

The general character of the building is as follows: Brick building 90 feet by 40 feet inside; walls 1 foot thick and 10 feet high under the eaves, having a slate roof supported by 8 iron trusses; the building has a concrete floor 6" thick, and the track of the construction railroad from the Engineer wharf runs through the building from end to end. On either side of the track are racks of 4"x 8" timber, arranged for the storage of buoyant-torpedo cases in two tiers. A suitable store room to be provided with shelves &c. for the storage of the smaller parts of the system is placed in the southeastern corner of the building, and it is

APPENDIX B.

Fiscal Year 1893 Annual Report of the Chief of Engineers, Gun and Mortar Batteries, Mortar Battery No. 1, and Gun Lift Battery No. 1, Sandy Hook, New Jersey

Lt. Col. George L. Gillespie to Brig. General Thomas L. Casey, Chief of Engineers, July 8, 1893
File 3259; F.Y. 1893 Annual Report; General Correspondence and Record Cards, 1893-94
Entry 98; Record Group 77; National Archives Building, Washington, D.C.

File with 3209.

pp. 604-617

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX No. 1.

GUN AND MORTAR BATTERIES—TORPEDO SHED, NEW YORK HARBOR.

REPORT OF LIEUT. COL. GEORGE L. GILLESPIE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

IMPROVEMENTS.

a. Mortar battery.
b. Gun-lift battery.
c. Torpedo shed.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., July 8, 1893.

GENERAL: I have the honor to transmit herewith annual reports, in duplicate, for the fiscal year ending June 30, 1893, upon fortifications in my charge.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

GUN AND MORTAR BATTERIES.

Plans have been prepared for the new works of defense, and during the fiscal year operations were carried on upon the construction of Mortar Battery No. 1, with ditch defense, arranged for sixteen 12-inch breech-loading rifled mortars, and upon one 12-inch gun battery, with hydraulic lifts for two 12-inch, breech-loading, high-power steel rifles, of which mention was made in the last annual report.

I A.

MORTAR BATTERY No. 1.

The mortar battery was begun in November, 1890, under instructions from the Chief of Engineers dated August 6 and September 13, 1890, in accordance with plans of The Board of Engineers dated September 28, 1888.

From the appropriation made by act of Congress approved August 18, 1890, for gun and mortar batteries, an allotment of $201,000 was made for its construction, and on February 24, 1893, a further allotment of $33,000 was made from the appropriation for gun and mortar batteries, act of July 23, 1892, to be applied to the completion of this mortar battery.

On March 10, 1893, an allotment of $20,000 was made from the appropriation, act of February 18, 1893, for "gun and mortar batteries, for the construction of gun and mortar platforms," "to be applied to the construction of eight mortar platforms." At the close of the last fiscal year the condition of the work was as follows:

The concrete masonry of the battery was completed, excepting the floors of the magazines and passages, the sloping concrete surface capping of the retaining-walls of the mortar pits and designed to protect the slopes from the effects of blast, the counterscarp wall, and galleries. The line of the ditch had been cleared of undergrowth and stumps and graded ready for the foundations of the counterscarp wall, and 13,025 cubic yards of concrete had been put in place.

At the close of the last fiscal year two contracts were in force:

1. With the Lawrence Cement Company, dated December 29, 1890 (expired January 1, 1892, extended to August 1, 1892), approved by the Chief of Engineers January 12, 1891, for the delivery of 30,000 barrels of cement, at $1.02 per barrel. Completed July 25, 1892.

2. With John A. Bouker, dated December 29, 1890 (expired January 1, 1892, extended to November 1, 1892), approved by the Chief of Engineers January 8, 1881, for the delivery of 21,000 cubic yards of broken granite, at $1.63 per cubic yard. Completed July 29, 1892.

Under sealed proposals opened July 20, 1892, a contract was made July 22, 1892, with Calvin Tomkins, of New York, the lowest responsible bidder, for the delivery of 25,000 barrels "Old Newark" Rosendale cement, at $0.939 per barrel, and 20,000 cubic yards of broken stone, at $1.28¾ per cubic yard.

There have been delivered under this agreement, up to June 30, 1893, 12,102 cubic yards of broken stone and 23,410 barrels of cement, of which amounts 10,000 cubic yards of broken stone and 19,773 barrels of cement were applied to the construction of masonry at the mortar battery.

Under sealed proposals opened April 12, 1893, bids for furnishing certain material for the construction of mortar platforms were accepted as follows:

WALDO & STOUT, BRIDGEPORT, CONN.

192 aluminium bronze bolts, at 29¼ cents per pound.
192 phosphor-bronze washers, at 22½ cents per pound.
192 steel nuts (for above bolts), at 57¼ cents each.
128 wrought-iron anchor bolts, with hexagonal nuts, at 39 cents each.

The aggregate cost of the above bolts and nuts for eight platforms is $3,742.80.

CASEY & SHERWOOD, NEW YORK CITY.

For eight sets of eight stones each, or 1,063 cubic feet granite rings (which form the upper surface of the mortar platforms and the seat of the base ring of the mortar carriage), at $319 for one set, equivalent to $2.4007 per cubic foot.

All of the above material is to be delivered on or before July 15, 1893.

The construction of masonry was continued throughout the year, excepting from December 1, 1892, to May 1, 1893, during which time it was necessarily suspended on account of cold weather.

The counterscarp wall (2,200 feet in length) and galleries are completed, excepting about 140 feet of the wall where openings have been left for construction purposes. The floors in the magazines and main galleries are laid within 4 inches of their finished level and the concrete protection for the slopes in the mortar pits is nearly finished.

The total masonry constructed during the year was 13,827 cubic yards and from the beginning 26,852 cubic yards. The average cost per cubic yard for all was $5.20.

The work of filling sand in the embankments covering the magazines and passage ways and surrounding the mortar pits has been carried on continuously since September 12, 1892, and at the close of the fiscal year 118,478 cubic yards had been excavated, hauled, and deposited, completing the sand cover inside the ditch, excepting about 5,000 cubic yards. This, with 9,449 cubic yards reported last year, makes a total of 127,927 cubic yards to June 30, 1893.

The progress sheet forwarded herewith (Pl. 1*) shows the total masonry constructed to June 30, 1893; also, in detail, that for each month of the fiscal year. The same drawing shows the embankment to date.

The total estimated amount of sand filling inside the ditch is 125,184 cubic yards; the amount in place June 30, 1893, was 127,927 cubic yards, an excess over the quantity estimated of 2,743 cubic yards. This excess is not due to an error in the estimate, and is easily accounted for. The sand at the battery site is dry and shifting; high winds frequently prevail, during which sand deposited on the higher portions of the embankments is blown away and again deposited in the ditch and upon those slopes not exposed to the wind. This will be checked when the sod which is to cover the upper and more exposed parts of the slopes is in place, and the surplus sand can all be utilized economically in filling in the covering of sand exterior to and resting against the counterscarp wall. Experiments made during the year indicate that the long slopes adjoining the ditch can be successfully and economic-

* Omitted.

ally protected from wind and weather by planting thereon a kind of heath, native to the locality, which is found in situations quite as exposed, both to sun and wind, as are the slopes mentioned above.

The following tables show in detail the cost of the operations during the year, the plant in use, and the average daily number of employés of each class:

I. COST OF MATERIAL.

	Cement, per barrel.	Broken stone, per cubic yard.	Sand, per cubic yard.
On scows or canal boats alongside of dock	$0.96137	$1.38601	....
Unloading into cars	.02579	.14679	....
Hauling to yard or shed	.00677	.03809	....
Storing in yard or shed	.01666	.08596	....
Hauling sand	....	....	$0.13043
Cost of material delivered at works	1.01059	1.65685	0.13043

NOTE.—The first cost of cement and concrete stone for the year, in the above table, is obtained by combining the prices under the contracts of the Lawrence Cement Company (terminated July 25, 1892) and Calvin Tomkins for cement, and those of John A. Bouker (terminated July 29, 1892) and Calvin Tompkins for concrete stone, as follows:

Cement.

Lawrence Cement Company, 8,933 barrels, at $1.02	$9,111.66
Calvin Tomkins, 23,410 barrels, at $0.939	21,981.99
	31,093.65

Or $0.96137 per barrel.

Stone.

John A. Bouker, 4,886.60 cubic yards, at $1.63	$7,965.16
Calvin Tomkins, 12,102.07 cubic yards, at $1.28¾	15,581.42
	23,546.58

Or $1.386 per cubic yard.

II. COST OF MATERIAL AND MANUFACTURE OF ONE CUBIC YARD OF CONCRETE.

Composition: 1 cement, 2 sand, 5 broken stone.

NOTE.—One charge of the mixer is equal to 1.05 cubic yards of masonry, machine mixed and deposited by derrick.

Material.

Broken stone, 0.92 cubic yard	$1.52430	
Cement, 1.43 barrels	1.44514	
Sand, 0.37 cubic yard	.04826	
		$3.01770

Manufacture and deposit.

Charging and running mixer	$0.35171	
Delivering under derrick	.09952	
Hoisting	.17597	
Placing and tamping	.31734	
Making and setting up forms	.22374	
Lumber and nails	.05217	
		1.22045
Total cost per 1 cubic yard		4.23815

III. TOTAL COST FOR ONE CUBIC YARD OF CONCRETE, INCLUDING COST OF REPAIRS AND MAINTENANCE OF PLANT, MOVING AND RIGGING DERRICK, TRACK WORK, MOVING AND SETTING UP MACHINERY, REPAIRS TO BUILDINGS, MAINTENANCE OF PUBLIC ANIMALS, SUPERINTENDENCE AND OFFICE EXPENSES, PURCHASE OF MATERIAL FOR OPERATING PURPOSES, EXCAVATION FOR COUNTERSCARP WALL AND GALLERIES, AND COST OF MATERIAL AND LABOR OF PLASTERERS IN FINISHING WALLS AND FLOORS.

Concrete masonry, 13,827 cubic yards, at $4.23815	$58,600.90
Repairs and maintenance of plant	1,621.92
Moving and setting up derricks	1,381.10
Moving and maintenance of track	769.29
Moving and setting up machinery	471.97
Repairs to buildings	674.83
Superintendence and office expenses	1,410.60
Purchase of material for operating purposes	1,694.56
Maintenance of public animals	611.55
Grading ditch and excavating foundation for counterscarp wall and galleries	1,292.13
Work of plasterers and cost of cement used in finishing counterscarp wall and galleries, and floors and walls of main gallery and magazines	2,246.03
Total cost	70,774.88
Total masonry constructed during the year, cubic yards	13,827
Total cost of masonry constructed	$70,774.88
Cost per one cubic yard	$5.1186

IV. COST PER ONE CUBIC YARD OF SAND EXCAVATED BY HAND AND GRAPPLES, HAULED AND PLACED IN EMBANKMENT INSIDE COUNTERSCARP WALL.

61,096 cubic yards sand excavated by grapple and loaded, at $0.06851 per cubic yard	$4,185.69
Hauling and placing same in embankment, at $0.06901 per cubic yard	4,216.23
57,382 cubic yards sand excavated and loaded by hand, at $0.08522 per cubic yard	4,890.09
Hauling and placing same in embankment, at $0.07827 per cubic yard	4,491.29
Total cost	17,783.30
Total cubic yards placed in embankment	118,478
Cost of excavating, loading, hauling, and placing same in embankment, per cubic yard	$0.150094

V. TOTAL COST PER ONE CUBIC YARD OF SAND EXCAVATED, HAULED, AND PLACED IN EMBANKMENT, INCLUDING COST OF PURCHASE AND MAINTENANCE OF PLANT, MOVING AND SETTING UP DERRICKS, MOVING AND REPAIRS OF TRACKS, MOVING AND SETTING UP MACHINERY, BUILDING TRESTLE TO FACILITATE THE DEPOSIT OF SAND, GRADING SLOPES OF EMBANKMENTS, CLEARING AND GRUBBING BORROW PITS, REPAIRS TO BUILDINGS, MAINTENANCE OF PUBLIC ANIMALS, PURCHASE OF MATERIAL FOR OPERATING PURPOSES, AND SUPERINTENDENCE AND OFFICE EXPENSES.

Sand filling, 118,478 cubic yards placed in embankment, at $0.150094 per cubic yard	$17,783.30
Purchase and maintenance of plant	5,175.37
Moving and setting up derricks	2,437.46
Moving and repairs of tracks	1,885.93
Moving and setting up machinery	870.29
Building trestle to facilitate the deposit of sand	811.13
Grading slopes of embankment	602.09
Clearing and grubbing borrow pits	314.78
Repairs to buildings	634.84
Maintenance of public animals	594.89
Purchase of material for operating purposes	1,694.57
Superintendence and office expenses	1,285.60
Total cost of sand filling	34,090.25
Total sand placed in embankment during the year, cubic yards	118,478
Total cost per 1 cubic yard	$0.28773

VI. TOTAL EXPENDITURE FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

13,827 cubic yards concrete masonry constructed, at $5.1186 per cubic yard	$70,774.88
118,478 cubic yards sand excavated and placed, at $0.28773 per cubic yard	34,090.25
1,381 linear feet drain pipe laid, cost of labor and material	684.17
Cutting and hauling sod for revetment of sand slopes	559.34
Cost of material and labor, building doors for counterscarp galleries and magazines	345.74
Cost of material and labor for embrasure armor, counterscarp galleries	209.23
2,268 square yards top slopes of main and transverse galleries covered with waterproofing material, at 25 cents per square yard	567.00
Total expenditure	107,230.61
Amount expended to June 30, 1892	102,407.87
Amount expended during fiscal year ending June 30, 1893	107,230.61
Total amount expended to June 30, 1893	209,638.48

VII. AVERAGE DAILY NUMBER OF EMPLOYÉS OF EACH CLASS FOR THE YEAR.

Overseers	1	Monthly laborers	0.43
Clerk	.08	Watchman	.23
Draftsman	.25	Blacksmiths	.69
Locomotive engineer	.83	Carpenters	5
Engineers	5.71	Plasterers	.96
Firemen	5.98	Stonecutters	.014
Riggers	.83	Teamsters	2.83
Master laborers	4.90	Laborers, daily	73.10

VIII. AVERAGE PLANT IN DAILY USE FOR THE YEAR.

Locomotives	.75	Dump cars	9.5
Hoisting engines	4.91	Flat cars	14.5
Stationery engines	.41	Bucket grapples	.75
Concrete mixers	.83	Horses	3.41
Derricks	4.75		

For purposes of comparison, the following tables I and II, showing detailed cost per cubic yard of concrete, from the annual report of last year, are here inserted:

I. COST OF MATERIAL.

	Cement, per barrel.	Broken stone, per cubic yard.	Sand, per cubic yard.
On scows or canal boats alongside of dock	$1.02	$1.63	....
Unloading into cars	.0227	.1211	....
Hauling to yard or shed	.0032	.0193	....
Storing in yard or shed	.0161	.0273	....
Hauling sand	....	....	$0.1181
Cost of material delivered at works	1.0620	1.7977	0.1181

II. COST OF MATERIAL AND MANUFACTURE OF ONE CUBIC YARD OF CONCRETE.

Composition, 1 cement, 2 sand, 5 broken stone.

NOTE.—One charge of the mixer is equal to 1.05 cubic yards of masonry in place, machine mixed, and deposited by derrick.

Material.

Broken stone, 0.92 cubic yard	$1.6539	
Cement, 1.43 barrels	1.5187	
Sand, 0.37 cubic yard	.0437	
		$3.2163

Manufacture.

Charging and running mixer	0.29310	
Delivering under derrick	.08315	
Hoisting	.11224	
Placing and tamping	.22838	
Making and setting up forms	.12286	
Lumber and nails	.06532	
		.90505
Cost per cubic yard		4.12135

The cost of a cubic yard of concrete for the fiscal year ending June 30, 1893, was $4.23815; that for the last year, $4.12135; the increase in cost was therefore about 11 cents per cubic yard. The cost of material was much less (about 20 cents per cubic yard). The cause of the increase in cost was due to the nature of the work done, as will be apparent from a comparison of the tables.

It was necessary for a part of the time to double the mixing plant, though in so doing the output was not doubled; that is, two concrete mixers, operated by separate engines, were in use for about three months, but in default of adequate transportation the full manufacturing capacity of which each was capable was not attained. To this fact may be ascribed the increased cost of "charging and running mixers."

