

Industrial Heritage '84



New England



The Fifth International Conference
on the Conservation of the Industrial Heritage



Guidebook

Lowell
Excursion

Charles Parrott

Industrial Heritage '84 is sponsored by the Society for Industrial Archeology and the International Committee for the Conservation of the Industrial Heritage and hosted by the SIA and its Southern New England Chapter.

Other sponsors of the Conference include:

Lowell Historic Preservation Commission
Lowell Historical Society
Lowell National Historical Park
Maine State Museum
Massachusetts Council on the Arts and Humanities
Massachusetts Department of Environmental Management
Massachusetts Executive Office of Economic Affairs
Massachusetts Heritage State Parks Program
Massachusetts Historical Commission
Office of Secretary of State
Massachusetts Institute of Technology
Department of Urban Studies and Planning
Program in Science, Technology, and Society
Merrimack Valley Textile Museum
National Trust for Historic Preservation
Slater Mill Historic Site
University of Lowell

Funding or support for the Conference has also been provided by:

Aetna Life and Casualty Companies
Architectural Conservation Trust
Bank of Boston - Essex
Blackstone Valley Electric Co.
Central Savings Bank, Lowell
City of Lowell
Alex B. Daunis, President
U.S. Providence Corporation
International Research and Education Exchange
Lowell Institution for Savings
Maine Humanities Council
and the National Endowment for the Humanities
National Park Service through the Massachusetts Historical Commission
New Hampshire Council for the Humanities
Nypro, Inc.
Theodore Edson Parker Foundation
Union National Bank, Lowell

Cover: The industrial landscape of Lowell looking north from the tower of City Hall ca. 1896.

All illustrations courtesy of Special Collections Library, University of Lowell except Merrimack Manufacturing Company view courtesy of Merrimack Valley Textile Museum.

In 1815 at Waltham, Massachusetts, an investment group which has come to be called the Boston Associates introduced what is considered the first integrated cotton factory, the Boston Manufacturing Company, where all operations were performed under one roof by powered machinery. The success of this experiment prompted the investors to look for another site where additional water power could be developed. In 1821 they chose a site at the Pawtucket Falls on the Merrimack River near Chelmsford, Massachusetts, which they developed into Lowell, the first successful American example of a planned industrial city. Here engineering work created a system of factories and power canals on a scale and a level of sophistication unsurpassed by previous schemes.

At Lowell, the Merrimack River fell some 30 feet (9.2 m.) over a succession of low falls and rapids in the space of about one half mile (1-1/4 km). In 1796, a company called the Proprietors of Locks and Canals on Merrimack River had built the Pawtucket Canal to bypass these falls. A transportation canal 1-3/4 miles (4-1/2 km) in length, it carried timber and other products from the upper valley to the sea at Newburyport. A second transportation canal, the Middlesex, built in 1803 further above the Pawtucket Falls, took away much of its business with a direct route to Boston, and the Pawtucket Canal fell into relative disuse.

The Boston Associates purchased the shares of the Proprietors of Locks and Canals, and some 250 acres (625 hectares) of adjacent farmland for factory development. Between 1822 and 1845, they rebuilt the Pawtucket Canal as a power canal, planned and built a dam across the head of the falls, added six power canals branching from the Pawtucket, and constructed ten factory sites which included 31 textile mill buildings, two prints works, and a machine shop. Concurrently they built more than 600 company-owned dwelling houses, both boarding houses for female employees and tenements for mechanics and overseers and their families.

In planning Lowell, the primary objective was the optimal location of industrial sites to take advantage of the water power. These sites were contained within or adjacent to the eastern half of an irregularly shaped area bounded by the Merrimack River and the Pawtucket Canal, forming a large island. Feeder canals were extended from the Pawtucket Canal to the mill sites which were located parallel to either the river or canals. These canals were: the Merrimack Canal, 1822-23; the Hamilton Canal, 1826; the Lowell Canal, 1828; the Western Canal, 1828-32; the Lawrence Canal, 1831-32; and the Eastern Canal, 1835-36. Placement of the canals established rectilinear street grid patterns among the mills and the adjacent corporation housing. Integrated into the city plan were previously-existing farm to market roads with established river crossing points. The Salem/Boston road (Merrimack Street) and the Billerica Road (Central Street) were main arterial streets then as now.

The villages and farms of East Chelmsford contained about 200 inhabitants in 1821. By

1826, the year Lowell was incorporated as a separate town, the population was about 2500.

When city status was achieved in 1836, the population was over 17,500 with 8000 employed in the mills. This tremendous growth in population and productive capacity suggests the parallel growth of the manufacturing operations during this period. By the late 1830s, increased demands for water power were beginning to produce shortages. Continued industrial growth was contingent upon an increased supply of water power. The textile corporations controlling Locks and Canals, the water power company, sought to improve the canal system so that more of the untapped potential of the Merrimack River could be utilized for their manufacturing operations. James B. Francis, Chief Engineer of the Locks and Canals Company since 1837, was charged with solving this problem. Francis determined that the addition of a new canal supplying more water to the system than the existing Pawtucket Canal, along with the development of a system for the controlled storage and release of water from the upstream watershed, and an increase in the head of water available in the canal system were all necessary to increase the guaranteed power available from about 6000 horsepower to over 9000 horsepower. This was achieved in 1846-48 by the construction of the Northern Canal and associated works, which was heralded as a heretofore unparalleled achievement of hydraulic engineering. Francis was also instrumental in the development and introduction of the large and efficient hydraulic turbines in the Lowell Textile mills starting about this same time.

These improvements in the quantity and efficiency of water power prompted further growth in productive capacity in the Lowell mills and further growth of the city. By 1850 the population was 33,000, and the ensuing decades witnessed continual enlargement and rebuilding of the textile factories. When even this new energy source was used to capacity, it finally became necessary to begin the large scale introduction of the steam engine in the textile factories as an auxiliary power source. From a point of only marginal power utilization in the 1840s, the steam engine surpassed water power as a power source by 1880 in Lowell's original textile corporations.

After 1875, Lowell began to fade from the limelight to which it had been thrust by the novelty of its development in the 1820s. The experiment of the paternalistically controlled corporation boarding house noted throughout the industrialized nations of the world had ended gradually after 1850 as exploitation resulted in labor strife, which beset the relative tranquility of the first years. The largely native female work force was replaced gradually by immigrants--first from Ireland, then in succession largely by French-Canadians and Greeks. The textile mills continued to be a competitive industry in Lowell through World War I and Lowell's population grew to a peak of about 100,000 at the turn of the century. However, after 1920, continuing labor disputes and the growing uncompetitive position of the

local cotton factories led to the gradual cessation of operations of the mills. The closing accelerated during the Depression of the 1930s; the last holdout, the Merrimack Manufacturing Company, ironically the first founded in Lowell, closed in the late 1950s.

The demolition of the Merrimack Manufacturing Company shortly after its closing exemplified the depressed conditions that had become the common experience of Lowell during the previous 30 to 40 years. The razing of this famous textile factory and its worker housing was also ironically the first rallying point for the economic and cultural rebirth of the city. Through a process of locally initiated support for the recognition of the historical significance of Lowell in the growth and maturation of industry in the United States, steps were accomplished which resulted in Lowell becoming a new and unique National Historical Park in 1978. Equally fortuitous has been the general rebirth of the industrial economy of northeastern Massachusetts, of which Lowell is a part, as a major center of the American microelectronics industry over the last several years. These two developments portend well for the preservation of Lowell's industrial heritage through the restoration and interpretation programs of Lowell's park-related entities and the rehabilitation of underutilized mill buildings for new uses prompted by the economic resurgence of Lowell.

All of Lowell's power canals and their hydraulic control machinery and major portions of seven of the factory complexes, along with much historic power generating equipment survive. These buildings, engineering sites, and machinery installations form the physical remains of Lowell's industrial heritage and are the focus of the points of interest described herein.

