Form No. 10-300 (Rev. 10-74)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM

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SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC
Old Waterworks

AND/OR COMMON
Old Waterworks

2 LOCATION

STREET & NUMBER On east bank of Monocacy Creek immediately north of Hill-to-Hill Bridge and immediately west of Main St. NOT FOR PUBLICATION

CITY, TOWN
Bethlehem — VICINITY OF

CONGRESSIONAL DISTRICT 15

STATE	CODE	COUNTY	CODE
Pennsylvania	42	Northampton	095

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE	
__DISTRICT	X PUBLIC	__OCCUPIED	__AGRICULTURE	X MUSEUM
X BUILDING(S)	__PRIVATE	X UNOCCUPIED	__COMMERCIAL	__PARK
__STRUCTURE	__BOTH	__WORK IN PROGRESS	__EDUCATIONAL	__PRIVATE RESIDENCE
__SITE	PUBLIC ACQUISITION	ACCESSIBLE	__ENTERTAINMENT	__RELIGIOUS
__OBJECT	__IN PROCESS	X YES: RESTRICTED	__GOVERNMENT	__SCIENTIFIC
	__BEING CONSIDERED	__YES: UNRESTRICTED	__INDUSTRIAL	__TRANSPORTATION
		__NO	__MILITARY	__OTHER:

4 OWNER OF PROPERTY

NAME Write: Karen Z. Huetter, Historic Bethlehem Inc.
City of Bethlehem Gordon Mowreer, Mayor
(Leased for 99 years to Historic Bethlehem Inc., 516 Main St.,18018)

STREET & NUMBER
10 East Church Street

CITY, TOWN
Bethlehem — VICINITY OF

STATE
Pennsylvania

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE, REGISTRY OF DEEDS, ETC. Recorder of Deeds

STREET & NUMBER
Northampton County Courthouse/Seventh & Walnut Sts.

CITY, TOWN
Easton

STATE
Pennsylvania

6 REPRESENTATION IN EXISTING SURVEYS

TITLE Historic American Buildings Survey; National Register of Historic Places; Historic American Engineering Record

DATE
1969; 1972; 1975

X FEDERAL X STATE __COUNTY __LOCAL

785

DEPOSITORY FOR SURVEY RECORDS Library of Congress; National Register; Library of Congress

CITY, TOWN
Washington

STATE
D.C.

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
X EXCELLENT	__DETERIORATED	__UNALTERED	X ORIGINAL SITE
__GOOD	__RUINS	X ALTERED	__MOVED DATE_____
__FAIR	__UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Old Waterworks was erected in 1762. It stands today in its original location on the flood plain of Monocacy Creek about 100 feet east of the present creek bed, immediately north of Hill-to-Hill Bridge, and adjacent to the site of the 1755 waterworks in the old Moravian industrial area, now a Historic Bethlehem Inc. park undergoing restoration.[7] The pumphouse is original; the waterwheel, pumps, and other machinery are reconstructions based on mechanical drawings of the original equipment. The drawings, prepared about 1767, were found in the Moravian Archives in Herrnhut, East Germany. Archological investigation of the Old Waterworks began in 1964, and restoration of the pumphouse was accomplished in 1972-73 when the limestone walls were repainted, the red tile roof reconstructed, and the original architectural features restored.[8]

The east-west oriented pumphouse is a 2 1/2-story native limestone rubble structure that measures 24 feet square and features a red-tile-covered bellcast-hipped-gable roof. A single red brick chimney pierces the roof crest east of center. The building rests on a stone foundation over a holding pit for spring water, which entered the structure until 1765 via an open trench and after 1765 was conveyed in wooden pipes. Neither system survives, but Historic Bethlehem Inc., hopes to restore the trench sometime in the future.

Three doors, each set under a segmental arch of red brick, provide pedestrian access to the pumphouse. One single wood plank door admits to the wheelroom from the west end, and a second, which has a three-light transom, admits from the south side. The third door, similar to the first, opens into the second floor storage area from ground level at the east end of the building where it abuts the sloping bluff. In each gable end another wood plank door gives access to the attic space. These openings, like the pedestrian doors and the windows as well, also feature segmental brick arches. Six symmetrically placed windows, three on each full story, light the north side of the pumphouse, and five light the south side. On each side all

(continued)

[7] See Section 8, Statement of Significance, for a description of the original equipment and the modifications made between 1762 and 1832.

[8] See Section 8, Statement of Significance, for a description of the condition of the Old Waterworks in 1964 and a discussion of restoration process.

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windows are six-over-six sashes except the northernmost one on the first floor. It is a single six-pane opening. Finally, one six-over-six sash window lights the west end of the second floor.