The next three items in the table may be consolidated under the general term "placing;" all show an increase over last year. This was due to the nature of the construction; the material was largely placed in the counterscarp wall, which is over 2,200 feet long and 15 feet high, with a thickness of 7 feet at the bottom and 3 feet at the top; the concrete had, therefore, to be distributed over a long line, increasing the haul and necessitating the frequent shifting of derricks, and deposited in restricted areas, which involved shoveling the concrete from the boxes.

The increase in the cost of "making and setting up forms" is due to the increased quantity of this class of work relative to the number of cubic yards of concrete constructed. The average thickness of the counterscarp wall is 5 feet, and that of all the other walls is 9 feet; therefore, the forms corresponding to 1 yard of masonry of the counterscarp wall should exceed in cost those for 1 cubic yard of the wall, having the greater thickness by about four-fifths.

The excavation, transportation, and deposit of sand in the embankments has been carried on by two methods; in the first the sand was shoveled by hand upon cars with removable boxes, having a capacity of about 1 cubic yard; these cars were then run under derricks, by means of which the car boxes were raised and dumped as desired. The other method was to load rotary dump cars of 3 cubic yards, capacity by grapples operated by steam, to haul the car up an incline by steam, and to dump it by hand.

The difference in cost of excavating and loading sand by grapple and by hand, as given in Table IV—1.67 cents per cubic yard—would have been greater had the facilities for transportation been such as to enable the grapple buckets to work up to their full capacity. One such grapple will excavate and load about 500 yards of sand in eight hours, under favorable conditions, while from the lack of proper plant for transportation purposes the greatest output per grapple here has not exceeded 350 cubic yards for the same number of hours.

The accompanying drawing, Pl. II,* shows the location of the three

* Omitted.

borrow pits from which sand was obtained, relative to the battery, and the successive location of tracks, derricks, etc., during the year.

On September 2, 1892, detailed plans and estimate of cost were submitted for the construction of the counterscarp galleries, designed for the defense of the ditch. These were approved by the Chief of Engineers September 15, 1892.

During the year a suitable drainage system for the battery was devised, the material for which was purchased, in accordance with law, at a cost of $355.14, and at the close of the fiscal year was all in place, excepting about 400 feet. The arrangement of this system, and the size and inclination of pipes, etc., are shown upon the accompanying drawing, Pl. III.*

The drainage is discharged into the swamp about 500 feet southwest of the battery.

As a matter of professional interest I desire to invite attention to the manner of constructing the counterscarp wall and galleries adopted by Lieut. Warren to obtain a smooth surface, and one which is apparently weatherproof. The plan originally followed was to build all the concrete masonry in forms of undressed spruce lumber, and then, on removal of the forms, to plaster the exposed face with cement. This coat of plaster could not be made to adhere to the older masonry, which rapidly absorbed its moisture, weakening the bond between the two, which was destroyed by the first cold weather, when the coating cracked and dropped off, much to the injury of the appearance of the work.

There was no economy in the use of the spruce lumber, which warped out of shape when subjected to the moisture of the concrete and could seldom be used more than once, and the plastering was very expensive.

It was decided to substitute forms made of first quality dressed white pine, grooved on both edges, and united by loose tongues of yellow pine, and to construct the masonry as follows:

That portion of the masonry next to the form, 4 inches thick, was put in without stone, the proportion of sand and cement remaining the same as in the concrete proper, securing a perfect bond between the face and the back of the wall. The forms being removed while the work was comparatively fresh, a little rubbing with a float gave a smooth surface to the face.

The counterscarp wall and the galleries, constructed in this way, have withstood an unusually severe winter without scaling or cracking.

Four spring return mortar carriages were transferred by the Ordnance Department to the Engineer Department June 10, 1893, for mounting upon four of the eight mortar platforms to be constructed, in compliance with instructions of the Chief of Engineers dated March 10, 1893. It is proposed to mount them upon the platforms of the northeast mortar pit, the masonry of which has been constructed longer than that of the other pits, and the inner slopes of which can be most conveniently completed first.

The base rings and bed plates for these mortar carriages are single castings, 14 feet in diameter, and weighing about 17 tons each. These dimensions prevent their passage through the transverse gallery joining the mortar pits, and it will be necessary to take them over the embankments surrounding the pits. This will be done at an early

---

* Omitted.

date, using the trestle constructed for moving sand, and every effort will be made to have the four carriages ready for their mortars on or before September 1, 1893.

---

1 B.

GUN-LIFT BATTERY No. 1.

Gun-Lift Battery No. 1 is arranged for two 12-inch, high-power, breech-loading rifled guns.

The estimated cost of the masonry and sand covering for a battery of this type, containing two guns, is $283,000. (Report of The Board of Engineers, September 8, 1890.)

The estimated cost of a single gun lift, including hydraulic ram and fittings, is $61,980, and that of the hydraulic power for not exceeding two lifts is $50,570, making the total estimated cost of the mechanism for a single lift $112,550, or for two lifts $174,530. (Letter from Chief of Engineers, February 20, 1890.) Trial may show that for the proper maneuvering of two lifts one additional pump will be required at an estimated additional cost of $2,590.

The estimated total cost of a completed battery of this type for two guns is therefore $457,530.

Excavations for the foundations of the northern half of the battery were commenced in January, 1891, under instructions from the Chief of Engineers dated February 20, 1890, and September 13, 1890, and on April 3, 1891, further instructions were received for the construction of the southern half of the battery.

From the appropriations of August 18, 1890, and February 24, 1891, for gun and mortar bateries, allotments of $154,000 and $129,000, respectively, were made for the construction of the masonry and the sand covering of one battery complete. From the appropriation of September 22, 1888, for armament of fortifications, an allotment of $112,500 was made for the construction of the mechanism and hydraulic motors for one lift, and from the appropriations of February 24, 1891, and July 23, 1892, for gun and mortar batterries, an allotment of $63,000 was made January 26, 1893, for the construction of the mechanism for the second lift as follow:

Appropriation of February 24, 1891	$9,087.43
Appropriation of July 23, 1892	53,912.57
Total	63,000.00

At the close of the last fiscal year the condition of the work was as follows:

The total quantity of masonry in place June 30, 1892, was 32,930.5 cubic yards.

All the parts of the gun-lift mechanism had been completed, delivered at the work, and so far adjusted as the condition of the masonry admitted.

At the beginning of the fiscal year, July 1, 1892, the following contracts were in force:

1. With the Lawrence Cement Company, dated December 29, 1890 (expired January 1, 1892, extended to August 1, 1892), approved by

the Chief of Engineers January 12, 1891, for the delivery of 30,000 barrels of cement, at $1.02 per barrel. Completed July 25, 1892.

2. With John A. Bouker, dated December 29, 1890 (expired January 1, 1892; extended to November 1, 1892), approved by the Chief of Engineers January 8, 1891, for the delivery of 21,000 cubic yards of broken granite, at $1.63 per cubic yard. Completed July 29, 1892.

* * * * * * *

4. With James Rudolph, dated May 31, 1892 (approved by the Chief of Engineers June 10, 1892), for the construction of a frame dwelling for the general use of the Engineer Department, at a cost of $5,000, including the services of the architect. This contract was completed July 30, 1892.

During the fiscal year the following additional contracts were made:

1. With the General Electric Company, dated November 23, 1892 (expired February 1, 1893; extended to March 1, 1893), approved by the Chief of Engineers December 20, 1892, for the installation of an electric-light plant, at a cost of $3,788. Completed March 10, 1893.

* * * * * * *

3. Under sealed proposals opened July 20, 1892, a contract was made July 22, 1892, with Calvin Tomkins, of New York, the lowest responsible bidder, for the delivery of 25,000 barrels "Old Newark" Rosendale cement, at 93.9 cents per barrel, and 20,000 cubic yards of broken stone, at $1.28¾ per cubic yard.

There have been delivered under this agreement up to June 30, 1893, 12,102 cubic yards of broken stone and 23,410 barrels of cement, of which amounts 102 cubic yards of broken stone and 3,637 barrels of cement were applied to the construction of the masonry at the Gun-Lift Battery.

The construction of the masonry was continued throughout the year, excepting the period from December 1, 1892, to May 1, 1893, during which the weather conditions rendered a suspension of such work necessary.

The battery, with the exception of the mechanism for the southern lift, *is practically completed.*

The hoisting and overhead carrying apparatus for the ammunition service are not in place, and the large doors for the main entrance are yet to be built and hung; all the material for these is either on hand or ordered for early delivery.

The total amount of masonry constructed during the year was 8,292.9 cubic yards, at a cost of $4.706 per cubic yard.

This includes 1,512 cubic yards of large stone bedded in the concrete and designed, by rendering the masonry nonhomogeneous, to deflect hostile projectiles; 538.3 cubic yards of cut granite, and 898.25 cubic yards of pavement of the interior and exterior of the battery.

The embankment of sand which rests against the exterior 20-foot wall and surrounds the battery, excepting at the defensible entrance (placed in rear of the battery and at the middle point), was also constructed during the year. The amount of sand excavated, hauled, and deposited therein was 5,185 cubic yards.

All of this work—masonry and earth construction—was done by hired labor, after the purchase of material by sealed proposals invited according to law.

The following tables show in detail the cost of construction, the plant in use, and the average daily number of employés of each class:

I. COST OF MATERIAL.

	Cement, per barrel.	Broken stone, per cubic yard.	Large stone, per ton.	Sand, per cubic yard.
On scows or canal boats alongside dock	$1.0088	$1.583	$0.790	....
Unloading into cars	.02424	.12649	.396	....
Hauling to yard or shed	.00304	.02422	.101	....
Storing in yard or shed	.01707	.05213	....	....
Testing cement	.00762	....	....	....
Placing large stone in wall	....	....	.197	....
Hauling sand	....	....	....	$0.11251
Total cost	1.06077	1.78584	1.484	0.11251

II. COST OF MATERIAL AND MANUFACTURE OF ONE CUBIC YARD OF CONCRETE.

Material.

Broken stone, 0.92 cubic yard	$1.64297	
Cement, 1.43 barrels	1.51691	
Sand, 0.37 cubic yard	.04163	
		$3.20151

Manufacture and deposit.

Charging and running mixer	$0.269734	
Delivering under derrick	.094380	
Hoisting	.149290	
Placing and tamping	.183840	
Making and setting up forms	.176680	
Lumber and nails	.060750	
		0.934674
Cost per cubic yard		4.136184

Composition, 1 cement, 2 sand, 5 broken stone.

NOTE.—One charge of the mixer is equal to 1.05 cubic yards of masonry in place, machine mixed and placed by derrick.

III. TOTAL COST OF COMPLETING THE MASONRY IN BATTERY, AMOUNTING TO 42,410.45 CUBIC YARDS, DIVIDED AS FOLLOWS:

39,012.65	cubic yards concrete masonry, at $4.13618 per cubic yard	$161,363.34
1,525	cubic yards large broken stone, bedded in concrete, at $3.333 per cubic yard	5,082.82
538.3	cubic yards cut granite masonry, at $36.1711 per cubic yard	19,470.94
*487	cubic yards in finished pavement of superior slope (Alsen's Portland cement), comprising an area of 1,096 square yards, at $3.11814 per square yard	3,417.48
411.25	cubic yards in finished pavement of exterior and interior slopes (Duryea's American Portland cement), comprising an area of 1,645 square yards, at $2.3757 per square yard	3,908.02
128.75	cubic yards in finished floors of galleries, and rooms (with Rosendale cement), comprising an area of 965.5 square yards at $1.41 per square yard	1,361.35
307.50	cubic yards bluestone pavement of terreplein entrance passage and boiler room, comprising an area of 1,845 square yards, at $2.70572 per square yard	4,992.07
42,410.45	cubic yards. Total cost	199,596.02

42,410.45 cubic yards completing masonry construction, at $4.706293 per cubic yard.

IV. TOTAL EXPENDITURE TO JUNE 30, 1893.

42,410.45 cubic yards masonry, at $4.706293	$199,596.02
Purchase and maintenance of plant, etc	23,850.34
Excavation for foundation, 5,177 cubic yards, at $0.251	1,299.43
Work of plasterers finishing interior walls and arches	1,453.87
Repairs to buildings	3,881.93
Purchase and maintenance of public animals	1,231.45
Sand filling in exterior slope, 5,185 cubic yards, at $0.22235	1,152.93
Material and labor finishing pavement of superior slope with Duryea's American Portland cement, 1,096 square yards, at $1.7924	1,964.47
Removing pavement of Duryea's American Portland cement from superior slope	258.75
Grading exterior sand slope and adjacent grounds	100.82
Track and derrick work	1,513.85
Building and hanging doors for magazines and casemates	1,241.33
Tearing out stone bins, cement sheds, etc., and clearing up refuse	1,545.06
Whitewashing interior walls and arches	411.21
Material and labor, laying drain pipe	172.11
Material and labor, putting in plant for permanent water supply	720.40
Material and labor, ammunition service, cars, track, and turntables	1,212.38
Material and labor, operating and maintaining gun-lift mechanism	2,083.31
Material and labor, mounting 12-inch rifle	1,073.31
Fastening pintle plate to platform and assembling Creusôt carriage	381.25
Material and labor fitting dynamo room and making steam connections for electric-light plant	226.16
Installation of electric-light plant	3,788.00
Three iron stairways, interior of battery	710.00
Iron cover of south lift loading gallery	250.00
Iron beams in floor of caponiere	180.49
Applying waterproofing process, 2,686 square yards, at $0.25	671.50
Iron-cover plates of pipe conduits	66.32
Purchase of material for operating purposes	752.83
General work, etc., consisting of items not susceptible of classification, and including time allowed employés for legal holidays	9,832.89
Office expenses	2,714.82
Superintendence and clerk hire	6,648.50
Total expenditure to June 30, 1893	270,985.73

Total expenditure	270,985.73
Total masonry ... cubic yards	42,410.45
Total cost per 1 cubic yard	6.38959

V. AVERAGE DAILY NUMBER OF EMPLOYÉS OF EACH CLASS FOR THE YEAR.

Overseers	1.54	Watchman	.29
Clerk	.91	Teamster	.79
Draftsman	.75	Blacksmith	1.35
Recorder	.804	Plasterers	2.42
Locomotive engineer	.17	Carpenters	3.70
Engineers	3.25	Stone cutters	6.35
Rigger	.17	Stone setters	1.91
Master laborers	2.58	Laborers, daily	39.55
Monthly laborers	.83	Firemen	2.40

VI. AVERAGE PLANT IN DAILY USE FOR THE YEAR.

Locomotive	.25	Dump cars	3.50
Hoisting engine	1.50	Flat cars	5.33
Stationary engines	.83	Derricks	3.45
Concrete mixers	.75	Horses	1.58

During the last fiscal year the general plan of the battery has received the following additions and modifications:

1. No special arrangements had been provided for the handling, either for storage or for service in action, of the ammunition. The

weight of the projectiles for the 12-inch rifles designed for mounting upon the battery, 1,000 pounds, obviously necessitated the employment of mechanical power for their economical and speedy handling, and the amount of powder required to fill the magazines (45 short tons) could not be well transported without special facilities.

For these reasons a plan was submitted on September 27, 1892, for furnishing the necessary conveniences while making use of a portion of the plant acquired for construction purposes. This plan, as modified by The Board of Engineers October 13, 1892, and finally approved by the Chief of Engineers October 15, 1892, has been carried out as as follows:

The construction track (36-inch guage) from the engineer wharf runs through the entrance of the battery to the transverse gallery connecting the magazine passage ways, where a turntable is placed, from which a track leads, right and left, to points opposite the entrances to the magazine passage. This track is of steel girder rails, 72 pounds to the yard, built into the concrete floor. Through the magazine passageway, crossing the track above described at right angles and extending to the ram of the ammunition hoist, runs another track of the same gauge (36-inch), but with rails composed of gun metal straps, 2 inch by one-half inch, screwed with brass screws to creosoted yellow-pine stringers, 4 inches by 4 inches, bedded in the concrete floor. A turntable is placed in the line of this track opposite the magazine entrances, from which tracks, constructed as above, run directly across each magazine. An ammunition car of 6 tons capacity, with gun-metal wheels, has been provided for use inside the magazine passages and magazines.