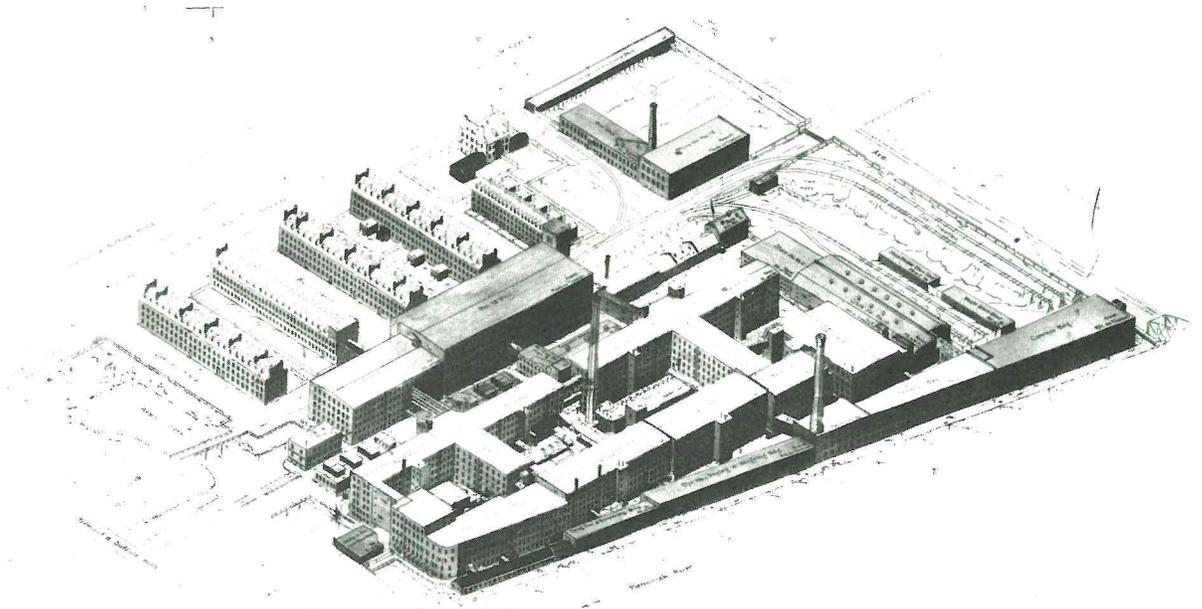
1. GUARD LOCKS

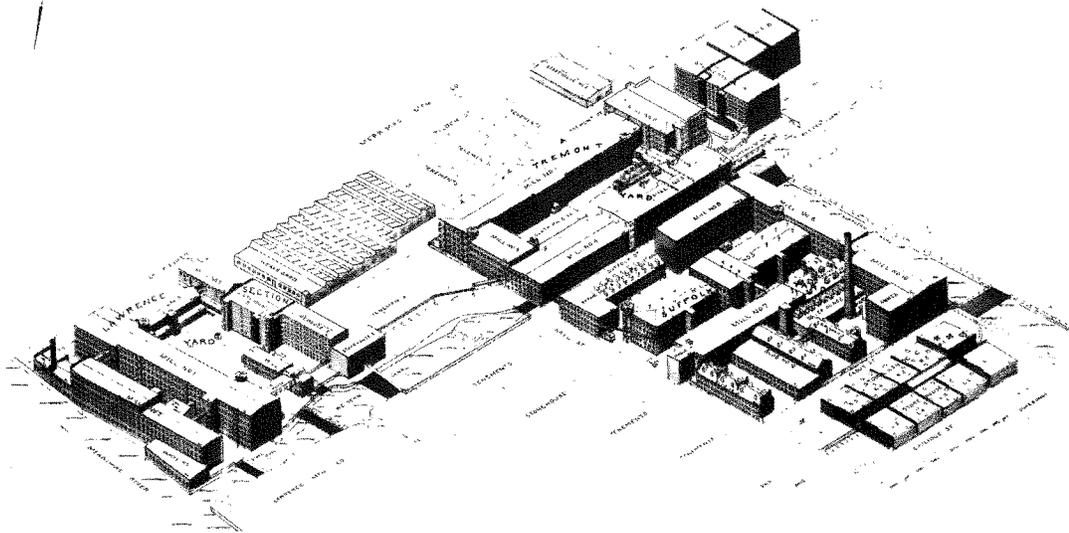
The works at this site form a part of the dam creating the "pond", or reservoir supplying water to the original power canal, the Pawtucket. The three individual structures are the brick Gate House (1870) on the water power channel which contained five water hydraulically operated sluice gate hoisting mechanisms; the Lock House (1881) over the transportation channel which protected the upstream gates of the boat lock; and the Great Gate (1850), better known as the Francis Gate, a sheltered timber portcullis flood gate which has been twice dropped. The dam itself, stretching across the site between Gate House and Great Gate, was built in 1832 and increased to its present height in 1848.

2. NORTHERN CANAL GUARD GATES (Pawtucket Gate House) and PAWTUCKET DAM

The eastern one third of the dam adjacent to the gate house was built in 1847 along with the gate house as part of the Northern Canal project. The gate house contains the original hoisting machinery of the ten sluice gates as well as the Francis turbine of the same date which originally powered the gates, along with the belt drive shafting and pullys of the power transmission system. The turbine is felt to be the original full scale prototype of the Howd-Francis turbine, predating those installed at the Boott Mills by two years. Although Francis did not mention this turbine in his Lowell Hydraulic Experiments of 1855, it was intended to be a test device as evidenced by the various

4. Lawrence Manufacturing Company in 1910. View by Associated Mutual Insurance Companies.





5 & 6. Suffolk Manufacturing Company and Tremont Mills in 1915 (Tremont and Suffolk Mills after 1871). View by Factory Insurance Association.

hydraulic test fittings built into the wheel pit. The dam was completed across the river in 1875, finally replacing the 1833 dam. The dam follows the line of the head of the Pawtucket Falls.

3. GREAT RIVER WALL, NORTHERN CANAL WASTE GATES (High Bridge Gate House) and LOCKS AND CANALS POWER HOUSE

The Great River Wall (1847) of the Northern Canal is a massive granite retaining wall nearly one-half mile (1 1/4 km) in length which separates canal from river in a section of the canal which was built on the river bed. The pin-connected Pratt deck truss road bridge carrying Moody Street (now University Avenue) across the canal and river at the River Wall was built in 1896. At the downstream end of the River Wall are the Waste Gates which contained four canal drain gates, two scouring holes, and a waste weir. A small turbine, powered gate hoisting machinery, and present gate house were added in 1872. Currently under construction immediately downstream from the Waste Gates is the Locks and Canals Company's Power House, which is scheduled to begin generating 15,000 volts of electricity in 1985. A control structure and boat lock will be built across the canal near the site of the temporary fill gravity dam.

4. LAWRENCE MANUFACTURING COMPANY

Incorporated in 1831, with production starting in 1833, this company produced cotton cloth exclusively until during the Civil War (1864) when woolen and later cotton knit

production was added. In 1896, cloth production was dropped in favor of knit goods with the sale of the Secondary Millyard (east of the Western Canal). The company's operations were curtailed during the depression years of the 1930s when much of the remaining property was sold. Water power was furnished by the Lawrence Canal on the lower level of the canal system, parallel to the mills and river. Three Hercules turbines of 1909-16 remain operational in a wheel room remnant of one of the mills. Two of the five original buildings survive in altered form with a link structure (c. 1855) between them. Three other early 20th-century Hercules turbines sit abandoned beneath this link structure. The roof on this three-building group was raised one story and the octagonal towers added c. 1870. All buildings in the Secondary Millyard and several in the main millyard, along with the eight blocks of corporate housing have been demolished. The nearby stone agent's house of 1833 survives, as does the second counting house of 1877.

5. SUFFOLK MANUFACTURING COMPANY (Wannalancit Office and Technology Center)

Incorporated in 1831, with production probably starting the following year, this company produced cotton textiles. The Suffolk Company was managed jointly with the adjacent Tremont Mills until 1871, when they were officially merged. In 1926, the Suffolk portion of the company was sold and the buildings subsequently owned by a succession of textile manufacturers, lastly the Wannalancit Textile Company until 1981, when its textile production (short run synthetics) ended. Most of the surviving complex was recently rehabilitated for tenancy as the Wannalancit Office and Technology Center. The two original mills of 1832 were

first linked together in 1844 and then replaced entirely with a new mill in 1862 during the Civil War cotton shortage shutdown. The 1831 Counting House with 1845 repair shop extension, one of the four boarding houses of 1831, the Agent's House built in the late 1830s, and eight of the original block of ten mechanic's houses of the late 1840s survive. Power water originally was supplied to the mills from the upper level Western Canal to breast wheels beneath the 1832 mills. But after the Northern Canal was built, by 1854 water was taken directly from it to all four new Boyden Turbines. The 1848 wheel house for these turbines was on the site of the existing wheel room which still houses the six paired and one single Victor replacement turbines installed in 1895. Hydroelectric belt driven generators were added to these turbines in 1909. A 1909 belt drive wheel is extant beyond the west wall of the wheel room.

in 1848 and its four Boyden turbines were all in operation by 1854. Evidence of the gearing and shafting supports for the power transmission system from these turbines survives in the north exterior wall of the wheel house. In 1851, James Francis conducted his famous "Experiments Upon the Tremont Turbine" here, the results of which were published in his Lowell Hydraulic Experiments in 1855. One of these Boydens was replaced in 1881 with a Humphrey Turbine. The remaining three Boyden turbines were first replaced in 1890 and then again in 1895 with six paired Victors and then finally by hydro-electric Morgan-Smiths during 1919-21. These last turbines were removed in 1983, although the penstocks, wheel pits, and tailraces remain unfilled. The Tremont yard now serves as a parking lot for the Wannalancit Office and Technology Center.