Inside, the machinery duplicates that described in the significance portion of this inventory, with the apparent exception that the waterwheel measures about 17 1/2 feet in diameter compared to the original wheel's 18 feet. Built of oak cut, as was all timber in the reconstruction, within 50 miles of Bethlehem, the wheel measures 2 feet 10 inches deep, has 6 sections of 48 fins each, and is situated with accompanying machinery on a 12-by-12-foot oak frame. The wheel hub is 24 inches in diameter and 9 feet long and is made of oak fitted around a steel shaft. Positioned on that same shaft, the oak wallower wheel measures 4 feet 6 inches in diameter, is 1 foot 4 inches deep, and has 33 turned hickory pegs set to mesh with the pump drive gear. This gear measures 7 feet 3 inches by 7 feet, and its hub measures 2 feet by 2 feet. Each of the three wooden connecting rods measures 5 by 14 inches by 8 feet. The pump features a laminated 20-by-21-inch wood cylinder block that is 7 feet long and has three 11 inch cyclinders lined with cast-iron casings. Its pistons are made of steel plates with leather washers. Presently the waterwheel is turned for effect by electricity, but Historic Bethlehem Inc., hopes in the future to restore the old stone-lined raceways and allow Monocacy Creek to power the works once again.

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8 SIGNIFICANCE

SIGNIFICANT IN BOTH
ENGINEERING AND INDUSTRY

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
__PREHISTORIC	__ARCHEOLOGY-PREHISTORIC	__COMMUNITY PLANNING	__LANDSCAPE ARCHITECTURE	__RELIGION	
__1400-1499	__ARCHEOLOGY-HISTORIC	__CONSERVATION	__LAW	__SCIENCE	
__1500-1599	__AGRICULTURE	__ECONOMICS	__LITERATURE	__SCULPTURE	
__1600-1699	__ARCHITECTURE	__EDUCATION	__MILITARY	__SOCIAL/HUMANITARIAN	
X 1700-1799	__ART	X ENGINEERING	__MUSIC	__THEATER	
X 1800-1899	__COMMERCE	__EXPLORATION/SETTLEMENT	__PHILOSOPHY	__TRANSPORTATION	
__1900-	__COMMUNICATIONS	X INDUSTRY	__POLITICS/GOVERNMENT	__OTHER (SPECIFY)	
		__INVENTION			

SPECIFIC DATES 1755-1832 BUILDER/ARCHITECT Johann Christopher Christensen

STATEMENT OF SIGNIFICANCE

According to the Historic American Engineering Record and Historic Bethlehem Inc., the Old Waterworks was the first municipal pumping system to provide drinking and washing water in the American Colonies.[1] As such it marks an important milestone in the history of American technology. Johann Christopher Christensen devised the system in 1754 to transfer spring water from the Monocacy Creek flood plain to the Moravian settlement on the bluff above it. Six years later, in 1762, Christensen enlarged the waterworks and installed it in a 24-foot-square limestone rubble structure with a red-tile-covered hipped-bellcast-gable roof. The system's 18-foot undershot waterwheel powered three single acting cast-iron pumps which forced spring water through wood (later lead) pipes 320 feet (94 vertical feet) to a collecting tower, and from there water flowed by gravity to strategically placed cisterns throughout the community.[1] Historic Bethlehem Inc., restored the pumphouse and machinery in 1976. Today the waterworks is both a National Historic Civil Engineering Landmark and an American Water Landmark.

History

Middle-European communitarian Protestants known as the Unity of Brethren, or Moravians, founded Bethlehem in 1741 and made it the seat of their ecclesiastical government in America. The settlement's first permanent residences rested on a bluff overlooking the flood plain of Monocacy Creek just northeast of that stream's confluence with the Lehigh River. A spring in the plain supplied the community with fresh water, and the

(continued)

[1] P.H. Scott, "The Old Water Works," Historic American Engineering Record Inventory Card, 1975; and Historic Bethlehem, Inc., "1762 Waterworks Data Sheet." Mimeographed. (Bethlehem, Pa., 1976).

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creek furnished power for some 32 industries which the Moravians established along its banks by 1747. Among these enterprises were a pottery, linseed oil mill, grist mill, fulling mill, and dyehouse.

By 1750 Bethlehem's population had reached several hundred, and the task of hauling sufficient drinking and washing water from the flood plain to the top of the bluff had become increasingly laborious.[2] Desiring to ease this chore and provide a measure of protection against fires in the community, the town officials asked mill-builder Henry Antes to suggest a remedy. There is no record that he responded, nor is there evidence that the officials subsequently asked carpenter-millwright Johann Christopher Christensen, who arrived in Bethlehem in 1751, to propose a solution. In any case, in the spring of 1754 Christensen, assisted by missionary John Böhner who had built a model pump, designed a pumped water system for the town.