This system of tracks and turntables will allow the ammunition, loaded upon flat cars from a lighter at the wharf, to be delivered at the entrances to the magazine passages. There it will be transferred to the ammunition car by an overhead trolley and hoist of 2,000 pounds capacity attached to the crown of the arch of the transverse gallery. The transfer completed, the car can be run directly into the magazines. The magazines designed for the storage of shells are provided with an overhead traveling bridge, trolley, and hoist, which will enable one man to handle a load of 2,000 pounds at any point of the magazine. The powder cylinders, weighing but 150 pounds each, can be piled by hand.

The combined ammunition carriage and loading tray, forming part of the mechanism of the lift, can, by the same system, be run from its place over the ram of the ammunition hoist into the magazines, receive its powder and projectile, and have them conveyed to their final position in the gun entirely by mechanical power.

2. As originally planned the battery was to have been lighted by oil lamps placed in suitable recesses constructed in the walls. The magnitude of the work, its many passages and casemates, make it apparent that while the system above described would be useful as an auxiliary it could not supply a good working light. It was therefore proposed to provide a suitable electric-light plant. This has been done.

The plant is of the same general type as that in use by the Navy Department on vessels of war.

It consists of a direct coupled Thomson-Houston engine and dynamo, having a capacity, with 80 pounds of steam and running at 550 revolutions per minute, of 100 volts and 40 amperes, equivalent to about eighty 16-candle-power lamps. Connected with this there are four 24-candle-power lamps, one in each magazine, and fifty-four 16-candle-power lamps.

The excess of power will be utilized in running electric fans for ventilation purposes should these prove essential.

The conductors are all lead-covered and run in moldings attached to the concrete wall and arches by brass expansion bolts. Every lamp is covered with steam and vapor proof globes and protected with metal guards. Steam is taken from the main boilers.

The plant is compact, simple, and durable, and has so far proved itself well adapted to its purpose. Its total cost installed was $4,014.16.

3. The specifications for the manufacture of the mechanism of the gun lift required that the final payment of 25 per cent should not be made until after it had stood satisfactorily a working test, in connection with its hydraulic appliances, weighted with its equivalent ultimate load in case the gun and gun carriage were not mounted at the time the structure was ready for test.

The gun and carriage were delivered and mounted immediately after the lift was ready for them, and the test, which began, as hereinafter stated, September 12, 1892, was continued for five days, in the presence of a board of engineer officers especially convened for the purpose. A report on the subject was made by the board to the Chief of Engineers, dated December 7, 1892.

The mechanism withstood the test without a single evidence of weakness, and final payment was made to the contractor December 21, 1892.

The concrete composing the superior slope at the time of firing was only four days old, and hardly had time to begin settling under a freezing temperature before it was subjected to severe gun blasts, which materially injured it.

The experimental firing of the 12-inch rifle mounted upon the north lift demonstrated the practicability of raising the interior crest of the battery 18 inches without impairing its fire over the channels, for the protection of which it was designed.

As this would materially increase the cover, not only to the gun detachments but also to the loading galleries, it was decided to make the change.

Accordingly, the interior crest has been raised by the addition of a wedge-shaped mass of masonry having a depth of 18 inches at the rear (interior crest) and running out to nothing at the exterior crest.

The effects of blast upon this masonry indicated that certain improvements in the composition and laying of the concrete could be wisely adopted on the reconstruction of the superior slope, necessitated by its elevation, as above reported.

Like all concrete structures the parapet of this battery is composed of successive layers of masonry from 4 inches to 8 inches in thickness, and, as is well known, the weak point in this class of work is the bond between successive layers. This was markedly shown in the present instance. The blast of the gun first destroyed the bond between the upper layers of concrete, and the effect of successive shots was to break these layers into smaller fragments, and finally, when sufficiently broken up, to wholly displace them.

In reconstructing the slope all concrete masonry showing signs of weakness was first removed. Then the masonry was built up in sectors, the successive layers of which were superposed before the underlying ones had time to set. This method had for its object the making of the blocks equally strong throughout and the substitution of vertical joints for the horizontal ones. The material used was Alsen's Portland cement and fine crushed granite, mixed by machine in the proportion of two parts of cement to three parts of stone, and carefully rammed in place, taking the precaution, while still fresh, to float the upper surface with dry cement and sand. The resulting surface is smooth and exceedingly hard. The thicknesss of the masonry of the nature above described was varied in proportion to its exposure to blast—from 12 inches directly under the gun to about 2 inches at the exterior crest.

To provide for the supply of water requisite for boilers, hydraulic system, and for purposes of cleanliness, a "Rider" hot-air pumping engine has been placed in a bomb-proof room, 7½ feet by 9 feet, situated under the sand embankment adjoining the defensible entrance on the right, and communicating with it by a doorway cut through the concrete wall. This pump has a capacity of 1,000 gallons per hour, which is ample, as the boilers of the lift mechanism evaporate but 500 gallons per hour, and the tank for supplying the hydraulic system (capacity 1,500 gallons) requires filling only occasionally. The pump is connected by a line of galvanized-iron pipe to a group of four 1½-inch well points sunk about 175 feet in rear of the battery.

On the left of the defensible entrance, covered by the sand and opposite the pump room described above, there has been constructed another bomb-proof room, 7½ feet by 16½ feet, to provide space for a suitable sanitary water-closet for the garrison when the work is occupied.

Flagstones taken from the old stone fort have been used to pave the terreplein of the battery, the floors of the boiler and accumulator rooms, the space included between the rails of the tracks for the ammunition service, and the exterior court included between the wing walls of the defensible entrance. In all, 16,605 square feet of such pavement were laid at an aggregate cost of $4,992.07.

GUN-LIFT MECHANISM.

North Lift.—As already stated, the mechanism of the northern lift was completed and reported ready for trial August 30, 1892. Prior to this, preliminary trials of the several parts had been made as the progress of the work allowed. The cage and platform were raised and lowered for the first time on July 7, 1892. The first trial of the mechanism—gun lift, ammunition hoist, and hydraulic rammer, as a whole—was made on August 31, 1892.

The official test of the mechanism was commenced on September 12, 1892, in the presence of a board of officers of the Corps of Engineers, convened for this purpose by Special Orders No. 43, Headquarters, Corps of Engineers, U. S. Army, Washington, D. C., September 3, 1892.

The test was continued November 22, 23, and 30, and December 1, 1892.

While the report of this board contains a detailed account of the tests, it is thought that the following tabular statement of the firings from the battery to June 30, 1893, should be here reported:

Date.	No. of shot.	Charge.		Weight of projectile, solid shot.	Instrumental velocity, 250 feet from muzzle.	Elevation or depression.	Pressure in pounds per square inch of bore.
		Kind of powder.	Weight.				
			Pounds.	Pounds.	Foot secs.	° ′	
1892.							
Sept. 12	1	V. P. XIV	200	1,000	....	3 25	14,929
Sept. 12	2	....do	300	995	1,639	05	23,210.5
Nov. 22	3	....do	200	995	....	2 00	14,892.5
Nov. 22	4	V. P. X	200	1,000	....	2 00	P 9,857; X less 9,000
Nov. 22	5	V. P. XV	300	1,000	....	2 00	22,809
Nov. 23	6	....do	325	1,002	1,658	0 00	25,050
Nov. 23	7	....do	375	998	1,797	0 00	30,182
Nov. 23	8	V. P. X	375	993	....	10 00	27,730.5
Nov. 30	9	V. P. XV	200	997	....	10 00	12,011.5
Nov. 30	10	V. P. XIV	390	995	1,915	0 00	40,501.5
Nov. 30	11	V. P. XI	460	1,000	....	15 00	32,725
Dec. 1	12	....do	460	1,000	....	19 40	32,786
Dec. 1	13	V. P. XV	423	1,000	1,917	0 00	33,777.5
Dec. 1	14	B. N. smokeless	204	999	1,947	0 00	28,038.5
1893.							
Mar. 15	15	V. P. XV	350	999	1,749	Depression 0 25	27,170
Mar. 15	16	....do	400	999	1,904	0 25	42,000
Mar. 15	17	....do	390	999	1,843	0 25	34,800
Mar. 31	18	V. P. XVI	350	1,000	lost	0 25	27,672.5
Mar. 31	19	....do	400	1,002	1,846	0 25	34,650
Mar. 31	20	....do	420	1,002	1,923	0 15	44,000
Apr. 24	21	V. P. XVII	350	1,002	1,922	0 15	about 73,000
May 31	22	V. P. XVIII	300	1,000	1,700	2 35	25,375
May 31	23	....do	350	1,000	1,808	2 35	31,925
May 31	24	....do	420	1,000	1,910	0 12½	36,100

From this table it will be seen that in all twenty-four rounds have been fired from the platform of the lift. Many of these, notably the twenty-first round, subjected the structure to stresses far in excess of any probable under service conditions; notwithstanding these excessive stresses, the mechanism has invariably worked smoothly and satisfactorily, and shows no signs of weakness in any part. During all the tests, there has been no delay of any kind due to the failure of the lift or its adjuncts to do the work required of them.

The official trials of the mechanism showed the desirability of some minor changes, mainly in the loading apparatus; these modifications, described below, were all made by the contractors at the suggestion of this office, and without any additional expense to the United States:

1. It was necessary to increase the speed of travel of the hydraulic rammer. The proper service of the gun requires that the projectile be so far driven home as to partly upset its rotating band in the grooves of the rifling. This condition, unknown when the rammer was designed, was not satisfactorily fulfilled, and, the weight of the rammer being fixed, the increase of its energy could be effected only by increasing the rate of travel. This was done by increasing the annular space through which the water escapes to the rear during the forward movement, so as to make this area equal to that of the inlet pipe.

2. The combined ammunition carriage and loading tray, and the auxiliary loading tray which forms the connection between the ammunition carriage and the breach of the gun when in the loading position, were modified as follows: The two charge bags which are carried upon

arms on each side of the powder tray of the ammunition carriage are now successively dropped into position, in front of the rammer, by a single motion of the operator. The auxiliary loading tray, operated by hydraulic power, is controlled by the same operator as are the ammunition hoist and hydraulic rammer. The effect of the changes will be to diminish the time required for loading.

3. The steel pin or throttling bar, which is placed in the top of the cylinder of the heavier of the two accumulators and which serves to gradually check its downward motion near the completion of the descent, was replaced by a longer one; this was deemed advisable, as in raising the lift at maximum speed it was found that the heavy accumulator seated with more force than was consistent with safety. The lengthening of the pin has removed this difficulty.

THE CARRIAGE.

As reported last year, all the parts of the gun carriage, designed and manufactured for use with the gun-lift mechanism, by Messrs. Schneider & Co., of Creusôt, France, was on the upper surface of the battery June 30, 1892. It was not until July 30, 1892, that the pintle or bed-plate of this carriage was finally attached to the platform of the lift. The lower surface of this plate was irregular, and it was necessary to do a great amount of chipping upon the upper surface of the platform before it was practicable to so adjust the pintle plate as to bring its limiting lines, the circles bounding the lower roller path, into horizontal planes.

This effected, the remainder of the carriage was assembled. This work was all done by the employés of the Engineer Department, excepting the insertion and adjustment of the rams in the recoil and reservoir cylinders and the adjustment of the obturating bars and the pump, which were effected by one machinist and helper furnished by the Ordnance Department.

The carriage was completely assembled ready for the gun on August 15, 1892, at a cost divided as follows:

Labor	$229.25
Attaching pintle plate to platform } Hold-down bolts }	152.00
Total cost	381.25

THE GUN.

The 12-inch B. L. steel rifle was delivered by the Ordnance Department under the wall of the battery at a point indicated by the engineer officer in charge, at 4 p. m., August 23, 1892. It had been placed on a cradle August 12, at a point about 1,200 feet from that of delivery, from which latter point it was delivered at the battery in ten working days.

The work of erecting the appliance designed for raising it had already been completed, as far as was practicable, prior to the delivery of the gun.

Final arrangements for raising and mounting the gun were completed on August 25, and the gun was successfully delivered on the wall of the battery, immediately in front of the lift platform, at noon on August 26.

The gun was finally placed upon its carriage and raised to the firing position by the hydraulic lift, at 7:30 p. m., Monday, August 29, 1892.

There are forwarded herewith, among others, a set of photographs* illustrating the method used for raising the gun.

The device for raising the gun, adopted and so successfully used by Lieut. Warren, may be briefly described as follows: A frame of timber, having a width between uprights slightly greater than that of the gun (measured from end to end of trunnions), was placed parallel to the wall of the battery and distant from it about 13 feet—6 inches greater than the distance of the axis of the trunnions from the face of the breech of the gun.

From the cap of this frame a steel bar about 4 inches in diameter (the eccentric axle of an old gun carriage) was suspended by three wrought-iron bands, from which were hung two blocks, one with four, the other with three, sheaves, through which and their falls was rove about 750 feet of $7\frac{1}{2}$-inch manilla rope, the standing part being made fast to the cap of the frame and the running part passing first through a single block secured to the bottom of one of the timber uprights, and thence to a secure anchorage. The gun, without preponderance, the breech-block being removed, was slung to the falls by $1\frac{3}{4}$-inch wrought-iron chain, the breech to the wall. Parallel to the frame first described, four smaller frames were so arranged that when capped they would form a platform at the elevation at which the gun was to be delivered. These frames were securely braced together and to the larger frame, and the whole structure tied and braced to the masonry of the battery.

Leads were taken from two hoisting engines near at hand, which formed part of the construction plant, to the running part of the $7\frac{1}{2}$-inch manilla rope, using two parts of half-inch steel-wire hoisting rope.

The object in connecting the two engines was to avoid any stoppage in the raising of the gun when once commenced, from shifting the purchase, or "fleeting" as it is technically known.

The gun was then raised vertically above the level of the auxiliary platform, the caps promptly put upon the frames, stringers laid over the caps, a cradle run out upon these from the wall, and the gun lowered upon the cradle, which was then hauled in upon the masonry by means of a lead from one of the hoisting engines above referred to.

Sixteen parts of $7\frac{1}{2}$-inch rope were used, the safe load for a single part being 12 tons, and as the load to be lifted was 52 tons, the factor of safety was therefore about four; on the steel-wire rope the same proportions existed, while the framing was calculated with a factor of safety of six.

The actual time required to hoist the gun was one hour and forty-three minutes and the actual time of motion was twelve minutes and twenty-five seconds—a rate of 1 foot in thirty-nine seconds. The delay is attributable to the fact that the cordage was saturated with water, which rendered it extremely stiff and made it difficult and slow work to take up the slack of the main anchorage.

The operation was performed in a pouring rain, which had been falling for the preceding twenty-four hours.

SOUTH-LIFT MECHANISM.

The mechanism designed for the southern emplacement of the battery is to be, in all respects, a duplicate of that now in place in the northern emplacement.

Sealed proposals for its manufacture, advertised according to law

---

* Omitted.

December 21, 1892, were opened January 24, 1893, and the contract was awarded for the sum of $63,000.

Under their contract, dated February 4, 1893, for the manufacture and erection of this mechanism, the contractors have on hand, June 30, 1893, all the material for its construction, and have commenced the preliminary work of assembling the parts forming the cage.

It is expected that they will be ready to begin operations during the month of July, 1893, and to finish the erection of the lift by September 1, 1893, as the contract requires.

No carriage has yet been procured for mounting upon the platform of the southern lift. It has, however, been decided that this carriage is to be a duplicate of that now in position on the north lift, and arrangements have been perfected with the Ordnance Department by which the pintle plate of the carriage will be delivered not later than September 1, 1893. When this pintle plate has been attached to the platform of the southern lift the top carriage and gun now mounted upon the north lift will be shifted to the southern lift for use in the test of the mechanism of that lift, and for other tests required by the Ordnance Department.

The recoil test will be five rounds by the 12-inch high-power gun, fired under service conditions of extreme charge of powder and extreme elevation.

---

1 C.

TORPEDOES FOR HARBOR DEFENSE.

CONSTRUCTION OF TORPEDO SHED.

Plans and estimate were submitted April 3, 1891, for the construction of a suitable building for the storage of torpedo material for the submarine defense of New York Harbor, and the sum of $9,000 was allotted for the work from the appropriation for torpedoes for harbor defense, act of February 24, 1891.