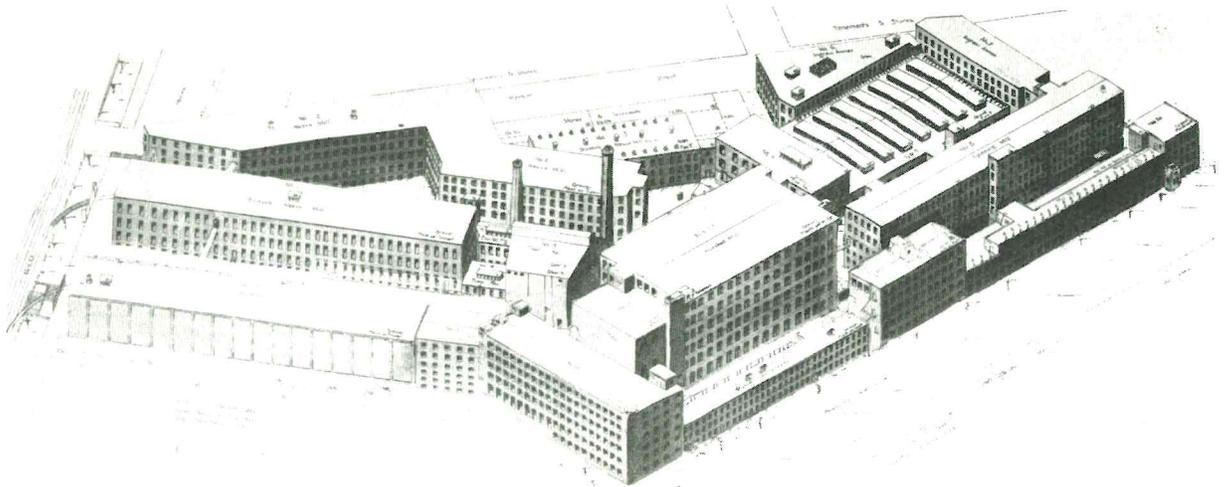
6. TREMONT MILLS (site)

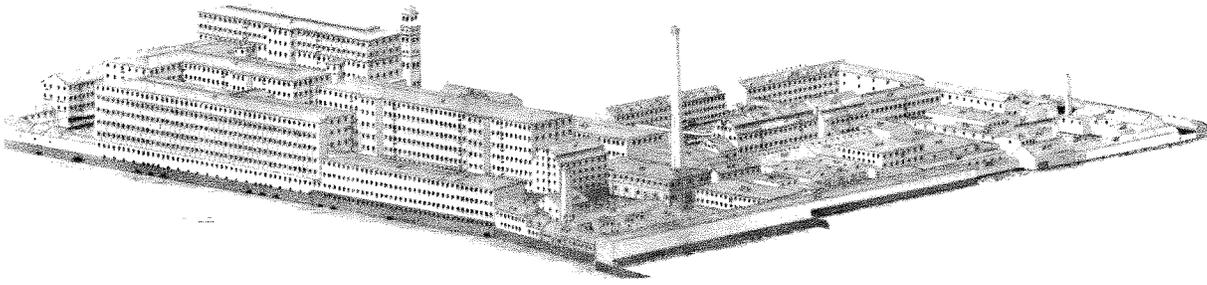
Incorporated in 1831, like the Suffolk Company, the Tremont began production of cotton textiles in 1832. Production continued in the Tremont millyard until the late 1920s when the first demolition began. Most of the buildings were demolished except for the 1906-15 weave shed (built on the site of the Tremont boarding houses) and some others including the mill containing the wheel room. Subsequent demolitions have left only the walls of the wheel room standing. The Tremont Mills was almost an architectural mirror of the Suffolk Company in early development; also originally having two mills which were first linked together in 1844 and then replaced by a larger building in 1862. The new wheel house to utilize Northern Canal water was also completed

7. TREMONT GATE HOUSE, HICKEY HALL DAM (Hall Street or Tremont Dam), AND LAWRENCE DAM

The Tremont Gate House and Hickey Hall Dam served, in turn, the function of creating the head between the upper and lower levels of the Western Canal. The Hickey Hall Dam was originally built in 1831-32 as part of the Western Canal and was rebuilt in 1845. A flight of two locks was originally located beside the dam. After the construction of the Northern Canal and relocation of the Tremont and Suffolk Mills headraces and wheelpits, the Tremont Gate House, 600 feet (165 m.) up the Western Canal from the Hickey Hall Dam at the confluence of the Northern Canal, was built in 1855. The bypassed portion of the Western Canal between these two sites was henceforth used as a wasteway to supply water directly to the Lawrence Mills when there were shutdowns at the

9. Lowell Manufacturing Company in 1906 (part of Bigelow Carpet Company after 1899). View by Associated Mutual Insurance Companies.





11. Merrimack Manufacturing Company in 1878. View by Barlow and Bancroft Insurance Survey.

Tremont and Suffolk Mills. The Lawrence Dam, built in 1831-32 at the end of the Western Canal just beyond the intersecting Lawrence Canal, controls the wasting of water from the lower level Lawrence Canal.

8. MOODY STREET FEEDER GATE HOUSE

The Moody Street Feeder was built in 1848. It is a triple tunnel underground canal that fed water from the Northern Canal into the Merrimack Canal. Northern Canal water reached the Feeder via a short section of the Western Canal--the flow of which was reversed after the inauguration of the Northern Canal. The brick Gate House controlling the flow of water in the Feeder is located at the end of the Feeder. The Gate House contains three manual sluice gates, set at a skew angle with the axes of the building to correspond with the curve of the Feeder tunnels into the Merrimack Canal beneath the Gate House. The unusual Flemish bond brickwork of the Gate House is a particularly fine example of brick masonry craftsmanship.

9. LOWELL MANUFACTURING COMPANY (Market Mills)

This company was chartered in 1828 with production beginning in 1829. The products of this company were much different than those of Lowell's other textile mills. The Lowell Manufacturing Company first specialized in the course cotton cloth known as Negro cloth, along with hand woven carpets. Some of the earliest work involving the introduction and development of the carpet loom in the United States was carried out here, and the world's first power carpet loom was developed here by Erastus Bigelow by 1842, after which the company increasingly specialized in carpet production. The third mill of 1848 was an unusual, early example of a monitor skylighted one story weave shed, built for large carpet looms. The

original buildings have all been replaced, but two of the later carpet mills were rehabilitated for mixed uses in 1980-81 under the name Market Mills. The Lowell National Historical Park Visitor Center is located here. The Lowell Manufacturing Company's corporation housing was located on the site of these two buildings. Some of the original frame double houses are thought to have been relocated to Wamesit Court, some blocks away, where they survive. The company was sold in 1899 to the carpet conglomerate founded by Erastus Bigelow. The Lowell operations of Bigelow ended in 1914 and the buildings were sold individually to several parties. The power house of 1911, now known as the Assets Power Plant, combined the location of the company's hydraulic turbines with its steam turbines. The original hydraulic turbines in this plant, four horizontal Hercules models, remain in use; the steam turbines, while out of service, have been retained in place. The power canal of the Lowell Manufacturing Company, the Lowell Canal, was covered by concrete vaults in 1906, and thus is not immediately evident on the site.

10. BOSTON AND LOWELL RAILROAD TERMINUS (site)

The Boston and Lowell Railroad was completed in 1835, along with the Boston and Providence and the Boston and Worcester, railroads. These were the first three railroads operating in New England. The Lowell terminal station, a wooden building of Greek temple inspired form, was located at the corner of Merrimack and Dutton Streets. It was one of the first railroad stations built in the United States. It was replaced in 1856 by a brick structure known as Huntington Hall, a mixed use building containing public meeting rooms on the upper floor and the railroad station on the lower floor. Although Huntington Hall was destroyed by fire in 1904, the brick vault on which it sat over the canal remains. Soon after the completion of the Boston and Lowell, tracks gradually began to be extended to the millyards and the use of the canals for freight

transportation was abandoned. Across Merrimack Street from the station site is a monument commemorating the Boston and Lowell. This monument preserves a section of the original B & L roadbed of granite ties and blocks and the cast-iron rail chairs and fish belly rails, imported from England.

11. MERRIMACK MANUFACTURING COMPANY (site)

This company was the first textile company established by the Boston Associates, and remained Lowell's largest. It was incorporated in 1822, and the first of its five original mills was put in operation producing cotton cloth in 1823. Its wooden and iron breast water wheels were powered by the 30 foot (9.2 m.) head of the newly dug Merrimack Canal. The Merrimack Company was the only Lowell textile company to enjoy the full fall of the Merrimack River available at Lowell. The associated Merrimack Print Works was built on an adjacent site and opened in 1826, producing calico prints. The first company housing was mostly wooden double houses built in the early 1820's but also included three blocks of four connected brick houses. These brick blocks were the prototype of the longer rows of multiple brick houses which soon became the standard in Lowell and similar new industrial cities. The original mill buildings of the Merrimack Company were taken down and new, larger buildings erected on the same sites in 1853. The often photographed Dressing Mill of 1863, whose tower visually terminated the Merrimack Canal, was demolished in 1940, followed by the remainder of the Merrimack Company buildings during 1958-62. Also demolished in this period was the Merrimack Dam of 1835, located at the head of the Merrimack Canal's wasteway. The part of the Merrimack Canal within the millyard, known as the Inner Canal, was filled at this time, but remains the only section of the canal system that has been obliterated. The worker housing was lastly demolished in the mid 1960's.

12. ROLLING DAM, BOOTT DAM, AND BOOTT PENSTOCK

The Rolling Dam and Boott Dam were both constructed in 1835 (along with the Merrimack Dam) to control the wasting of water back into the river from both the Merrimack canal (Rolling Dam) and Eastern Canal (Boott Dam). Both dams are covered by small buildings which protected sluice gates and the hoisting apparatus. Within the building housing the Rolling Dam is an additional sluice gate which controlled the flow of water into the Boott Penstock, an underground conduit built in 1846, which after 1848 supplied Northern Canal water via the Merrimack Canal to the Eastern Canal for the often water starved Boott Mills.