Machines to raise water had been in use in Europe for centuries, but until now none had been erected in the American Colonies. In 1652 the Water-Works Company of Boston had constructed a gravity conduit system that used bored logs to convey water from wells and springs to a 12-foot-square reservoir, but the system had not fulfilled the expectations of its promoters and had fallen into disuse.[3] Christensen, born in Schleswig-Holstein in 1716 and trained during his youth in a royal mill in Hadersleben, probably took his ideas for the Bethlehem system from his knowledge of the forcing pumps that had been in use in many German cities since the end of the fifteenth century.

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[2]In 1782 the Marquis de Chastelleux estimated Bethlehem's population to be about 600, but Karen Zerbe Huetter, of Historic Bethlehem Inc., places it at over 1,000 by the mid-1750's. De Chastellux, Travels in North America in the Years 1780, 1781 and 1782, vol. 2. Translated by Howard C. Rice, Jr. (Chapel Hill, 1963), 524; Huetter, The Bethlehem Waterworks. Bethlehem Heritage Series, vol. 1 (Bethlehem, Pa., 1976), 9.

[3]Nelson Manfred Blake, Water for the Cities: A History of the Urban Water Supply Problem in the United States (Syracuse, 1956), 15.

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Early Bethlehem records show that by mid-March 1754, Christensen had begun floating hemlock logs, from which he planned to fabricate distribution pipes, down the Lehigh River from the Gnadenhuetten sawmill near present Lehighton. In June he tested his and Böhner's pump using power supplied by the waterwheel in the oil mill. The pump, which was made of Caribbean hardwood and had two cylinders, proved able to force water up the bluff to the town, but soon after the test, for reasons that remain unclear, Christensen traveled to North Carolina, where he remained until 1756. Construction of the waterworks proceeded without him but presumably according to his plans. A one-story, 14-by-18-foot building housed the system's machinery just east of the oil mill. On May 21, 1755, the works pumped water up the bluff to the Platz, or center of town, and from there the liquid flowed through wooden pipes to the Brethern's House. By the end of June other pipes had been installed to take water to the Sisters' House. Christensen and his colleagues had launched what, according the Historic American Engineering Record and Historic Bethlehem, Inc., was the first municipal pumping system to provide drinking and washing water in the American Colonies.[4] As waterworks historian Nelson Manfred Blake, has pointed out, the next workable pumping system devised in an American community was the steam-powered New York City system which was abandoned shortly after going into operation in 1776. No other municipal system succeeded until Philadelphia opened its Fairmont Waterworks in 1811.[5]

Although successful initially in supplying the town with water, the Bethlehem system soon developed problems. The wooden pipes burst under pressure, and apparently the waterwheel, which powered the pumps, was positioned incorrectly in the wheelpit. In the summer of 1759 the Gemein Conferencz, or Community Council, began discussing the possibility of rebuilding the system. Two years later Christensen, Frederick von Marshall, and John Arbo who is believed to have owned an

(continued)

[4]Scott, "The Old Water Works," Historic American Engineering Record Card, 1975; and Historic Bethlehem Inc., "1762 Waterworks Data Sheet."

[5]Blake, Water for the Cities, 15-43. See also: Huetter, The Bethlehem Waterworks, 12-13.

illustrated copy of the 1724 German volume Theatri Machinarum Hydraulicarum, began planning the necessary changes. With the help of an assistant, Christopher Demuth, Christensen had the new pumping system operating by July 6, 1762, but he did not complete the new pumphouse until 1764, due in part to damage from a fire that destroyed the nearby oil mill in 1763.

When finished, the pumphouse was a 24-foot-square, 2 1/2-story native limestone rubble structure with a red-tile-covered hipped-bellcast-gable roof. The pumping mechanism, which was positioned over spring water channeled into a holding pit, consisted of three single acting force pumps of 4-inch caliber and 18-inch stroke. Made of iron cast at the Durham Furnace, they worked on a triple crank that had been foraged by blacksmith Stephen Blum. An 18-foot undershot waterwheel turned by the flow of Monocacy Creek powered the pumps through a wallower of 33 rounds and a spurwheel of 52 caps.[6] Spring water entered the pumphouse via an open trench until 1765, after which time it was conveyed to the holding pit in wooden pipes. Monocacy Creek water entered the building through a sharply angled race and passed back to the stream through a similar tailrace. Wooden pipes still carried the pumped spring water up the bluff 94 vertical feet, 320 feet in all, to a reservoir. Pyramidal in shape, the large cistern stood behind the Married People's House on the site of the present Central Moravian Church. The water flowed from here through wooden pipes to distribution points which by 1786 included the Single Brethren's House, Sisters' House, Sun Inn, and Apothecary Shop. From the Sisters' House other pipes led to four other stations. A short time later, by 1791, the Moravians expanded the system to serve at least six additional structures, including the Widows' House, Girls' School, and Single Sister's Kitchen. Presumably each of these buildings had its own small cistern for storing water when it arrived by pipe.