The general character of this structure is as follows: The building is of brick, 40 feet by 90 feet, inside measurement, with walls 1 foot in thickness and 10 feet high under the eaves. The roof is of slate, supported by eight iron trusses. The floor is of concrete, and the track of the construction railroad from the engineer wharf runs through the building from end to end. On either side of this track are racks of 4-inch by 8-inch timber, arranged for the storage of buoyant torpedo cases in two tiers. A suitable storeroom for containing the smaller parts of the torpedo system is located in the southeastern corner of the building, and an overhead hoisting and conveying appliance will be placed at the eastern end of the building for handling the heavy anchors and ground mines.

At the close of the last fiscal year the building was complete, excepting the shelving, etc., in the storeroom and the overhead trolley.

The shelving in the storeroom has been left unfinished, pending the arrival of the material to be stored therein. The overhead trolley for handling the heavy torpedo material inside the shed has been ordered, and will also be put in place at an early date.

APPENDIX C.

Granolithic Pavement,
Gun Lift Battery No. 1,
Sandy Hook, New Jersey

Lt. J.G. Warren to Lt. Col. George L. Gillespie, Dec. 19, 1892
Miscellaneous Reports, 1892 - 1894, Engineer Bureau, Sandy Hook, New Jersey
United States Engineer Bureau, New York

SUBJECT: Granolithic Pavement.

ENGINEER OFFICE, U. S. ARMY,

Room F. 7, Army Building, 39 Whitehall Street

NEW YORK, N. Y.
Sandy Hook, N. J.,

December 19, 1893.

Colonel H. L. Abbot,

Corps of Engineers,

Bvt. Brig. General, U. S. Army,

New York City.

Thro' Lieut. Col. G. L. Gillespie,

Corps of Engineers, U. S. Army.

General:

In compliance with your verbal request, I have the honor to enclose herewith a tabular statement showing in detail the cost per cubic yard of the granolithic pavement as applied to the superior slope of Gun Lift Battery No. 1, at Sandy Hook, N. J.

The average thickness of this pavement under the muzzle of the gun in firing position is 12 inches, diminishing outward to the exterior crest where the thickness is about two inches. The pavement was constructed upon a foundation freshly laid, of concrete composed of Rosendale cement one part, sand two parts and blue stone (1 1/2 inch) five parts. It was put on in blocks averaging about 90 sq. ft. superficial area, each block composed of layers from four to six inches thick, well rammed and superposed before there was time for the setting of the lower layers. The top surface was smoothed over with neat cement paste, protected from the rays of the sun and from injury by passing men and kept thoroughly wetted with fresh water for about a week after completion.

Very respectfully,

Your obedient servant,

J. G. WARREN,

1st Lieut., Corps of Engineers.

Forwarded for Lieut. Warren's signature

Statement of Cost of Granolithic Pavement

as placed in Superior Slope of Gun Lift Battery No. 1, Snady Hook, N.J.

Average Composition: 1 Barrel Cement to 1 1/2 Barrels Crushed Granite.

1.	600 Barrels Alsen's Portland Cement (cost alongside wharf \$2.39) at \$2.43 per barrel	\$1458.00
2.	98.00 cubic yards Crushed Granite (\$1.37 1/2 alongside wharf) at \$1.57 1/2 per cu. yd.	154.35
3.	Mixing and placing 133.00 cu. yds. at .80 ¢ ...	106.40
4.	Work of plasterers and helpers finishing surface, comprising an area of 1096.00 square yards, at .31 1/2 ¢ per yard	345.24
5.	Work of carpenters, setting forms	70.25
	Total	\$2134.24
	133.00 cubic yards Granolithic Pavement at \$16.046	\$2134.24

APPENDIX D.

General Description of Gun-Lift Battery No. 1, Sandy Hook, New Jersey

Lt. Robert McGregor to Lt. Col. George L. Gillespie, Dec. 24, 1894
File 9716, enclosure 2; General Correspondence 1894 -1923
Entry 103; Record Group 77; National Archives Building, Washington, D.C.

GENERAL DESCRIPTION OF GUN-LIFT BATTERY No.1, SANDY HOOK, N.J.

This battery is a monolithic structure of concrete, designed to mount two 12-inch B.L. steel rifles, Model 1888M, on center-pintle carriages of the "Le Creusôt" pattern. The gun is loaded under cover of the parapet, and afterwards elevated to fire "en barbette." The raising and lowering of the gun, and the serving of the ammunition are accomplished by hydraulic power, as hereinafter described; the carriage itself is maneuvered entirely by hand in laying the gun.

<u>Masonry</u>.

The battery is 238 feet 9 inches in length by 162 feet 4 1/2 inches in depth, and consists essentially of an inner wall, 10 feet thick, inclosing the battery proper and its accessories with an outer protecting wall 20 feet thick inclosing a sand core generally 29 feet thick.

A caponiere, located centrally in rear, is designed to furnish a defensible entrance to the battery.

The battery proper is 140 feet long by 100 feet deep, in two stories. Upon the first floor are located the magazinesand the rooms containing the mechanism of the battery; and upon the second floor the casemates for the gun detachments, the loading galleries, and the communications. The terreplein of the battery is protected in front by a concrete parapet $6^{1}/2$ feet high, and on the sides by a thin wall with a minimum height of 3.9 feet. In the firing position of the gun, the gun platform is flush with the terreplein.

Two openings in the terreplein, each 20 feet 4" ~~5~~ inches long and 25 feet 7 inches deep, allow the guns to rise from the loading chambers below to the firing position, and in that position the openings are closed by the platforms. These openings are recessed around the edges for the reception of an elastic buffer, to transmit to the surrounding masonry the recoil thrust.

The parapet in front of the guns is 40 feet thick, and in order that the guns may have an all around fire, circular recesses drawn to a radius of 25 feet $4^{1}/2$ inches from the center of the gun pits, are formed in the parapet. The superior slope is 3 feet in 40. On each flank the exterior crest is carried back on the quadrant of a circumference concentric with the interior crest.

A chemin de ronde is arranged along the exterior crest, to give an infantry fire over the front approach. It has a parapet 1 foot thick and $4^{1}/2$ feet high, rising just to the line of the superior slope, which extends back to the rear of the terreplein to give a similar fire on the flank approaches.

Below the exterior slope the enveloping wall has an exterior and protecting embankment of sand arranged with the natural slope.

The main parapet, for a depth of $15^{1}/2$ feet below the interior crest, is composed of concrete, in which is embedded large broken stone, resting upon the sand core contained between the two walls of the battery.

The firing tests which have been made at this battery show that the concrete of the superior slope as ordinarily made is subject to disintegration by the blast of the gun. To remedy this defect, the slope has been paved with granolithic concrete 12 inches thick, which extends from the interior crest outward for a distance of 15 feet, and far enough laterally to embrace the extreme limits of exposure.

The foundation of the outer wall is placed 7 feet above mean low water, and projects 10 feet beyond the face of the wall on either side. The foundation of the main structure is in general 3 feet thick, except under the guns and accumulators, where it is increased to a thickness of 5 feet for additional strength. Thus the greatest pressure on the foundation at any point is $3^1/2$ tons per square foot.

The reference of the first floor is 10 feet above mean low water level at Sandy Hook, as established by the U.S. Coast and Geodetic Survey, giving a fall of 5 feet to the ordinary water level, for drainage.

The only entrance to the battery is through the caponiere. From the first floor room of the caponiere an entrance passage through the rear wall, ~~20~~ feet wide by 22 feet high, opens into the boiler room.

10 " " " 11 " " " 12

The boiler room is located along the central line of the battery from front to rear. It is 50 feet long by 18 feet wide, with walls 16 feet high. The ceiling is a segmental arch, with a rise of 6 feet. The boilers are located along the left wall of this room, in depressions in the floor 1 foot deep.

The front end of the boiler room opens into the accumulator room, which lies perpendicular to the boiler room and occupies the space between the two gun pits. It is 38 feet 8 inches long by 20 feet wide, with walls 20 feet high, and has a ceiling formed of a segmental arch with a rise of 6 feet. The ceiling and the side walls for $2^1/2$ feet down are extended on either end to the side walls of the battery, across the gun pits, for ventilation and communication. From each end of the accumulator room a passage 6 feet wide opens into the gun pit and extends across it to a recess 20 feet by 5 feet 4 inches, adjacent to the 10-foot wall, by which access is obtained to the heads of the bolts supporting the guide rails of the gun lift. It being of vital importance that the guide rails shall always be rigid and in line, the heads of all these bolts are at all times accessible. Those in front are reached through a transverse gallery outside of and adjacent to the 10-foot wall; those in rear, in the magazines.

In the floor of the accumulator room is a pit 20 feet long by 10 feet wide, 10 feet deep, in which are placed the accumulators; the stated depth is given to provide sufficient vertical space for the travel of the weights.

The two halves of the battery, on either side of the central line, are similar in arrangement and general design. Description will hereafter be confined to but one side.

The gun pit is 15 feet 4 inches square, and is located within the 10-foot wall of the battery proper, 25 feet 4 inches from the outside line on the side, and 12 feet 4 inches from the line on the front. The pit starts at reference 8, or 2 feet below the first floor level. A circular recess, 4 feet in diameter and $1^1/4$ feet deep, is made at the bottom of the pit, to receive the bed plate of the gun ram. Nineteen and one-half feet above the bottom of the pit, or at reference 27.5, the pit is enlarged to a length of 20 feet 5 inches and a depth of 25 feet 7 inches, for the reception of the gun platform; this opening extends to the terreplein above. A splayed recess in front of this platform pit, 8 feet 9 inches deep from the terreplein, receives the chase of the gun at any angle of traverse within 15 degrees of the front position. The magazines, two for each gun, are located in rear of the gun pits, one on each side of a central gallery. They are 30 feet by 15 feet in extreme dimensions, but the inner corner of each room is built up solidly to furnish necessary supporting masonry for the gun-lift guide rails.

The side walls of the magazines are 7 feet high. The outside room, on each side, designed for the storage and filling of shells, is furnished with a traveling bridge crane, of 2,000 pounds capacity, for handling projectiles.

The powder magazine has a capacity of 200 rounds; each round is subdivided into three sections of 150 pounds each, packed in zinc cases and stored on end.

The magazines are lighted by electricity, in connection with the general system of the battery, but bulls-eyes are placed in the rear walls to admit of illumination from the exterior, by lamps, should it be necessary.

The magazine gallery is 37 feet 4 inches long by 8 feet wide. The walls between the magazines and gallery are 4 feet thick; the wall between the magazine and boiler room is 5 feet thick.

The front end of the magazine gallery opens into the gun pit, and the rear end into the transverse gallery of the battery. An elevator shaft, located 7 1/2 feet in rear of the gun pit, gives passage for the ammunition to the loading gallery above.

The transverse gallery, in rear, extends from end to end of the battery in rear, a distance of 120 feet, crossing the rear end of the boiler room; the gallery is ten feet wide and 11 feet high under the crown of the ceiling arch.

A track, with a gauge of 3 feet, for the transportation of ammunition, extends through the entire length of this gallery, and communicates, by means of a turntable in the rear of the boiler room, with a similar track through the entrance. The track is constructed of girder rail, 72 pounds to the yard, set in the concrete floor of the battery.

An ammunition service track, made of gun-metal straps screwed to stringers of creosoted yellow pine 4 inches square, traverses each magazine gallery and intersects the supply track in rear, where ammunition is transferred by means of an overhead hoist. The service track communicates with the magazines by means of a turntable in the magazine gallery opposite the entrances to the magazines, and tracks, also of gun metal, which extend into the magazines on each side.

Doors, 10 feet from the main entrance, on either side, communicate from the rear longitudinal gallery to two small rooms located in the rear wall - one used as a storage room for paints and oils, and the other for a small electric plant designed to light the battery.

Two iron stairways furnish communication with the second floor. They are located in the rear wall at points 16 feet distant from the main entrance to the battery, on either side. These open on the second floor into a longitudinal gallery directly over the first floor gallery, 10 feet wide and 120 feet long, which is carried across the boiler room upon a bridge composed of 6-inch I-beams spaced 24 inches apart, covered by a flooring of $1^1/2$-inch pine plank.

The reference of this gallery is 25, the same as that of the second floor, and the thickness over the first floor arches is 4 feet.

The second floor is arranged similarly to the first floor. The rooms over the magazines are designed to be used as casemates or bomb-proof quarters for the gun detachments. The transverse gallery between the casemates on each flank is used as a loading gallery, and contains the hydraulic rammer and the operating stand for loading the gun. The rear end of this gallery, for a length of $5^{1}/2$ feet, has its floor at the level of the longitudinal gallery and communicates directly with the casemates; the floor of the front part is 5 feet higher, or coincident with the reference of the gun platform in the loading position, and connects with the lower level by means of a vertical iron ladder.

The ceiling of the north gallery is a full-center, inclined arch. Starting at the rear end, with the crown ~~13~~ 11 feet above the second floor level, it inclines forward and upward with a rise of $3^{1}/2$ feet in 30. The hydraulic rammer for loading the gun is rigidly fixed under the crown of this arch, at an angle of 5 degrees with the horizontal, in line with the loading position of the gun. The front end of this arch is faced with cut granite, to increase the strength at this point, where the masonry between the gallery and the terreplein has a thickness of only $4^{1}/2$ to 6 feet.

In the south half of the battery, the construction of the loading gallery was changed by substituting for the front end of the inclined arch a horizontal ceiling consisting of a series of flat transverse arches resting on 10-inch I-beams placed transversely and spaced 24 inches apart, with their lower flanges $4^{1}/2$ feet below the terreplein level. This modification strengthens this portion of the gallery, and gives additional headroom over the operating platform.

At the central point of the longitudinal gallery, a passage 4 feet wide leads to the rear into the second story room of the caponiere. Opening out of this passage, at a distance of 3 feet from the longitudinal gallery, a circular well, 4 feet in diameter, contains a spiral stairway leading to the terreplein above. The well is curbed at the edge of the terreplein with cut granite, and is surrounded by a guard rail, and covered by a temporary wooden turret to exclude rain. This stairway forms the only communication of the battery to the terreplein.

The terreplein level is 19 feet above the second floor level, giving a thickness of 6 to 10 feet over the second floor arches and those of the boiler and accumulator rooms. The terreplain is paved with flagging, 4 inches thick, to which is given a gentle slope from the gun pits in all directions, for drainage. The edges of the gun pit opening are faced with cut granite.

The caponiere, located centrally in rear, and covering the entrance to the battery, is 26 feet by 18 feet, and is built of cut stone, with walls 2 feet thick and 21 feet high. The second floor consists of concrete resting upon 8-inch I-beams spaced 24 inches apart, with their ends resting in the masonry walls and the intervals spanned by low concrete arches. The second floor ceiling is formed by two segmental arches with a rise of 3 feet, forming a groin. The rear corners of the caponiere are built in the form of octagonal towers, 4 feet on a side, projecting in a way to give an adequate cross fire.

The entrance is arched, and is 10 feet wide, and 12 feet high in the center, closed by two doors of yellow pine faced with steel. The walls of the towers on the first floor, and the entrance doors, have loop-holes for infantry fire. The second floor walls are similarly arranged, and have, in addition, three embrasures for machine guns; one bearing on the approach to the entrance, and one on each side, to sweep the rear slopes of the battery. The embrasures are of the Totten form, with openings 10 inches by 10 inches, and are closed when not in use by steel plates sliding in vertical frames. They were designed for guns of the Hotchkiss type for flank defense.

From the rear corners of the caponiere, sloping wing walls extend outward, to retain the adjacent embankment.

Opening out of the caponiere, on the first floor, are two rooms, one on either side, located against the rear wall and under the rear embankment. The one on the right is 9 feet by 7 feet 6 inches, and contains the pump for water supply; that on the left, 16 feet 4 inches by 7 feet 6 inches, has the floor raised 2 feet above the general floor level, and is designed to be used for water closets. From this room a separate drain pipe leads around the left end of the battery to a distant point of drainage.

Four ventilating flues, 8 inches in diameter, are located in the walls, extending from the ceiling of each magazine and casemate to the terreplein above, where they are covered by conical caps of sheet iron. The drainage of the second floor casemates and galleries consists of 4-inch pipes leading from the floors down through the walls into the soil below. The first floor magazines are drained through pipes of the same size through the floor foundations. The main drain of the battery has three openings, one in each gun pit and one in the center of the accumulator room, and extends underneath the front wall of the battery to the low ground near the beach. Trenches, from 1 to 2 feet wide and 1 foot deep, are provided in the floor wherever necessary, to convey the pipes of the mechanism. These trenches are covered by cast-iron checkered plates, 3/8-inch thick, and are connected with the main drain of the battery, for drainage.