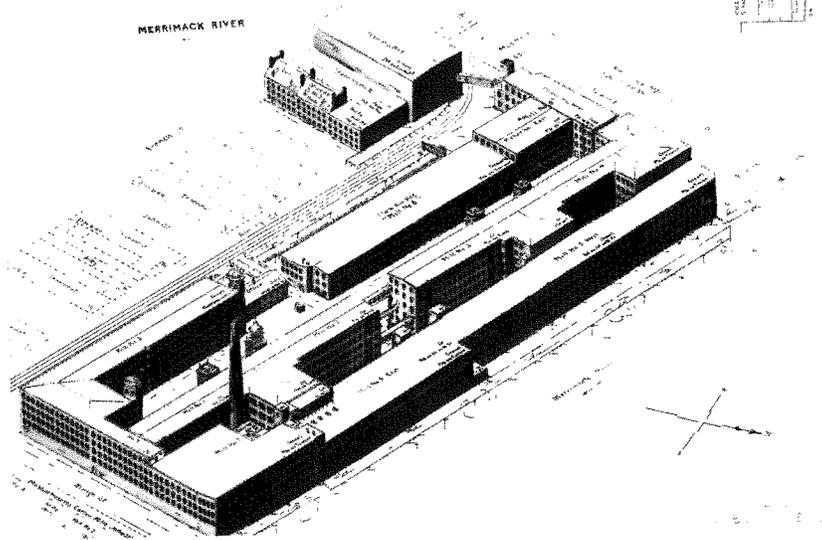
13. BOOTT COTTON MILLS BOARDING HOUSE

The Boott Mills originally had a classic array of eight boarding house blocks, located in parallel rows directly across the Eastern Canal from the millyard. Built in the 1835-37 period, these buildings each contained eight individual units: four mill girl boarding houses located in the middle 2/3 of the building, and four single family "tenement" houses located in pairs and entered at each end of the building. The blocks were built in the style and of the type typical to most of Lowell's corporation housing: 3-1/2 stories, brick with flat granite trim, and parapet connected chimneys. Only one of the Boott blocks has survived, albeit in severely altered form. This building is undergoing a rebuilding which will see the reconstruction and restoration of its original exterior appearance and the provision of a new interior designed to house multi-use cultural and interpretive functions. The first two floors of one typical boarding house unit also will be reconstructed.

14. BOOTT COTTON MILLS

This company was incorporated in 1835, and the first two of its four original mills began production in 1836. Water power was supplied by the 17 foot (5.2 m.) head of the new Eastern Canal. The row of four parallel original mills survives in altered form, along with upper and lower courtyards formed by later buildings located along the canal and river in rows parallel to the original buildings. These rows of buildings and parallel water courses exemplify the classical siting of a textile mill complex as optimally arranged for utilization of direct drive water power. The fifth mill was built in 1847-49 forming the lower courtyard. Upon completion, this mill housed the first two Francis center-vent turbines installed in a production facility. One of these turbines was the subject of Francis' "Experiments on the Power of a Centre-Vent Water Wheel, at the Boott Cotton-Mills" as published in his Lowell Hydraulic Experiments of 1855. Six additional wheels, probably Boydens, were installed in two groups of three in 1859. The Boott Mills appear to have been the primary location of Francis type turbines prior to the development of the Swain turbine. Two inoperative Swain mixed-flow wheels installed in the early 1870s remain in the mill complex along with five other turbines from the early 20th century, including four which still operate. The four original buildings were joined together in two pairs and the towers constructed during the Civil War. All five early buildings and the link structures had their gable roofs replaced in the 19th century. Of the earliest buildings, only the Counting House survives in the exterior form of its original construction. The Boott Mills ceased production in 1954-55 and the buildings were sold to real estate interests who have

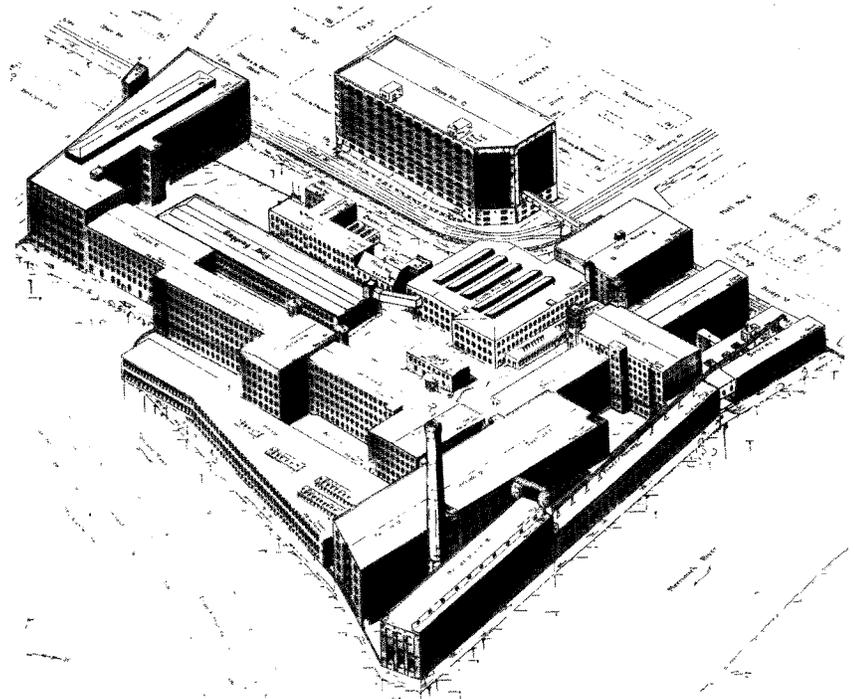
tenanted the buildings since that time. The Counting House and adjacent Mill No. 6 of 1871 are under development as interpretive facilities of the Lowell National Historical Park.



14. Boott Cotton Mills in 1911. View by Associated Mutual Insurance Companies.

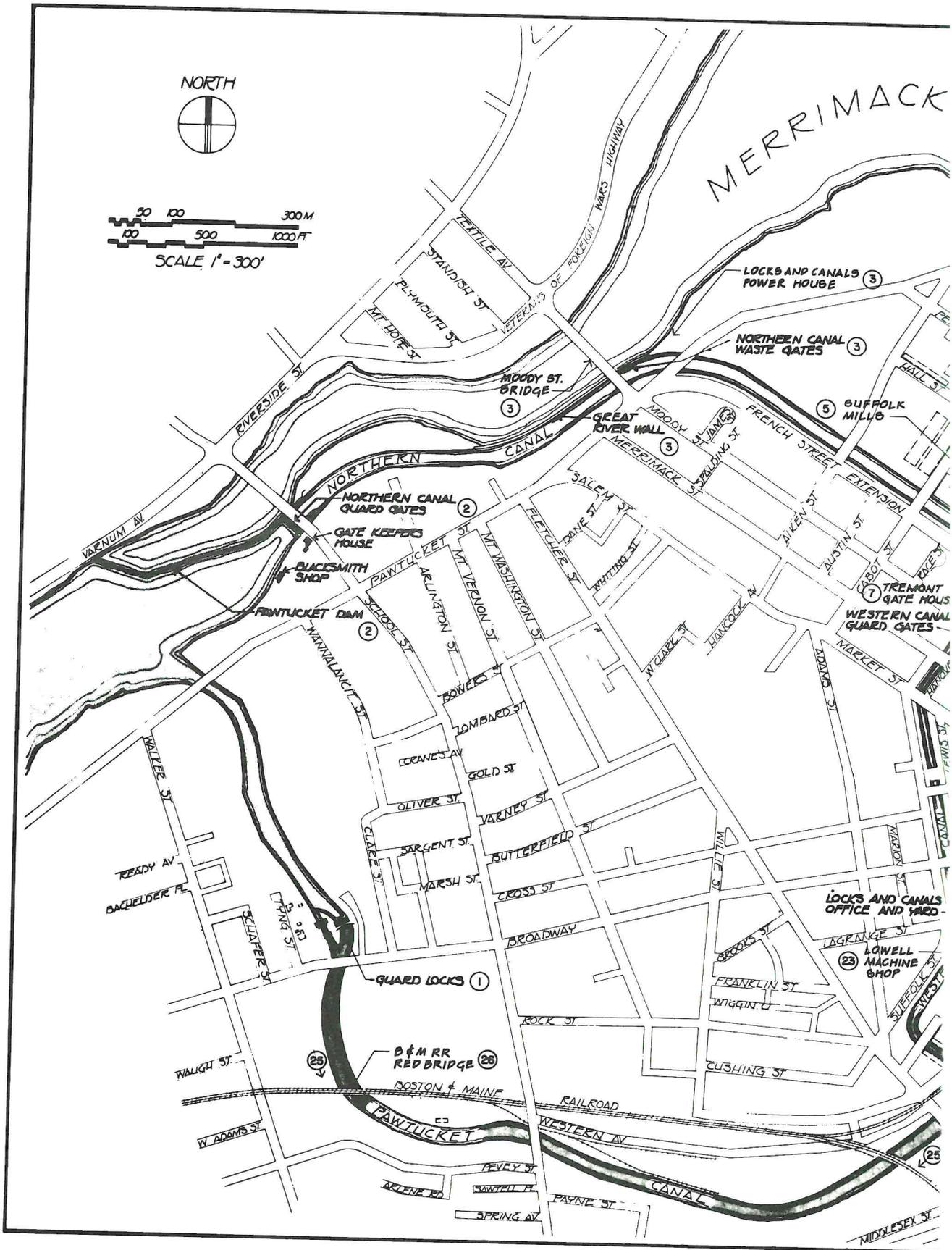
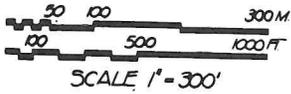
15. MASSACHUSETTS COTTON MILLS

Chartered in 1839, this company began production of cotton textiles in the first of its four original mill buildings in 1840. Water power was supplied to the mills by the 17 foot (5.2 m.) head of the Eastern Canal, already serving the previously constructed Boott Mills. The four mills were arrayed in pairs at a right angle to conform to the site's L shape created by the confluence of the Merrimack and Concord Rivers behind. The paired buildings were connected together with link buildings built in 1851 (north buildings) and 1862 (east buildings). The stair towers and flat roofed fifth story on both enlarged buildings were not added until the 1870s. Other significant buildings are "Section 8," a wheel house built in 1856, which housed the first Massachusetts Mills turbines, and today contains three vertical Hercules turbines of early 20th century vintage, all still in operation; the Main Power House of 1909-11 which still contains its partly operational three pair of original horizontal Hercules turbines; the Boiler House of 1909-11 prominently sited at the confluence of the two rivers; and Storehouse C of 1910, a massive 11 story reinforced concrete building with unusually elaborate architectural detail. The Massachusetts Mills ceased operation in the late 1920s, and has been leased to numerous small tenants in the ensuing years. Although there has been some demolition of buildings in the millyard, most of the important structures survive. The complex is currently being considered for rehabilitation as offices.



15. Massachusetts Cotton Mills in 1911. View by Associated Mutual Insurance Companies.

NORTH



MERRIMACK

LOCKS AND CANALS POWER HOUSE (3)

NORTHERN CANAL WASTE GATES (3)

SUFFOLK MILLS (5)

NORTHERN CANAL GUARD GATES (2)

GATE KEEPERS HOUSE

BLACKSMITH SHOP

PAWTUCKET DAM (2)

GUARD LOCKS (1)

D&M RR RED BRIDGE (26)

LOCKS AND CANALS OFFICE AND YARD

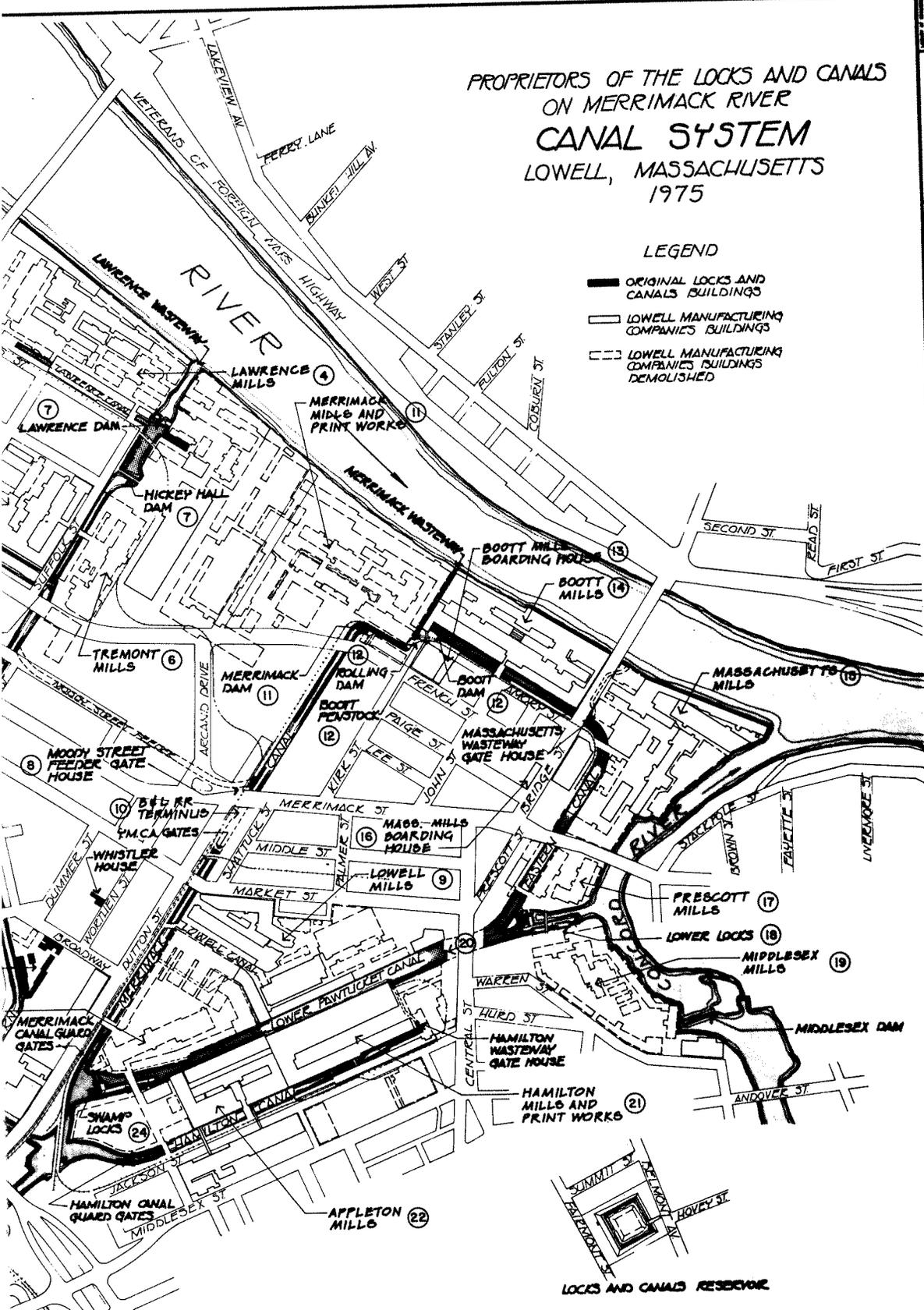
LOWELL MACHINE SHOP (23)

MIDDLESEX ST

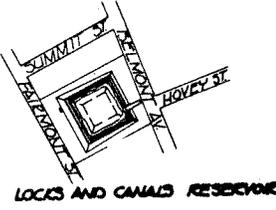
PROPRIETORS OF THE LOCKS AND CANALS
ON MERRIMACK RIVER
CANAL SYSTEM
LOWELL, MASSACHUSETTS
1975

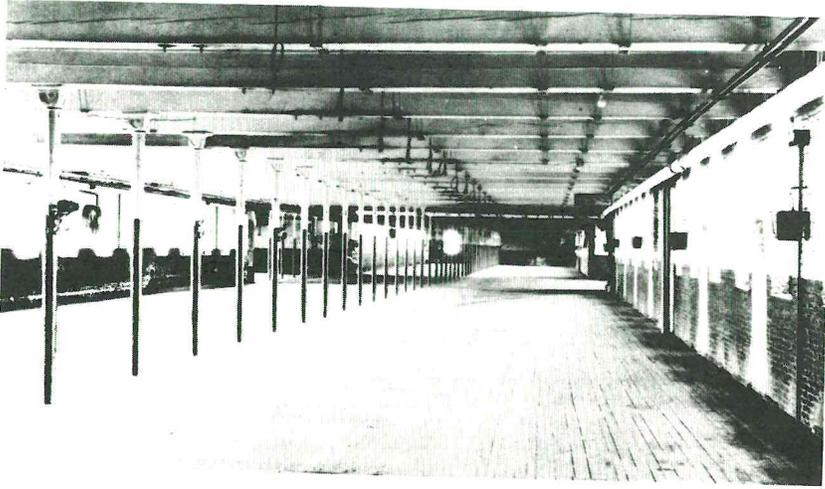
LEGEND

-  ORIGINAL LOCKS AND CANALS BUILDINGS
-  LOWELL MANUFACTURING COMPANIES BUILDINGS
-  LOWELL MANUFACTURING COMPANIES BUILDINGS DEMOLISHED



HISTORIC AMERICAN ENGINEERING RECORD
 SHEET 1 of 2 SHEETS
 RECORD NO. HAER MA 1
 MASSACHUSETTS
 STATE AND LOCATION OF STRUCTURE
LOWELL CANAL SYSTEM
 SOUTH OF MERRIMACK RIVER, WEST OF CONCORD RIVER
 MIDDLESEX COUNTY
 LOWELL
 DRAWN BY: MARK M. HOWLAND 1975, MICY CAROLNEY 1978
 OFFICE OF ARCHITECTURE AND HISTORIC PRESERVATION
 LOWELL CANAL SURVEY
 UNDER THE AUSPICES OF THE HISTORIC ENGINEERING RECORD
 OFFICE OF ARCHITECTURE AND HISTORIC PRESERVATION





15. Fourth Floor in Mill No. 1 of Massachusetts Cotton Mills showing framing system typical of New England mill construction with transverse beams at about ten foot (3.1 m.) intervals and longitudinal heavy timber structural deck about 3-1/2 inches (8-1/2 cm.) thick.