The battery is lighted by electricity. The plant consists of a direct-coupled Thompson-Houston engine and dynamo, capable of delivering a current of ~~40~~ 75* amperes at 100 volts when running under a pressure of 80 pounds steam. The plant is located in the small room in the rear wall to the left of the main entrance, which is lined with pine sheathing, to insure against moisture from condensation. There are four 24-candle-power lamps located in the magazines, and fifty-four 16-candle-power lamps in the various rooms and passages. The lamps are covered with water-proof globes, and protected by metal guards. The wires are lead covered and placed in wooden molding fastened to the masonry walls by brass expansion bolts. The steam for operation of the plant is taken from the main boiler.

Mechanism.

Each gun platform consists of a direct-acting lift, raised and lowered by means of an hydraulic cylinder, and so arranged as to permit of the gun being loaded under the protection of the surrounding walls, and then raised vertically, a distance of 14 feet, to the firing position. The lift is efficiently guided in its movement, and is securely locked in position when elevated for firing, by bolts of sufficient strength to support the gun, carriage, and platform.

The bolts are so arranged as to be automatically locked when the gun reaches the firing position; after which they can be withdrawn at will by the operator.

The entrance of the water into the hydraulic cylinder is controlled by valves in such a manner that the lift shall move slowly and without shock at the beginning of the stroke, then continue at an accelerated speed until near the end of the stroke, when it is slowly brought to rest. By means of these valves the lift is under absolute control at all times; but safety devices are applied to prevent excessive travel, and to cause the hydraulic cylinder to land easily, without undue shock to the supply pipe in case of accident.

The water to operate the lifts is stored under pressure in two accumulators, under which water is pumped. The accumulators are duplicates, with the exception that they are weighted unequally to insure successive travel. The object of their duplication is to reduce the length of stroke within the available overhead space of the battery.

The combined capacity of the two is slightly in excess of that required to raise a single lift to its full height. The heavy accumulator is arranged to automatically stop the pumps at the top of its travel, and to start them as it begins to descend.

The accumulators are raised by means of two Worthington duplex pressure pumps, the steam for which is supplied by two return tubular boilers of 150-horse-power each.

The accumulator pressure is 1063 pounds to the square inch. The pressure on the gun-lift ram, due to gun carriage and movable parts, is 800 pounds per square inch.

The pumps receive their water from a supply tank of 1,500 gallons capacity, which is also the receptacle for the exhaust water from the lifts when said lifts are lowered.

The supply tank is supplied by a Rider Hot Air Compression Engine, which pumps from wells driven into the soil in rear of the battery. The capacity of the supply pump is 1000 gallons per hour.

The ammunition is elevated from the magazine gallery to the breech of the gun by a hoist which receives its motive power from the same source as the gun lifts.

A single charge is placed on a specially designed car, which is then run to the elevator shaft where it is elevated by the ram of the hoist, to bring the projectile and the three sections of the powder charge successively in line with the chamber of the gun.

The charge is inserted by an hydraulic rammer, fixed to the ceiling of the loading gallery.

The arrangement of the various parts of the mechanism can be seen by an inspection of the drawings. For details as to size and construction of parts reference is made to the detailed specifications (Inclosure 2), in accordance with which the mechanism for this battery was constructed, and which, for prudential reasons, form an inclosure to the general report.

Robert McGregor

2d Lieut., Corps of Engineers.

U. S. Engineer Office,

New York, N.Y., Dec.24, 1894.

(2 inclosures: 1, Drawings in 11 sheets.
2, Specifications of Mechanism.)

DEFENCES OF NEW YORK HARBOR, NEW YORK.

1894

GUN-LIFT BATTERY Nº 1.

SANDY HOOK, N.J.

CONSTRUCTED UNDER THE DIRECTION OF

LIEUT.-COL. G.L. GILLESPIE, CORPS OF ENGINEERS, U.S.A.

1st Lieut. HARRY TAYLOR, Corps of Engineers, U.S.A., Assistant from June 20, 1889 to Aug. 20, 1891.
1st Lieut. J. G. WARREN, Corps of Engineers, U.S.A., Assistant from Aug. 10, 1891 to Dec. 27, 1893.
2nd Lieut. ROBERT McGREGOR, Corps of Engineers, U.S.A., Assistant from Dec. 27, 1893.

GENERAL DRAWINGS OF MASONRY AND MECHANISM.

• IN 10 SHEETS •

MASONRY.

SHEET Nº 1. Plan of First Floor.
SHEET Nº 2. Plan of Second Floor.
SHEET Nº 3. Plan of Terre-plein.
SHEET Nº 4. Sections through Lifts and Boiler Room.
SHEET Nº 5. Sections through Magazines and Gun-Pits.

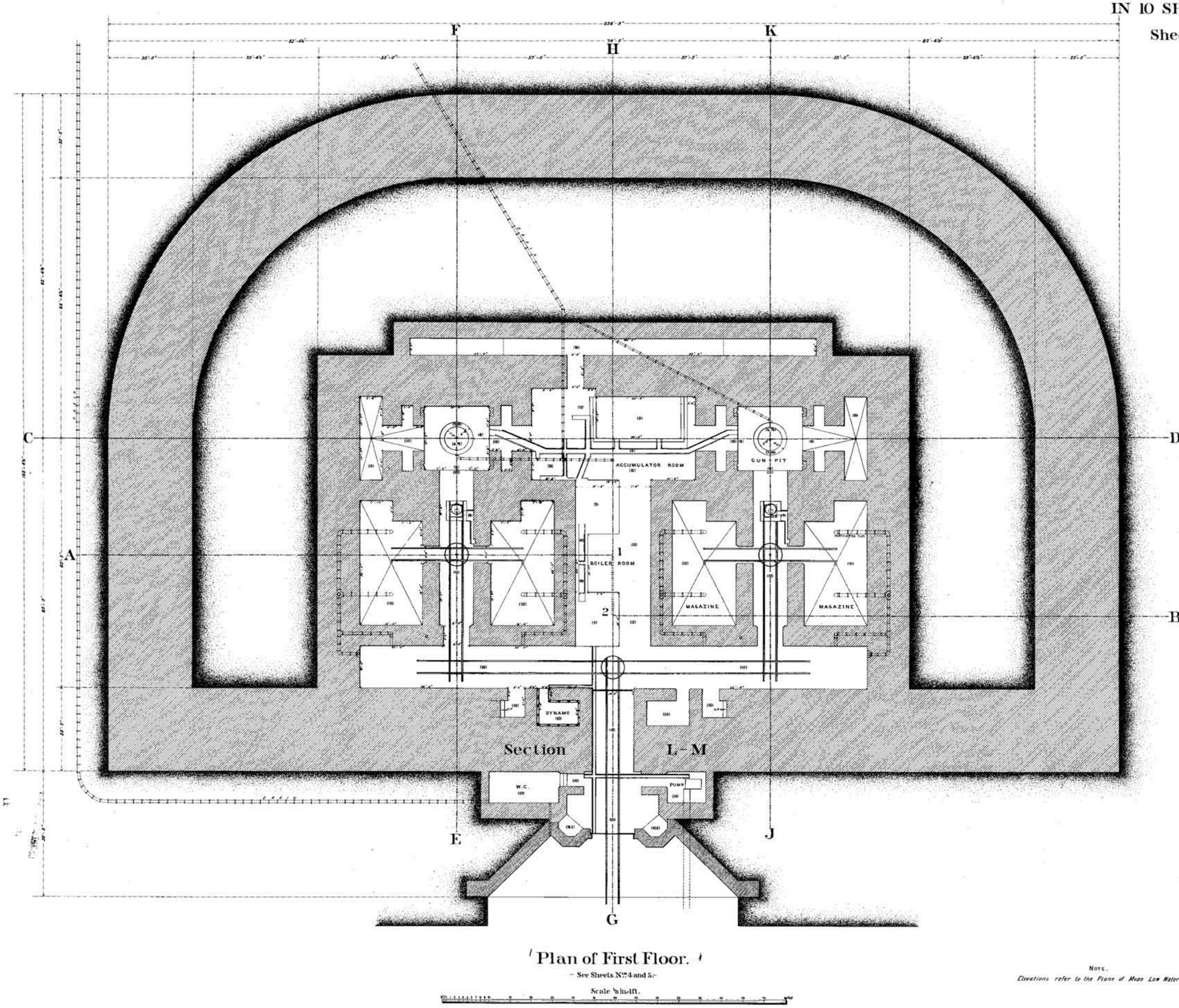
MECHANISM.

SHEET Nº 6. Plan of First Floor.
SHEET Nº 7. Plan of Second Floor.
SHEET Nº 8. Section through Boiler Room.
SHEET Nº 9. Section through Accumulator Room.
SHEET Nº 10. Sections through Gun Pits: North and South Lifts.

Drawn by C.G. Auerbach and W.H. Schmidt.

GUN-LIFT BATTERY, No. 1, SANDY HOOK, N. J.

IN 10 SHEETS.
Sheet No. 1.

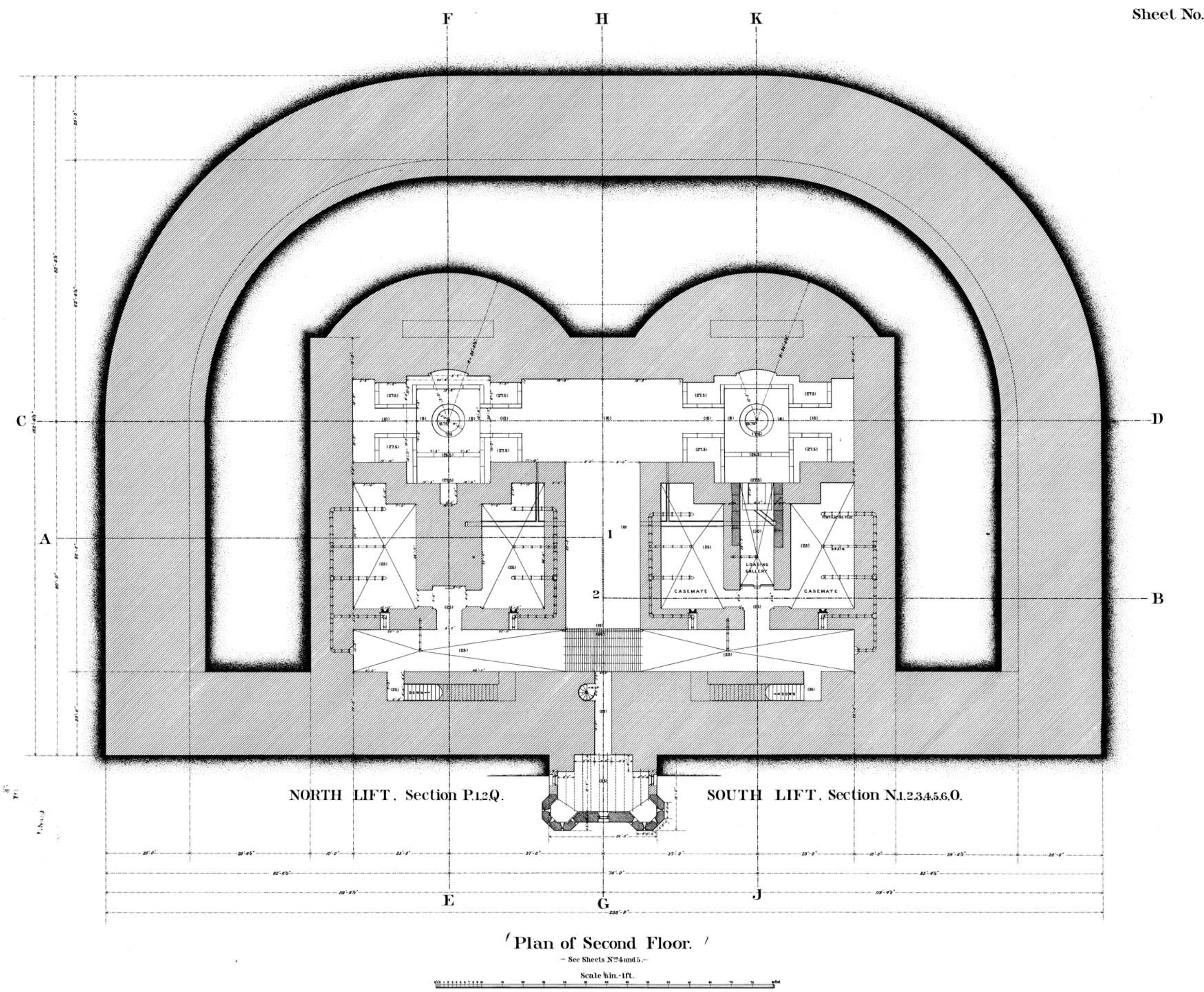


Plan of First Floor.
- See Sheets Nos. 4 and 5. -
Scale 1/8 in.-1 ft.

NOTE.
Elevations refer to the Plane of Mean Low Water.

GUN-LIFT BATTERY, No. 1, SANDY HOOK, N. J.

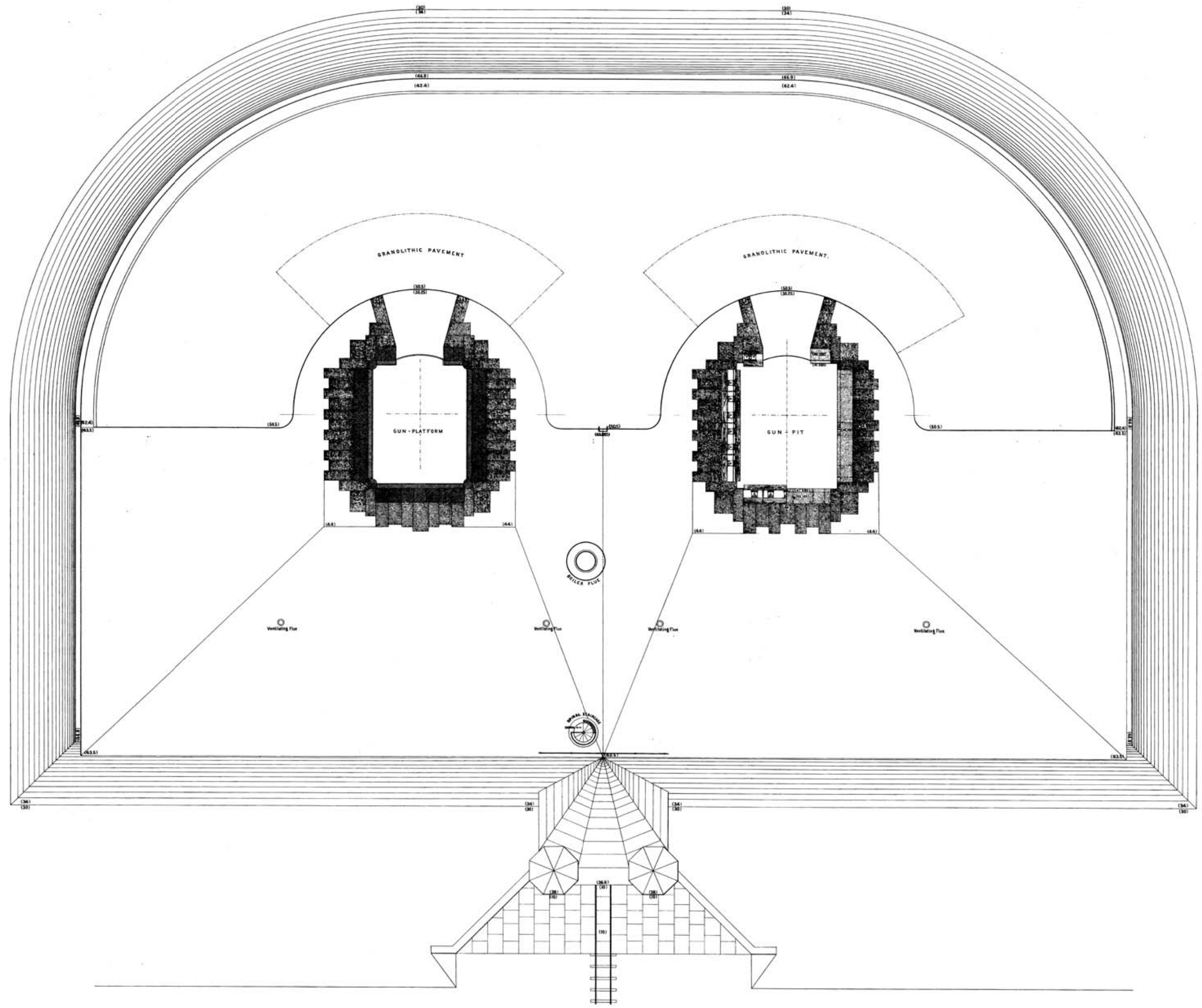
IN 10 SHEETS.
Sheet No. 2.