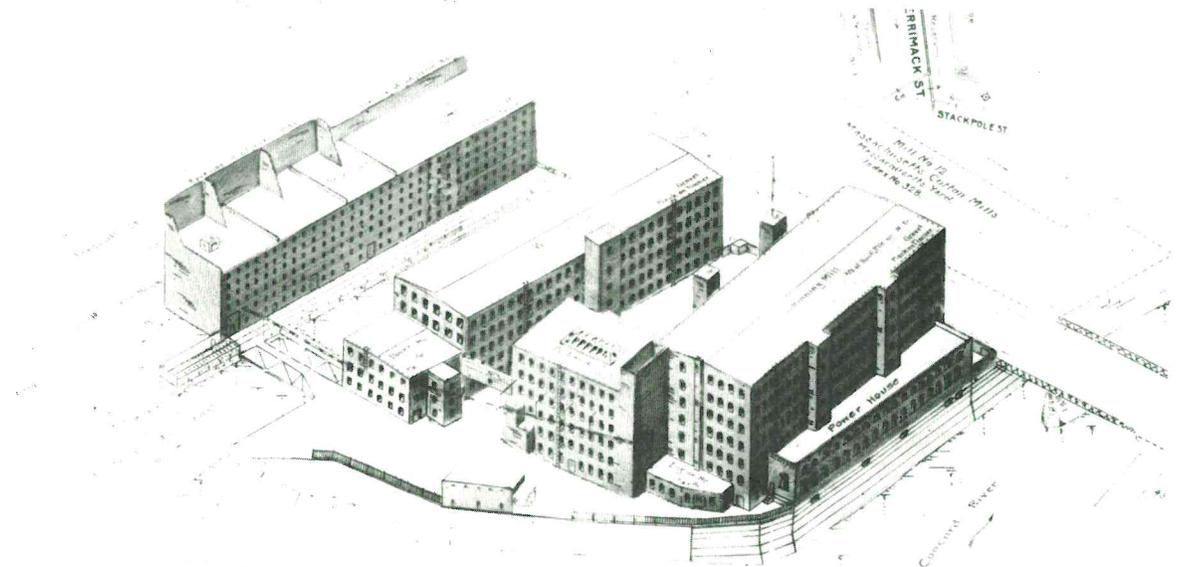
16. MASSACHUSETTS COTTON MILLS BOARDING HOUSE

By the early 1840s, the Massachusetts Mills had built its 64 corporation houses irregularly arranged into 10 blocks near the factory site. Although the plan relationship of these houses was not nearly as uniform as those of the Boott Mills, the individual houses were practically identical to those at the Boott. This one surviving block once contained eight separate houses. The four larger houses were entered from Bridge Street, while pairs of smaller houses fronted on the ends of the building, as at the Boott Mills blocks and those of several of the other corporations. Unlike either of the other two surviving boarding house blocks, the upper floors of this building contain much of their original interior. The ground floor was given over to commercial purposes well before the end of the 19th century and has been substantially altered both inside and out.

17. PRESCOTT MANUFACTURING COMPANY (site)

Incorporated in 1844, the Prescott Company was the last factory site developed on the Locks and Canals system. The Prescott utilized the water power of the 17 foot (5.2 m.) fall from the lower level Eastern Canal. Because of its relatively late construction date, the Prescott was the one company on the Locks and Canals system outfitted initially with turbines. The principal buildings were two mills built in 1846. Unlike other companies of the time, the

17. Prescott Manufacturing Company in 1911 (part of Massachusetts Cotton Mills after 1847). View by Associated Mutual Insurance Companies.



with their original gable roofs until demolition of the complex took place in 1956. The site was a parking lot until 1983, when construction began on a hotel attracted by the financial incentives offered by the City government and the nearby location of the new Wang Training Center.

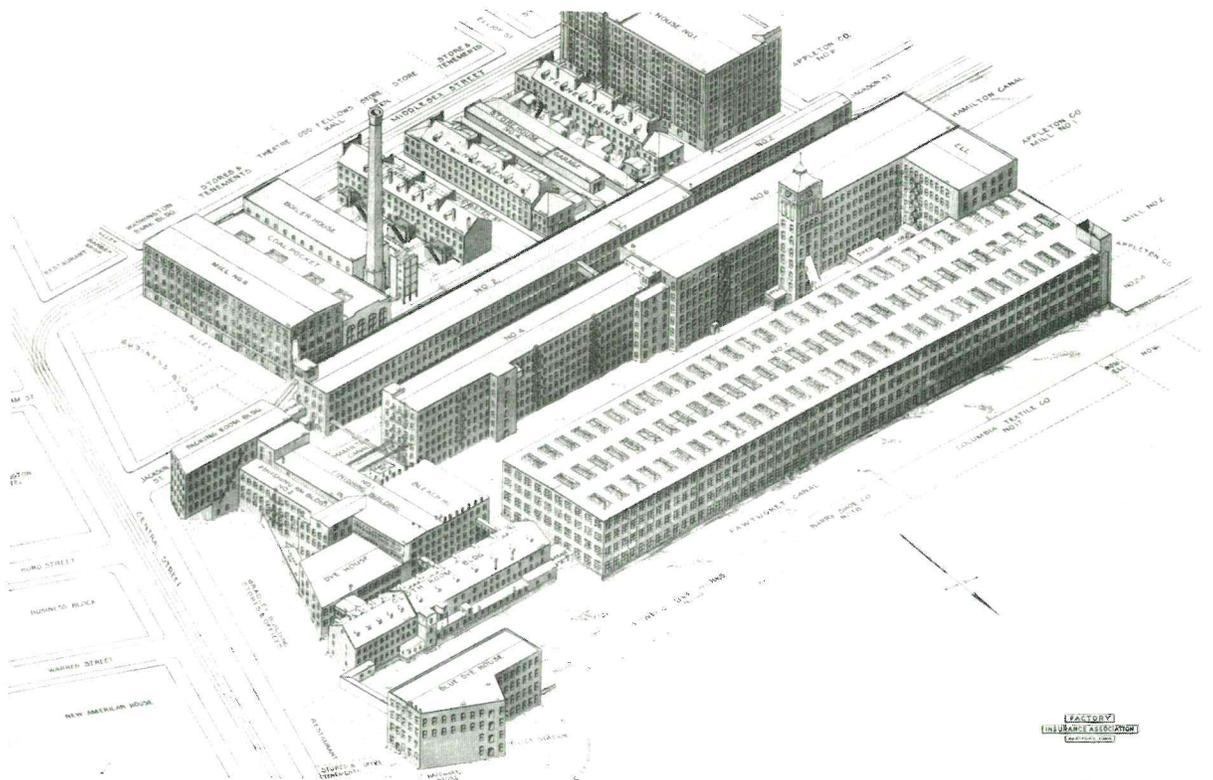
buildings on these platforms were taken down in 1982-83 to open the view both up and down the canal. The adjacent canal banks will be developed for pedestrian use over the next few years.

20. LOWER PAWTUCKET CANAL INDUSTRIAL "CANYON"

Looking west from the Central Street Bridge, a view is had of the three textile manufactories which lined the lower Pawtucket Canal. In the left foreground are the surviving buildings of the Hamilton Manufacturing Company. The buildings in the left background were erected by the Appleton Company. The surviving buildings on the right bank were part of the Lowell Manufacturing Company. The cleared site on the immediate left bank was the location of the Hamilton Print Works. The two story building on the immediate right bank, once a four story building, was the Hamilton's Blue Dye House and was connected to the Hamilton buildings across the canal by a bridge. After about 1850, it was impossible to look either up or down the canal from Central Street as commercial buildings on bridged platforms lined Central Street across the canal. Later

21. HAMILTON MANUFACTURING COMPANY

The Hamilton Company was incorporated in 1825, the second cotton textile manufacturing company to be established by a group of the Boston Associates. Two of the four original mills were constructed immediately, with one completed in 1826, the other in 1827. The Hamilton Canal was built concurrently as an upper level canal branching from the Swamp Locks basin, parallel to the lower Pawtucket Canal, providing water power with a 13 foot (4.0 m.) head. The third mill was built in 1830, as was the Hamilton Print Works, adjacent on the east. In 1846, the first two mills were joined together by a gabled infill building, and a fourth gable roofed mill built directly on the Hamilton Canal Bank. This fourth mill is extant, although it was raised two stories with a flat roof by 1893. The three original buildings were replaced by the present large mill along the Pawtucket Canal in 1911 and 1919. The Hamilton Company built a row of five housing blocks

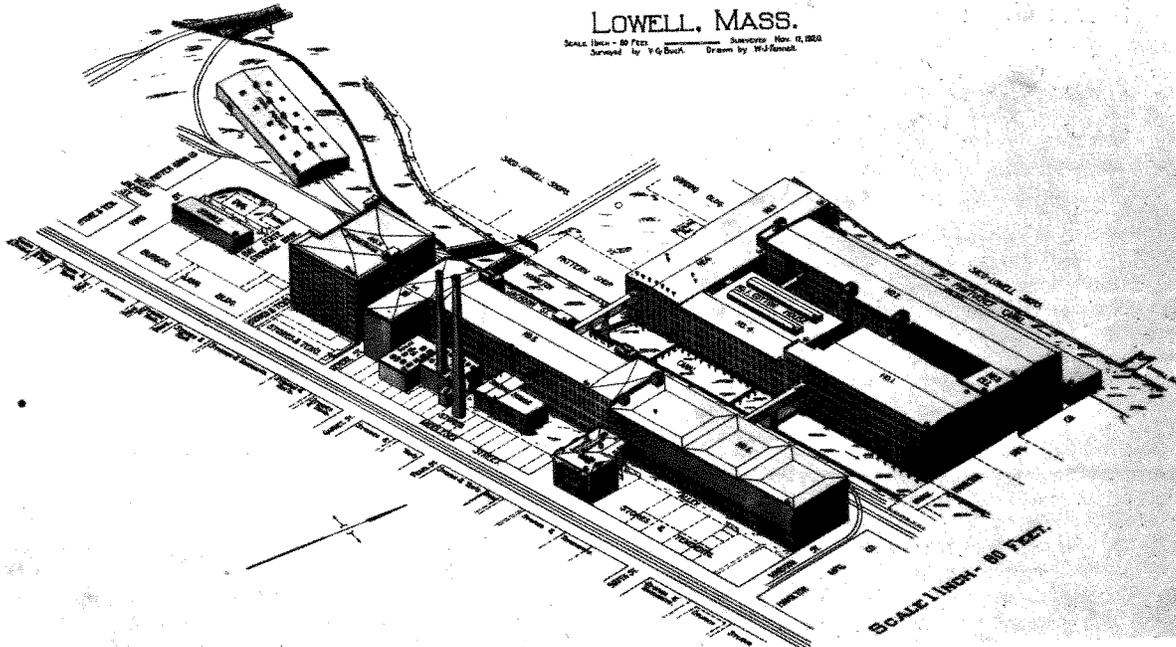


21. Hamilton Manufacturing Company in 1920. View by Factory Insurance Association.

FACTORY INSURANCE ASSOCIATION

APPLETON COMPANY,
LOWELL, MASS.

SCALE 1/8" = 50 FEET Surveyed Nov. 11, 1920
Surveyed by F.G. BUCK Drawn by W.G. FURNESS



22. Appleton Manufacturing Company in 1920. View by Factory Insurance Association.

adjacent to the mills across the canal to the south. The housing blocks were all demolished to make way for industrial and commercial expansion; the last was demolished in 1934. The Hamilton Company closed in the late 1920s. Some buildings along the Hamilton Canal were sold to the Courier Citizen Company, which continues to own them. The print works buildings were demolished in 1935. Joan Fabrics Corporation now owns the mill on the Pawtucket Canal and since the mid-1970s has carried out synthetic upholstery weaving in it using modern European plush looms. This is today Lowell's only active weaving operation. Five Leffel turbines in the Joan Fabrics building, operated by Locks and Canals, continue to generate electricity.

22. APPLETON MANUFACTURING COMPANY

The Appleton Company was founded in 1828, and by the end of that year had commenced manufacturing cotton textiles in its two original mills. The Appleton Company also built blocks of boarding houses, now all demolished, opposite the mills across the canal to the south. The Appleton's original breast wheels were powered by the Hamilton Canal, already constructed, through its 13 foot (4.0 m.) fall into the lower Pawtucket Canal. Paul Moody introduced the main belt-drive system to transfer power from water wheel to line shafts without gearing in these mills in 1828. As at

several of the other mill complexes, these two original factories were joined together by a gable-roofed infill structure in ca. 1845. In 1844, in the new picker house just built at the west end of the site, Uriah Boyden installed his first outward-flow turbine based on the Fourneyron model. This was the first turbine put in operation in Lowell. James Francis' testing of Boyden's wheel in 1846 confirmed the advantages of the turbine over the breast wheel and resulted in the Locks and Canals purchase of rights to the Boyden Turbine in Lowell. Boyden turbines were used in almost all water motor installations in Lowell over the next quarter century, but none survives in Lowell today. Directly across the Hamilton Canal from the original buildings, the Appleton Company built a new steam powered mill in 1873. This "New Mill" is something of an ideal steam mill in architectural form and in location with respect to the waterpowered mills. The original engine house remains attached to the rear of the new mill, and houses the only reciprocating steam engine remaining of the many that once existed in the Locks and Canals system factories. The engine, now abandoned, is a Skinner "Unaflo", installed in 1931. The original Appleton water powered mills were all demolished and replaced with new structures between 1905 and 1918. Five pairs of inoperative horizontal turbines remain in Appleton wheel pits including a pair of McCormicks of 1899, three pair of Hercules, and a pair of Hunts. In spite of this rebuilding, the Appleton Company went out of business in the late 1920s, and thenceforth leased the space

until selling the complex in 1944. Today the buildings are partially vacant.

23. LOWELL MACHINE SHOP (site)

The Lowell Machine Shop was established in 1824 as part of the Merrimack Manufacturing Company. It was originally powered by water from the Merrimack Canal through the 13 foot (4.0 m.) fall into the lower Pawtucket Canal. In 1825, the Machine Shop became the property of Locks and Canals and was finally separately incorporated in 1845. Throughout these corporate reorganizations, the Machine Shop remained a prime manufacturer of textile machinery, water wheels, turbines, gearing and shafting, steam engines and other industrial machines, including, for a time, locomotives. The main shop building on the north bank of the Pawtucket Canal was built in 1824-25, and was similar to the textile mill buildings of the period, but twice as long. This building was replaced with a new building in 1882. A foundry was located on the south bank of the canal and was also constructed in 1824-25. Many other buildings were at one time a part of the yard including a saw mill, smith shops and pattern shops. The Lowell Machine Shop was merged with three other shops into the Saco-Lowell Shops in 1912, including the Kitson Machine Shop, located just across the Merrimack Canal. In the late 1920s the Lowell operation was closed and all the buildings, except two reinforced concrete structures and the Kitson buildings were demolished. An unaffiliated manufacturing company now occupies much of the site in buildings put up in the late 1960s.

24. SWAMP LOCKS

Of similar configuration to the Lower Locks, the Swamp Locks, on the Pawtucket Canal, also contain two navigation locks parallel to a wasteway with a dam located at the west end of the wasteway. This configuration was established in the 1822-23 rebuilding of the Pawtucket Canal. Most of the extant work is of later vintage, however, including some from 1839-41 when the stepped dam was built and the 25 foot (7.6 m.) locks narrowed to 12 foot (3.7 m.) width. The purpose of the dam is to allow the wasting of water from the upper level of the canal system to the lower level. The north half of the weirs across the dam and their portion of the 1859 sheltering building were removed in the 1960s although the remaining portion of this building continues to cover the central sluice gate and its hoisting machinery and several of the old flash board weirs on the south side. Another larger sluiceway through the lock chamber wall, built in 1828, runs beneath the small building at the south end of the dam, which contains the gate's hoisting machinery.

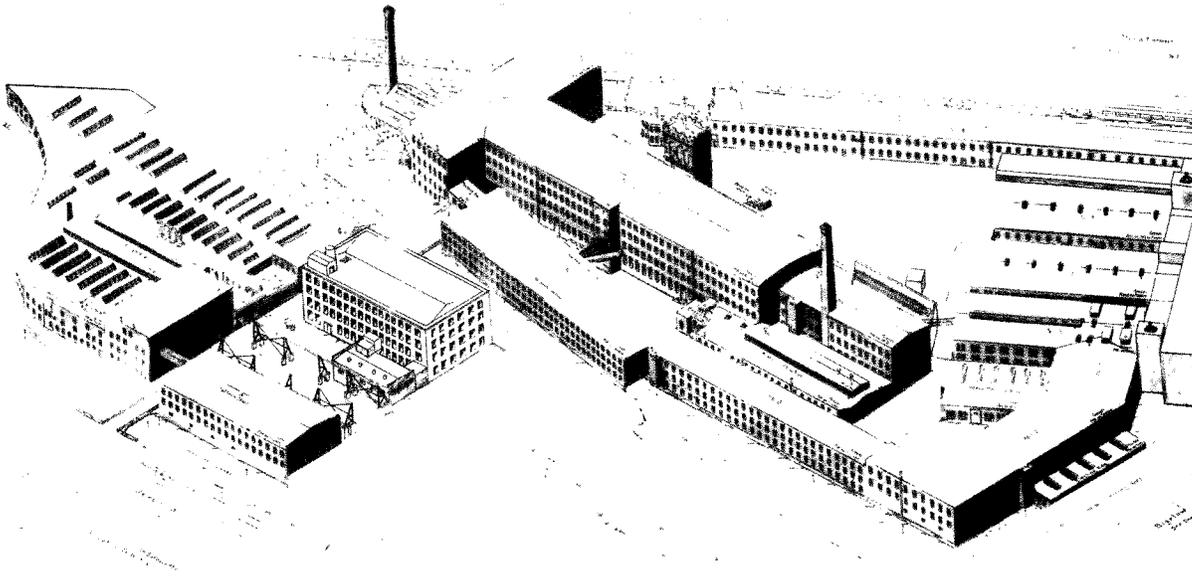
From the adjacent Swamp Locks Basin, three of the power canals branch from the Pawtucket Canal: the Merrimack, the Hamilton and the Western. After the construction of the Northern Canal, the flow of the Western Canal was reversed and it then flowed into the Swamp Locks Basin.