Plan of Second Floor.
– See Sheets Nos. 4 and 5. –
Scale 1/8 in. = 1 ft.

GUN-LIFT BATTERY, N°1, SANDY HOOK, N. J.

IN 10 SHEETS,
Sheet No.3.



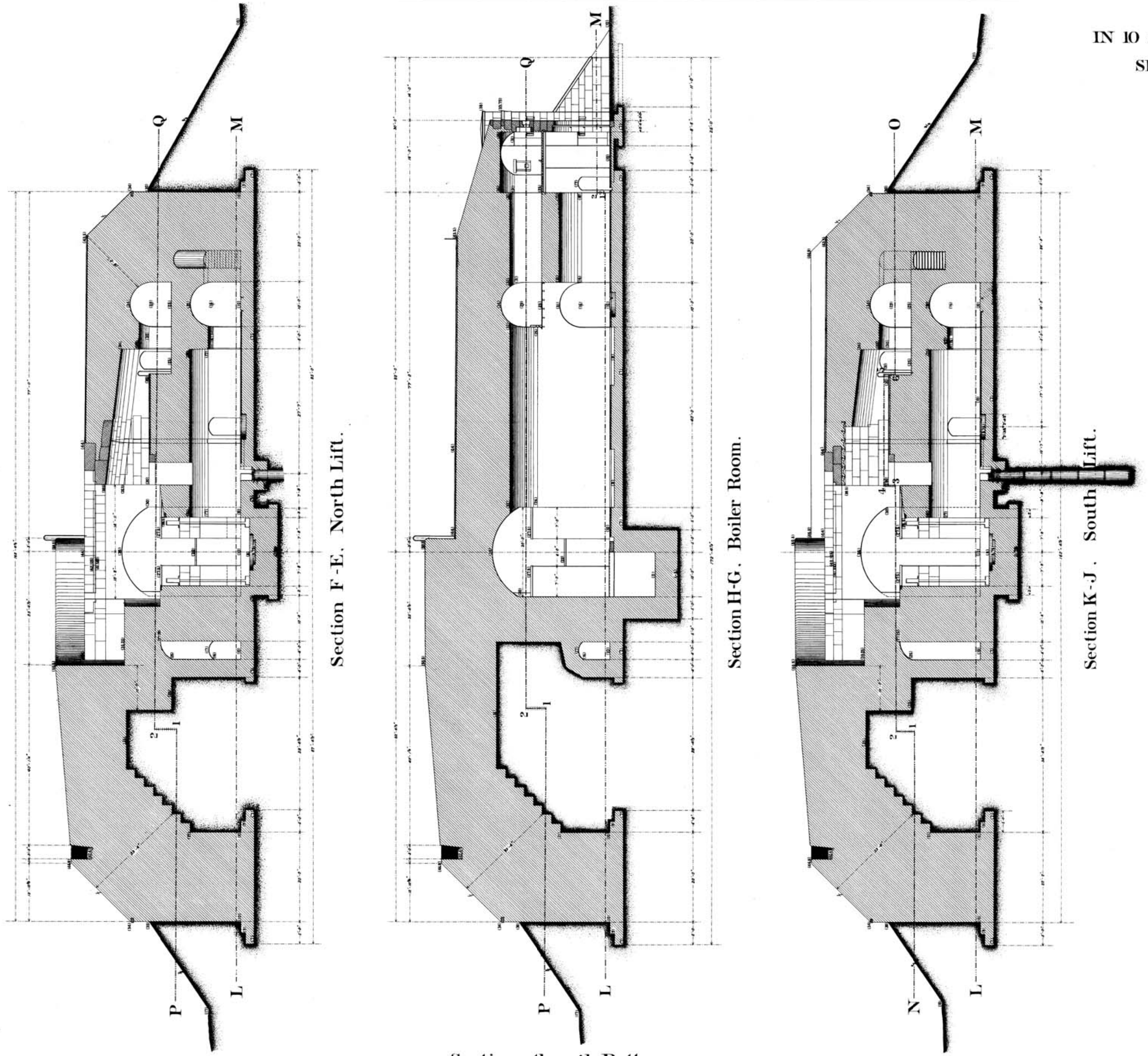
Plan of Terre-plein.

Scale ⅛ in.-1ft.

GUN-LIFT BATTERY, No. 1. SANDY HOOK, N. J.

IN 10 SHEETS.

Sheet No. 4.

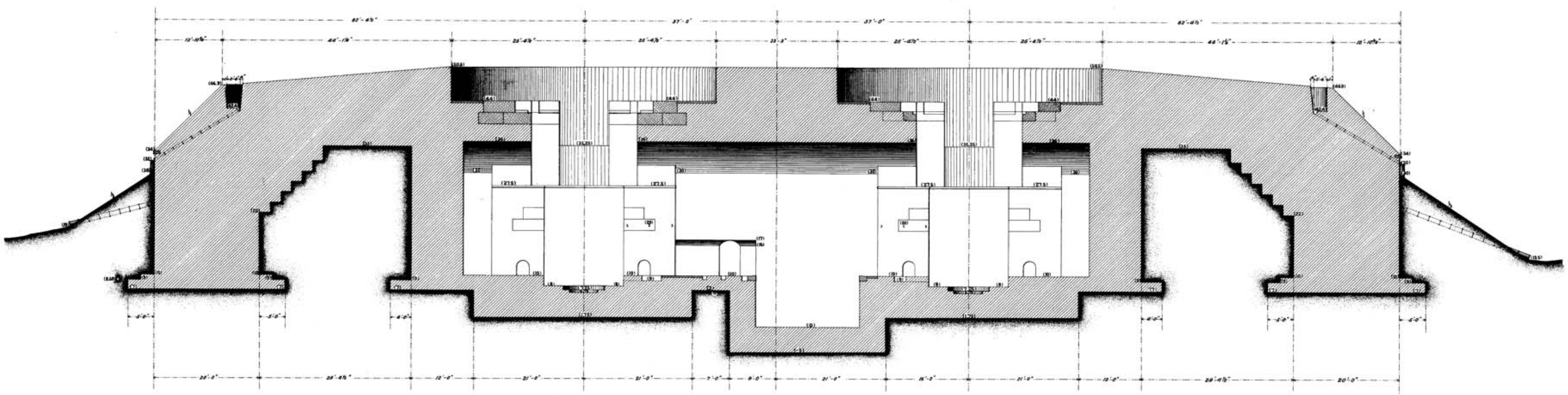


Sections through Battery.

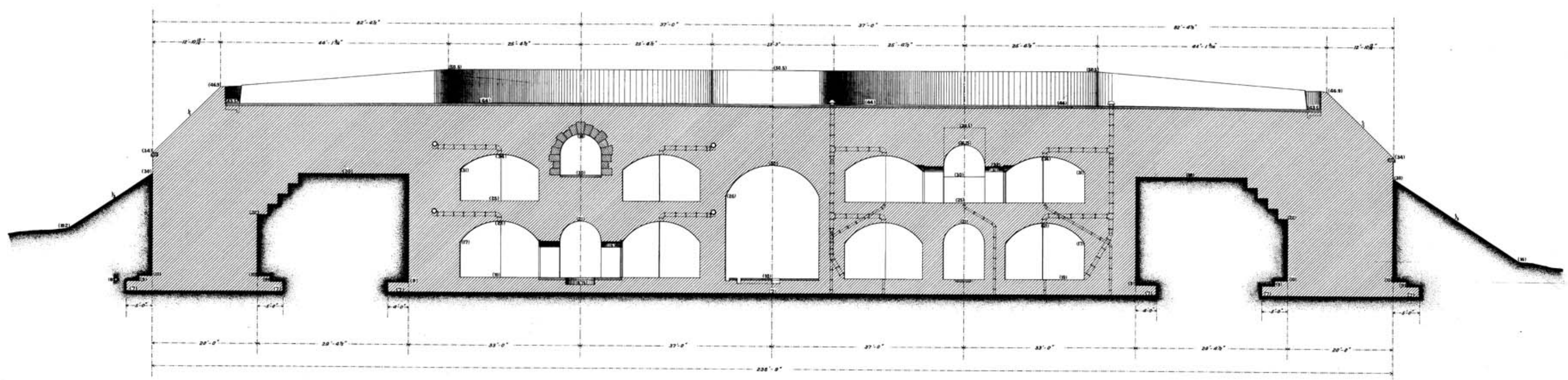
Scale 1/8 in.-1ft.

GUN-LIFT BATTERY, No. 1, SANDY HOOK, N. J.

IN 10 SHEETS.
Sheet No. 5.



Section C-D. through Gun-Pits.



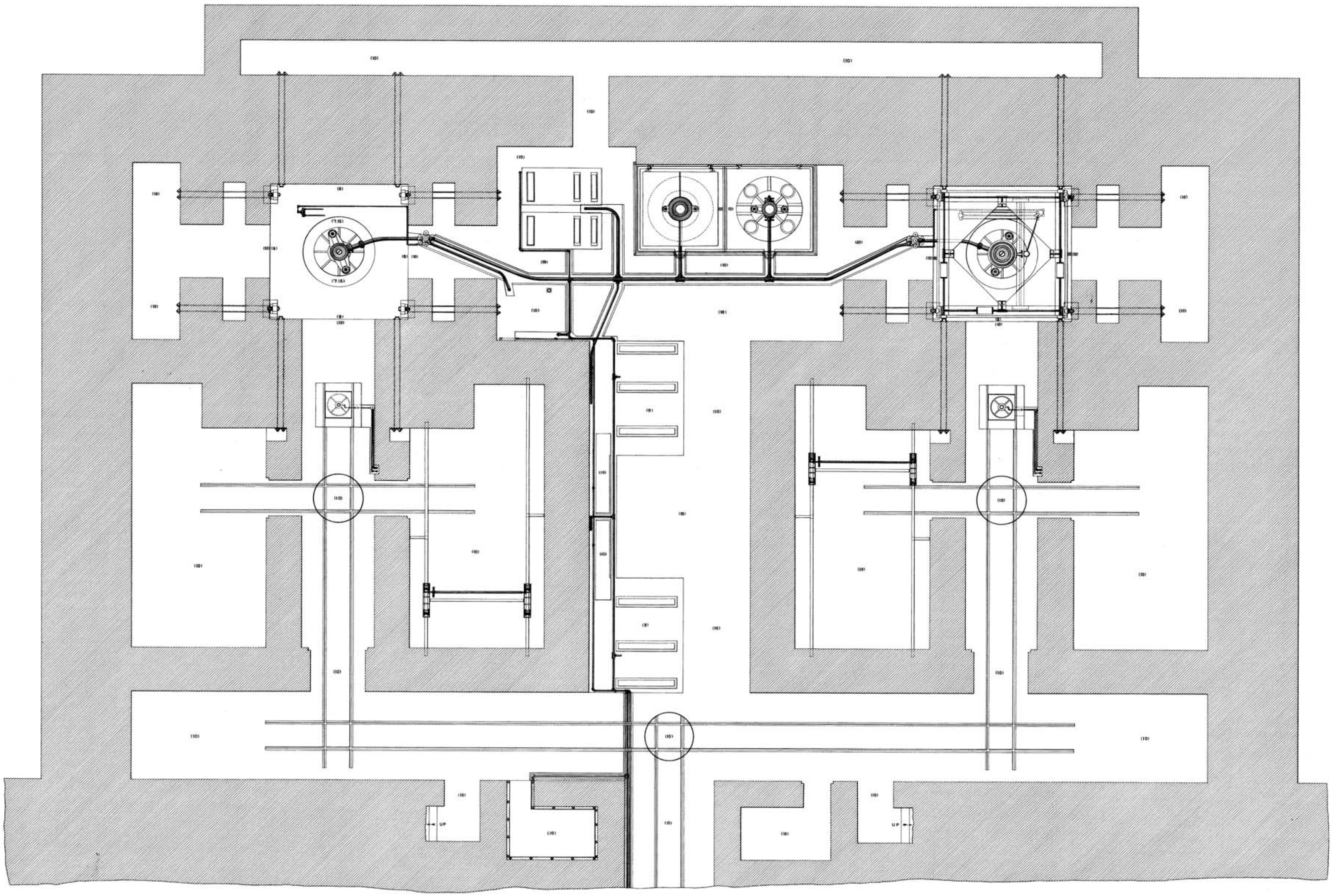
Section A.1.2.B. through Magazines.

Sections through Battery.

Scale ⅛ in. 1 ft.

GUN-LIFT BATTERY, No.1, SANDY HOOK, N. J.

IN 10 SHEETS,
Sheet No. 6.

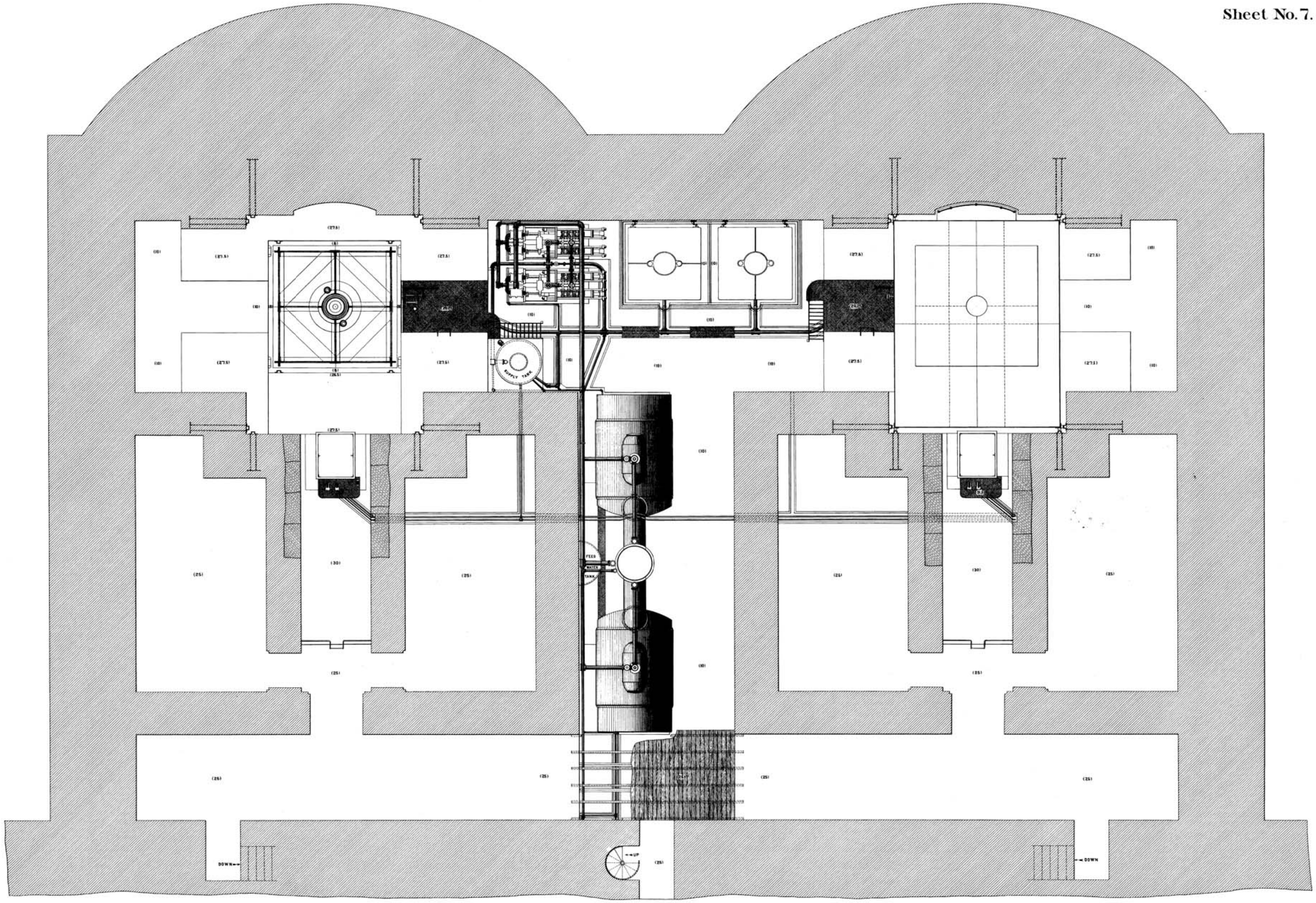


First Floor Plan of Mechanism.