25. INDUSTRIAL SITES ON THE UPPER PAWTUCKET CANAL

On the Pawtucket Canal above the Swamp Locks, secondary industries grew up which were not dependent on the water power available only beyond the Swamp Locks Basin. One principle industry on the north bank was the Massachusetts Mohair Plush Company, a complex of steam powered buildings dating from about 1890 to 1930. All along the south bank, lumber yards and saw mills proliferated in the 19th and early 20th centuries, originally supplied by timber shipped on the river and canal. The Nashua and Lowell Railroad's double ended freight station, built ca. 1865, still survives on the north bank, as do several of the early structures of the Lowell Gas Light Company, founded in 1949. Originally a coal gas manufacturing plant, remaining buildings include the concrete and steel vertical vaulted Coal Shed (ca. 1902), and the rubble stone Purifying House (ca. 1872) and what may have been the Meter House or Retort House (ca. 1865), as well as early 20th century retort and power houses. The original brick gas holder houses do not survive. On the north bank just downstream from the railroad bridge is the site of the Locks and Canals Kyanizing Works where wood used in various canal system projects was preservative treated. An early example of wood preservative treatment use in the United States, this plant was started and diligently utilized by James Francis by the time of the Northern Canal project.

26. BOSTON AND MAINE RAILROAD PAWTUCKET CANAL BRIDGE (Red Bridge)

Just as the Boston and Lowell Railroad was completed in 1835, the Nashua and Lowell Railroad was chartered. Its 15 mile (24 km) line along the south bank of the Merrimack River between Lowell and the up-river mill town of Nashua, New Hampshire, was completed in 1838, as the second leg of what was to become the Boston and Lowell system. Although Lowell has no railroad bridge across the Merrimack River, a classic, single 160 foot span through-truss bridge does carry the descendant Boston and Maine Railroad over the Pawtucket Canal on the route of the original Nashua and Lowell. Called Red Bridge because of the color it was painted when it was maintained, the present bridge is a riveted Baltimore truss, of skew configuration. The current bridge dates from 1884, although the diagonal lattice web members were replaced with box members in 1928.



23. Lowell Machine Shop in 1921 (part of Saco-Lowell Shops after 1912). View by Associated Mutual Insurance Company.

SUGGESTED READING

Coolidge, John P. Mill and Mansion: A Study of Architecture and Society in Lowell, Massachusetts, 1820-1865. New York, Columbia University Press, 1942.

Dublin, Thomas. Women at Work: The Transformation of Work and Community in Lowell, Massachusetts, 1826-1860. New York, Columbia University Press, 1979.

Eno, Louis, ed. Cotton Was King. Lowell, MA, Lowell Historical Society, 1976.

Gibb, George, S. The Saco-Lowell Shops, 1813-1949. Cambridge, MA, Harvard University Press, 1950.

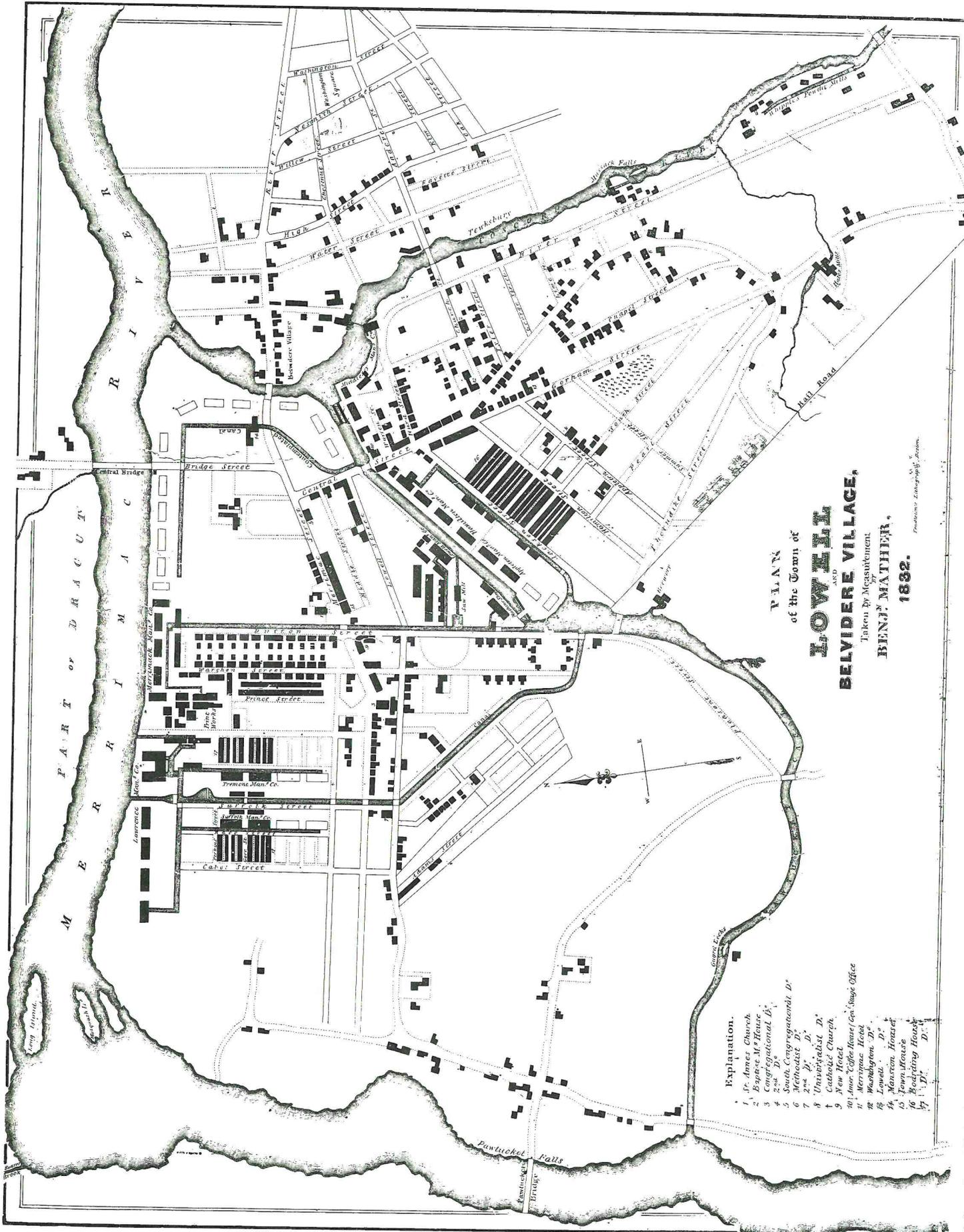
Gregory, Frances W. Nathan Appleton: Merchant and Entrepreneur, 1779-1861. Charlottesville, VA, University Press of Virginia, 1975.

Hunter, Louis C. Waterpower: A History of Industrial Power in the United States, 1780-1930, Volume I. Charlottesville, VA, University Press of Virginia, 1979.

Malone, Patrick M. Canals and Industry: Engineering in Lowell, 1821-1880. Lowell, MA, Lowell Museum, 1983.

Malone, Patrick M. The Lowell Canal System. Lowell, MA, Lowell Museum, 1976.

Parker, Margaret T. Lowell: A Study of Industrial Development. New York, MacMillan Company, 1940.



PLAN
of the Town of
LOWELL
AND
BELVIDERE VILLAGE,
Taken by Measurement
by
BENJ. MATHER,
1832.

- Explanation.**
- 1 St. James Church.
 - 2 Expense M^o House.
 - 3 Congregational B^y.
 - 4 2nd D^y.
 - 5 South Congregational D^y.
 - 6 West End D^y.
 - 7 2nd J^y.
 - 8 Universalist D^y.
 - 9 Catholic Church.
 - 10 New Hotel.
 - 11 Iron Coffee House / Gen. Stage Office.
 - 12 Merrimack Hotel.
 - 13 Washington D^y.
 - 14 Western House.
 - 15 Town House.
 - 16 Residing House by J. D.

II. Lowell and Belvidere Village - 1832 - by Benjamin Mather



200th ANNIVERSARY YEAR

BANK OF BOSTON

ESSEX, N.A.

Suggested price \$3.00

Published by
The Society for Industrial Archeology
Room 5020, National Museum of American History
Smithsonian Institution
Washington, DC 20560

Additional copies of this guidebook are available from
Merrimack Valley Textile Museum
800 Massachusetts Avenue
North Andover, MA 01845

Publication of this volume is supported by a grant
from the Bank of Boston - Essex.