Scale ¼ in.-1 ft.

GUN LIFT BATTERY, No. 1. SANDY HOOK, N. J.

IN 10 SHEETS.
Sheet No. 7.

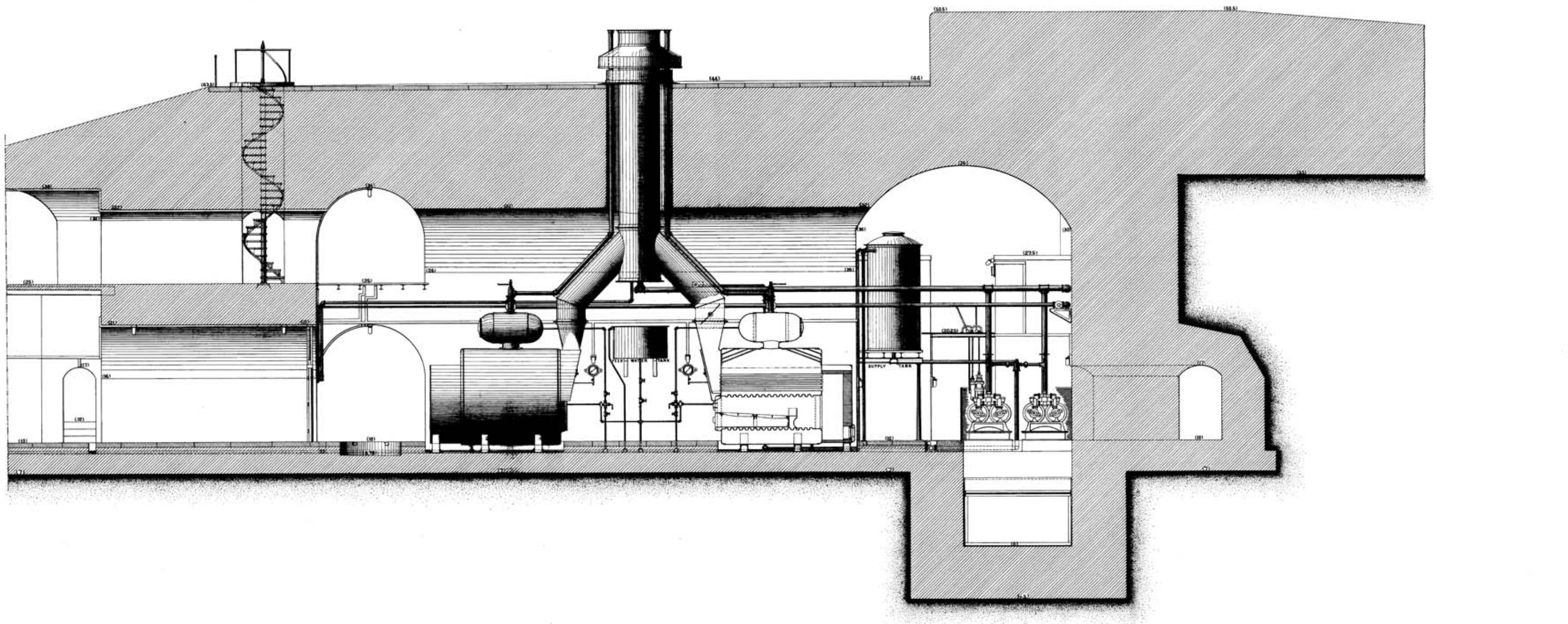


Second Floor Plan of Mechanism.

Scale 1/8 in.-1 ft.

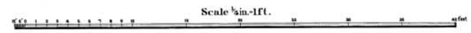
GUN-LIFT BATTERY, No. 1. SANDY HOOK, N. J.

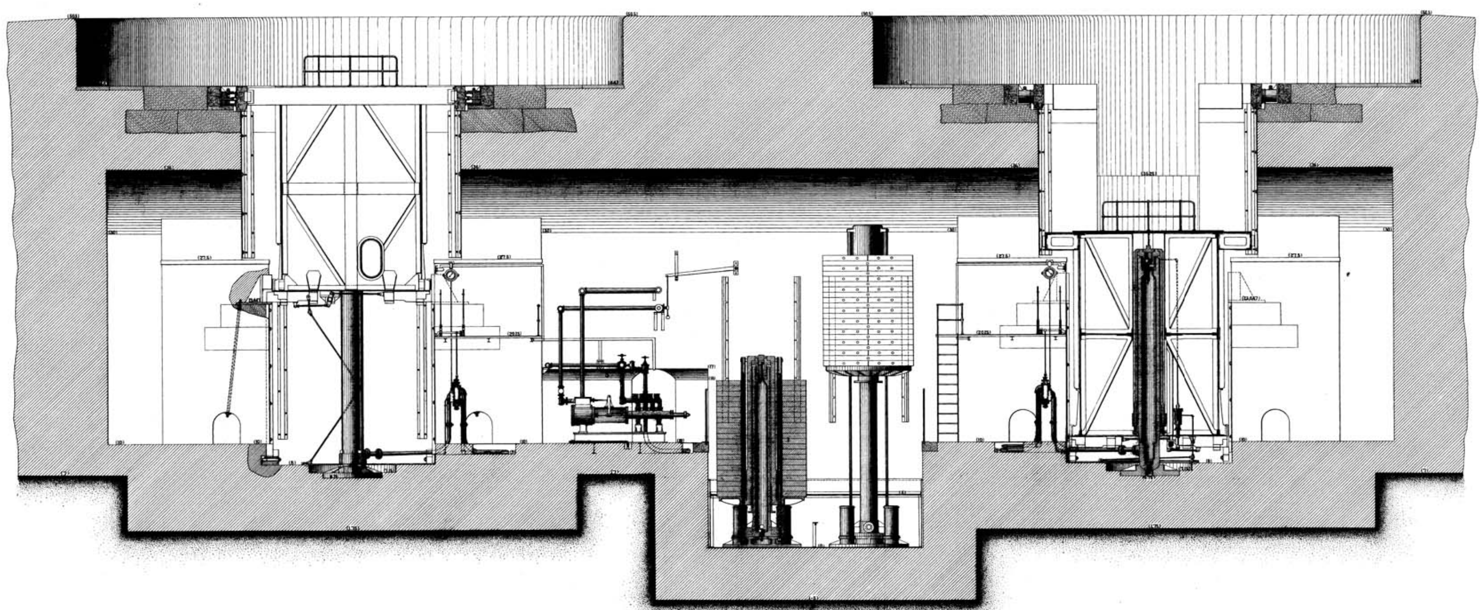
IN 10 SHEETS.
Sheet No. 8.



Section through centre line of Boiler Room
showing
Arrangement of Mechanism.

Scale ⅛ in.-1 ft.

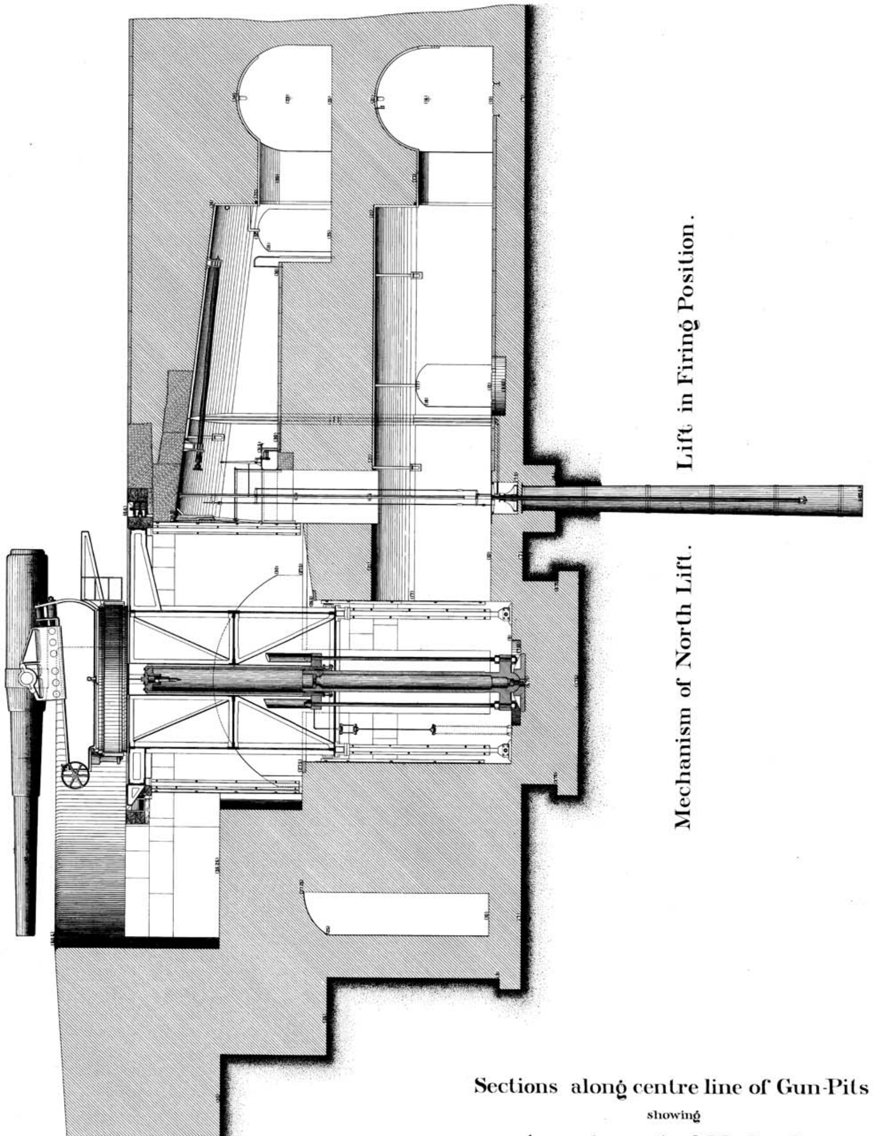




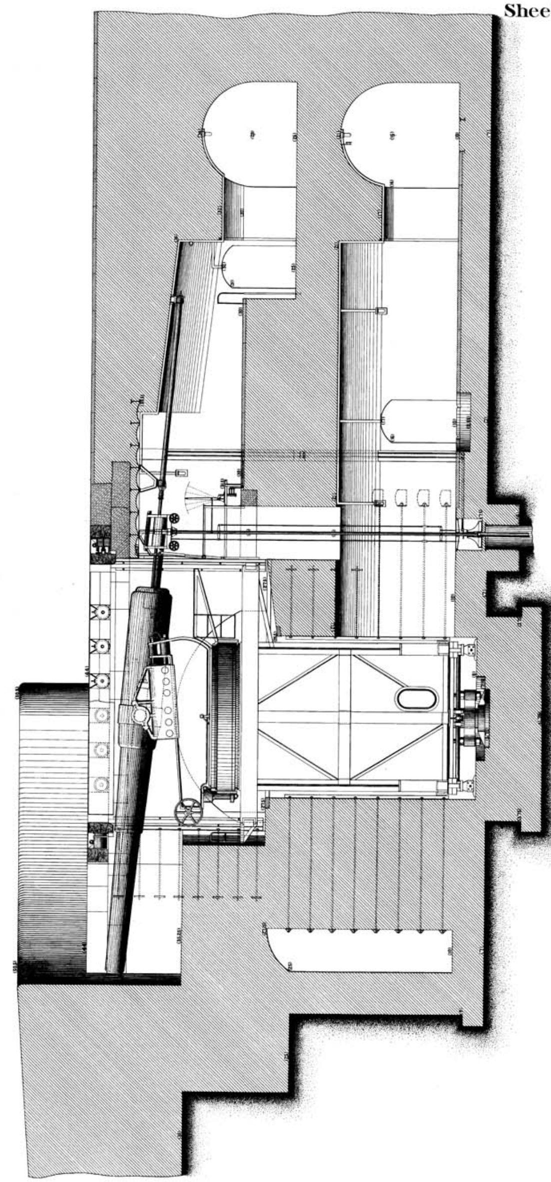
Section through centre line of Accumulator Room
showing
Arrangement of Mechanism.

Scale ⅛ in. = 1 ft.

IN 10 SHEETS,
Sheet No. 10.



Mechanism of North Lift. Lift in Firing Position.



Mechanism of South Lift. Gun in Loading Position.

Sections along centre line of Gun-Pits
showing
Arrangement of Mechanism.

Scale 1/8 in. = 1 ft.

APPENDIX E.

Report for the Mortar Platforms in Mortar Battery No. 1, Sandy Hook, New Jersey

Lt. Robert McGregor to Lt. Col. George L. Gillespie, March 5, 1894
File 1708, incl. 40; General Correspondence and Record Cards, 1893-94
Entry 98; Record Group 77; National Archives Building, Washington, D.C.

Guns & Mortar Batteries | U.S. Eng. Office, New York, N.Y.
Received Mar. 6 1894

Copies

OFFICE, CHIEF OF ENGINEERS, U. S. A.
INCLO. 40 OF 1708

Sandy Hook, N.J.,
Mar. 5, 1894.

Robert McGregor,
2d. Lieut., Corps of Engrs.

Submits report of the methods followed in sinking the foundations and setting the holding down bolts for the Mortar Platforms in Mortar Battery No. 1. at Sandy Hook, N. J.

RECD. OFFICE CHIEF OF ENGRS. MAR 13 1894

Copy:

U.S.Engineer Office,

Sandy Hook,N.J.,March 5,1894.

Lieut.Col.G.L.Gillespie,
Corps of Engineers,U.S.A.,
Army Building,New York City.

Colonel:-

I have the honor to submit, in compliance with your instructions, the following report on the methods followed in sinking the foundations and setting the holding down bolts for the mortar platforms in Mortar Battery No.1, at Sandy Hook, N.J. This work was done under the personal supervision of 1st Lieutenant J.G.Warren, Corps of Engineers, U.S.A., who was in local charge of the works at this place until December 20, 1893.

The soil upon which the battery is built is a heavy quicksand as far down as borings have been made, to a depth of 22 feet below the plane of mean low water. The level of the water in the sand is between 4 and 5 feet above mean low water. It varies with rains, and unusually high tides when recurrent, but is not appreciably affected by the regular tidal movement. The water is fresh down to about mean low water level; below that it is brackish.

The foundations of the walls of the mortar pits start at elevation 5 (the plane of reference being that of mean low water). The foundations of the platforms start below this, at elevation 2.3. To lay these latter foundations there was required an excavation of an area of 40 feet by 40 feet, or the entire pit, excepting the passage along the rear wall. Experience had shown it to be impossible to excavate below the water level without some precaution against sand flowing in from around the area excavated. It was necessary to guard against this from the first, to prevent undermining the adjacent wall foundations. The method adopted was proposed by Mr. J.H. Casey, assistant engineer. It consisted in draining the sand in the vicinity of the excavation by pumping from well points distributed over the area and connected with a single pump. The fresh-water supply for the construction plant on the work is from such a system, and experiments in this direction showed the practicability of lowering the level of the water in their vicinity by continuous pumping; and also furnished data as to the size of plant required for the work proposed.

Work was confined to a single pit at a time, the entire plant being removed and transferred as required. For the two north pits twelve well points were used, located as shown in the drawing, Fig. 1. The wells were $1^1/2$ inches in diameter and driven to about 2 feet below mean low water; they were connected together at the upper end and to the pump by a line of pipe, 5 inches in diameter at the pump, and diminishing to $1^1/2$ inches at the extremities. The pump used was a Blake Tank Pump with a 12-inch stroke, an 8-inch water cylinder, and a 5-inch suction; which at a speed of 100 strokes per minute gave a capacity of about 260 gallons per minute. It discharged through the main drain from the pit into the general drainage system of the battery. The pump was one that was on hand here, having been purchased for general use. Steam was supplied from the 20 horse power boiler of a double-drum hoisting engine on the work.

Water gauges, to determine the effect of the pumping and the area drained, were located as indicated on Fig.2, one in the northeast pit, two in the northwest pit, one in the ditch near the entrance to the north pits, and a fifth (not shown on the drawing) in a sand pit about 200 feet south of the battery, where it would be well beyond the effect of the pump. These gauges consisted of well points driven in the usual way and were provided with interior cylindrical floats of tin. The elevation of the water was indicated by the upper extremity of an upright rod fastened to the float, and moving over a vertical scale, the zero of the scale corresponding to mean low water. During the pumping for the two north pits readings were taken on the gauges every hour, and the results recorded. The record made during the pumping for the northwest pit is given below, to show the local effect of the pumping. The pump was started at 10 p.m., August 9, and run with but slight intermission until 2.40 p.m., August 11, when the concrete of the foundations was high enough to be out of danger from submergence.

At 8 a.m. August 10, the water was found to be low enough to admit of excavation, and the work was accordingly begun and carried on as rapidly as the lowering of the water would admit. Concrete was placed as fast as the excavation was ready, the pumps being worked continuously until 2.40 p.m., August 11, when the concrete was up to elevation 4.2.

Date.	Time of day.	Gauge readings.				Remarks.
		I.	II.	IV.	V.	
		Feet.	Feet.	Feet.	Feet.	
Aug. 9	10 p.m.	4.02	4.03	4.01	....	Gauge III was not read.
	11 "	4.11	5.05	4.02	....	
	12 "	3.09	2.10	4.02	....	
Aug.10	1 a.m.	3.29	2.74	4.02	....	
	2 "	3.33	2.05	4.02	....	
	3 "	3.07	2.03	4.02	....	Stopped pump 3.30.
	4 "	3.75	2.25	4.01	....	Started 4.10.
	5 "	3.30	2.02	4.02	....	Stopped 5.10.
	6 "	3.22	3.25	4.06	....	Started 6.25.
	7 "	3.70	2.20	4.20	....	
	8 "	3.65	1.92	4.20	....	Excavating for plat-
	9 "	3.60	1.92	4.20	4.05	forms began.
	10 "	3.67	1.87	4.20	4.05	
	11 "	3.56	1.86	4.10	4.07	
	12 "	3.54	1.84	4.09	4.07	
	1 p.m.	3.53	1.80	4.06	4.03	
	2 "	3.52	1.82	4.06	4.03	
	3 "	3.51	1.70	4.05	4.04	
	4 "	3.50	1.82	4.05	4.04	
	5 "	3.05	1.08	4.05	4.03	
	6 "	3.04	1.07	4.05	4.03	
	7 "	3.04	1.07	4.00	4.06	
	8 "	3.04	1.07	4.00	....	
	9 "	3.04	1.07	4.00	4.06	
	10 "	3.04	1.06	4.00	....	Stopped at 10.00.
	11 "	3.04	2.02	4.00	....	Started at 11.00.
	12 "	3.04	1.09	4.00	....	
Aug.11	1 a.m.	3.04	1.08	4.00	4.06	
	2 "	3.04	1.08	4.00	....	
	3 "	3.04	1.09	4.00	4.06	
	4 "	3.04	1.09	4.00	....	
	5 "	3.38	2.00	4.00	....	
	6 "	3.38	2.03	3.98	3.98	
	7 "	3.38	2.00	4.00	....	
	8 "	3.42	1.90	3.98	....	
	9 "	3.42	1.95	3.98	3.98	
	10 "	3.42	1.86	3.98	....	
	11 "	3.42	1.90	3.98	....	
	12 "	3.42	1.90	3.98	3.98	
	1 p.m.	3.44	1.90	3.98	....	
	2 "	3.44	1.95	3.98	4.05	Pump stopped at 2.40 p.m.
	3 "	3.44	2.10	3.96	....	
	3.30"	4.40	4.40	4.40	....	
	5 "	3.55	3.30	3.96	4.05	

The draining of the pit in this way left the sand free from water, but damp enough to stand vertical under the wall of the pit, enabling the concrete to be put in against it without forms. Wooden forms were used for the concrete of the platforms, except where it came under the footing of the wall. No especial care was taken to preserve the well points that came within the concrete; but they were all afterwards withdrawn, only two being lost in the operation.

The plan worked well from the first, and no unforeseen difficulties were met with. At the time of excavating for the south pits, on October 9, the general level of the water in the soil was higher, being about 4.8; in addition to this fact, a bed of coarse gravel, about 3 feet thick, underlying the foundations, allowed the water to flow in the soil more readily, and the one pump was found to be insufficient. In the southeast pit twelve hours continuous pumping lowered the water only 1.2 feet. It was therefore thought best to increase the plant by a second smaller pump, connected to six well points distributed over the center of the area to be drained before beginning work. Even with this additional power headway was made but slowly against the water, and both pumps were run continuously from 3 p.m., October 9, to 1 p.m., October 11, before it was deemed safe to stop the small pump; the large pump was continued until noon of October 12. It should be stated that the insufficiency of the increased plant was probably partly due to the inability of the boiler to supply sufficient steam for both pumps.

The bolts, twenty-four in number, that hold the roller path to the platform,extend entirely through the concrete foundation,where they are held,at the bottom,by washers. As the setting of these bolts is an operation requiring great accuracy,it was thought best not to attempt it while the foundations were being put in; and their subsequent setting and adjustment was provided for in the following manner. At the bottom of the excavation,and about where the head of each bolt would come,was placed a small layer of concrete about 2 feet in diameter and 6 inches thick (Fig.4). This was rammed in place and an empty cement barrel inverted over it. The foundation was carried up around these barrels,thus leaving holes,18 inches in diameter,that allowed a large latitude in setting the bolts. The upper head being left in the barrel kept the hole clear during the progress of the work and until the time came for setting the bolts; the concrete at the bottom of the hole kept the sand from flowing in when pumping was stopped,and also served as a support for the head of the bolt during the operation of setting.

Figure 3 shows the method used for setting the bolts. A skeleton frame or template swinging on a fixed center served to hold the bolts in position after the center had been accurately located and one bolt set at the proper distance from it. The pieces of the template were not fastened together,but were simply swung over the bolts to hold them in place,the bolts being plumbed,and supported at the proper level from below. The barrels were broken up and entirely removed preparatory to setting the bolts. The holes being full of water,the concrete in which the bolts were to be set was lowered to its place in bags, where it was deposited and tamped in place. The sections of the template were moved progressively around the circle as the bolts were set. The bolt at the center was set in a temporary mound of concrete which was afterwards broken up and removed.

There are transmitted herewith a drawing illustrating the methods employed, and a number of photographs taken during the progress of the work in the pits, which may be of interest in this connection.

Very respectfully, your obedient servant,

(Sd) Robert McGregor,

2d Lieutenant of Engineers, U.S.A.

APPENDIX F.

Report on the Proof Firing at Mortar Battery No. 1, Sandy Hook, New Jersey

Lt. Robert McGregor to Lt. Col. George L. Gillespie, June 23, 1894
File 1708, incl. 47; General Correspondence and Record Cards, 1893-94
Entry 98; Record Group 77; National Archives Building, Washington, D.C.

New York, N.Y.,
June 23 '94.

Gillespie,
Lt. Col. G. L.

Reports the results of a proof firing which came off yesterday at Mortar Battery No. 1, Sandy Hook, N.J., under supervision of the Ordnance Officer Comdg. Proving Ground thereof, to test gun, carriage, platform & effect of blast upon breast-height wall & the blast slope. The southeast gun of north-east pit was tested. Blue print showing mortar in position inclosed.

1 Inclo. (blue print)

Letter to The Bd. of Engrs. June 27, 1894.
Inclo. 48 (Blue-print) noted on Fort. Map Files June 28, 1894.
K

G.& M.B.

SUBJECT: Proof Firing, Mortar Battery.

LT. COL. G. L. GILLESPIE,
CORPS OF ENGINEERS, U. S. A.

ENGINEER OFFICE, U. S. ARMY,

ROOM F 7, ARMY BUILDING, 39 WHITEHALL STREET,

NEW YORK, N. Y.

June 23, 1894.

Brig. Gen. Thomas L. Casey,
Chief of Engineers, U.S.A.,
Washington, D.C.

General:-

I have the honor to report the results of a proof firing which came off yesterday at Mortar Battery No.1, Sandy Hook, N.J., under the supervision of the Ordnance Officer Commanding Proving Ground and myself.

The trial had for its object proof of gun, carriage, platform, and also especially of the effect of blast upon breast-height wall and the blast slope.

The southeast gun of the northeast pit was selected for the test, because, when laid normal to the crest line of the battery at the minimum distance of 18 inches, with an elevation of 45 degrees (the minimum), and fired with the extreme charge, it subjected the wall and slope to the greatest possible pressure.

The following table gives the characteristics of the rounds:

No. of Round.	Powder.	Elevation.	Weight of shot.	Weight of charge	Pressure	Time of flight.
		° '	Pounds	Pounds	Pounds	Seconds
1	B.P.R.H....................	45 00	630	67 1/2	21,000	Lost.
2	B.P.R.H....................	45 00	630	73	22,800	45 2/5
3	B.P.R.H....................	45 00	630	81 1/4	29,000	47 4/5

The projectiles went to sea, and were not recovered.

When the battery was planned, it was expected that the center of trunnions would be in the vertical plane passing through the center of pit - but in the carriage adopted, the plane of trunnion passes 3 feet $3^{1}/2$ inches outside the pit center, throwing the muzzle of the mortar proportionately nearer the breast-height wall. It was thought possible that this change might necessitate the elevation of platforms in other batteries similarly located.

As fired, the muzzle was 18 inches from the crest of the wall, and the lower surface of the bore extended was only 6 inches from the slope.

It was feared that the blast would damage the interior crest, and possibly tear out the concrete slope.

No such result was realized. Neither platform, crest, nor slope was damaged in the slightest degree, and the only observable injury to the battery was the dislodgment of the first line of sodding at the top of the blast slope, covering a length of 10 feet approximately, along the crest and 2 feet up the slope.

The crest of wall is at reference (20.0), and the crest of slope at (35.0). The length of slope is 21 feet, approximately.

The sod dislodgment was due partially to the fact that it projected slightly - two inches or more - over the concrete slope, furnishing a surface for the blast to act upon.

It is estimated that the time of flight, 45 to 47 seconds.

corresponds to a range of 4 to 5 miles - for Gedney Channel and its adjacent approaches, east and west, the elevation will probably be 60 degrees.

It was observed, as one of the incidents of the firings, that following the explosion a violent rush of wind passed through the transverse gallery to the pit, taking off the straw hats of the observers, and scattering papers, books, etc., lying upon the observers' table - the greatest wind pressure being apparently along the floor.

The smoke of the blast whirled to the right and left towards the adjacent corners of the pit, but was speedily carried upwards and over the slope by the rush of wind from the rear gallery.

It is proposed by the Commanding Officer of the Proving Ground to continue the firings until each mortar and carriage has been subjected to a proof test of five rounds. Records of all firings will be taken by my assistants.

I will add that notice in advance of the firing was given to the Light Keeper of the main tower close to the battery, and station was taken by him upon the lantern gallery to observe effect.

No glass was broken, and while an appreciable shock was felt there, no injurious vibration of tower or adjuncts took place.

A blue print is inclosed showing mortar in firing position, and section through breast-height wall and blast slope of east face of the battery opposite southeast platform of northeast pit.

Very respectfully, your obedient servant,

G. L. Gillespie

Lieut. Col., Corps of Engineers.

(1 inclosure.)

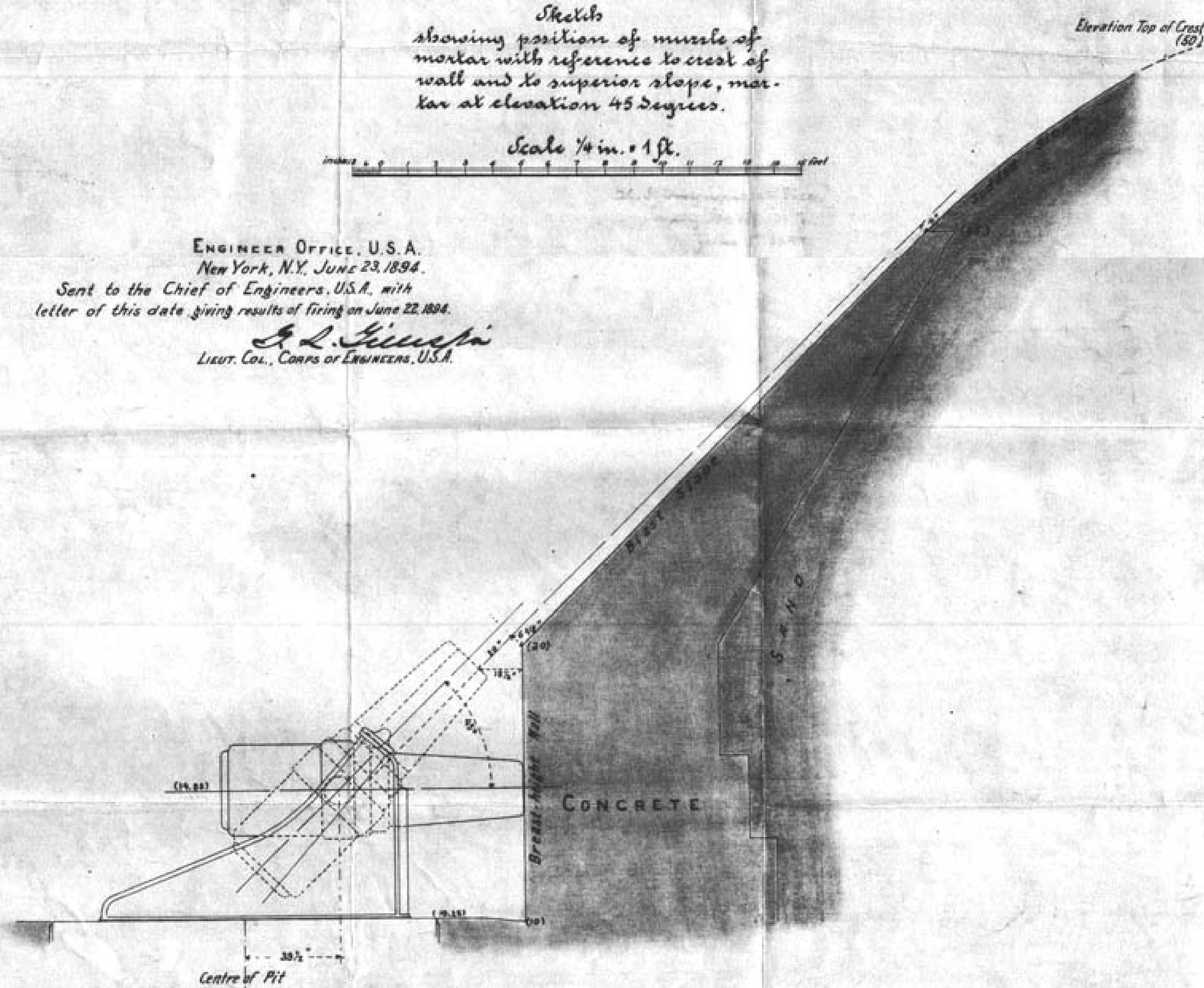
Mortar Battery No. 1.
North-East Pit, South-East Gun.

Sketch
showing position of muzzle of
mortar with reference to crest of
wall and to superior slope, mortar at elevation 45 Degrees.

Scale 1/4 in. = 1 ft.

ENGINEER OFFICE, U.S.A.
New York, N.Y. June 23, 1894.
Sent to the Chief of Engineers, U.S.A. with
letter of this date giving results of firing on June 22, 1894.

G. L. Gillespie
LIEUT. COL., CORPS OF ENGINEERS, U.S.A.



National Park Service
U.S.Department of the Interior

Historic Architecture Program
Northeast Region
Boott Cotton Mills Museum, 4th Floor
115 John Street
Lowell, MA 01852

Cover photograph: Battery Potter, Proof Firing March 1894. Gateway NRA Museum Collection, Sandy Hook (Catalog # GATE 7795).