Over the years additional alterations proved necessary to maintain the water system's ability to supply the community's needs. For example, in 1786 the city fathers began replacing the wooden mains, which frequently burst under pressure or in

(continued)

[6]Huetter, The Bethlehem Waterworks, 3-5.

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freezing weather, with lead pipes, and in 1813 they replaced these with pipes of iron. By the 1790's the number of mills competing for water along Monocacy Creek drastically reduced the power available to turn the waterworks wheel, and in 1799 an adjustment of the wheel in its pit failed to correct the problem. As a result, in 1810 the Moravians rebuilt the wheel and pit and realigned the raceway so that both the waterworks and the oil mill shared the same flume. This allowed water to enter the works at a gentler angle with less friction and greater velocity. Even without these latter changes, however, in a 1798 test, pumps were able to force water an additional 28 feet up the bluff to the site chosen for the Central Moravian Church, erected in 1803-6. The 1762 system continued to serve Bethlehem until 1832, when the community built a new pump powered by steam and housed in the adjacent oil mill.

Interest in restoring the original waterworks began in the early 1960's after the city rescued the old Monocacy Creek flood plain industrial area from an automobile junkyard and deeded the 9-acre tract to Historic Bethlehem, Inc., a voluntary, nonprofit, community organization dedicated to restoration. Vincent P. Foley conducted preliminary archeological examinations of the works in 1964, and in 1972 he began preparing it for restoration. The Earl W. Ecker Construction Co., Inc., of Bethlehem restored the pumphouse in 1972-73, and in 1975-76 the National Heritage Corporation drafted plans for reconstruction of the waterwheel and pumps based on circa 1767 mechanical drawings of the original machinery. These documents were found in the Moravian Archives in Herrnhut, East Germany. Eisenhardt Mills, Inc., built the new wheel and associated parts and installed them in 1976, using funds provided largely by the Frederick W. Beinecke Fund and the Laros Foundation.

Today an electric motor turns the wheel, but plans are being developed to restore the raceways and spring water trench so that in the future the waterwheel can once again be powered by Monocacy Creek and turn pumps that will send water up the bluff to the old community buildings. Meanwhile the American Society of Civil Engineers has recognized the Old Waterworks as a Historic Civil Engineering Landmark, and the American Waterworks Association has designated it an American Water Landmark.

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Boundary Justification: The boundary includes approximately 6.2 acres, roughly the southeastern two-thirds of the 9-acre Historic Bethlehem, Inc., Moravian industrial park. This 6.2-acre tract encompasses the Old Waterworks, the site of the now demolished oil mill, and that stretch of Monocacy Creek nearest the waterworks, and is free of other buildings.

Boundary Description: As indicated in red on the accompanying maps [(1) U.S.G.S., 7.5' Series, Pennsylvania, Allentown East Quad., 1964, photorevised 1972; and (2) AASLH Sketch Map, 1977], a line beginning on the east bank of Monocacy Creek directly underneath the north side of Hill-to-Hill Bridge and continuing approximately 300 feet along the plane of the north edge of said bridge to the west side of the right-of-way of Main Street; thence, north approximately 300 feet along the west side of the right-of-way of Main to an unmarked point; thence, due west approximately 600 feet to the east side of the right-of-way of an industrial railway; thence, south approximately 600 feet along the east side of the right-of-way of said railway to a point directly below the north side of Hill-to-Hill Bridge; thence, east approximately 400 feet along the plane of the north side of said bridge to the point of beginning.

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9 MAJOR BIBLIOGRAPHICAL REFERENCES

(See continuation sheet.)

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY circa 6.2 acres

UTM REFERENCES

	ZONE	EASTING	NORTHING
A	1,8	4,6,7,4,9,0	4,4,9,6,4,2,0
B	1,8	4,6,7,6,6,0	4,4,9,6,4,2,0
C	1,8	4,6,7,6,6,0	4,4,9,6,3,2,0
D	1,8	4,6,7,4,9,0	4,4,9,6,2,4,0

VERBAL BOUNDARY DESCRIPTION

(See last page of description.)

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

NAME / TITLE

George R. Adams, Director, Historic Landmarks Project

ORGANIZATION — DATE

American Association for State and Local History — October, 1977

STREET & NUMBER — TELEPHONE

1400 Eighth Avenue South — 615-242-5583

CITY OR TOWN — STATE

Nashville, — Tennessee 37203

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL ___ STATE ___ LOCAL ___

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE

TITLE — DATE

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST: DATE

KEEPER OF THE NATIONAL REGISTER

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Huetter, Karen Zerbe, The Bethlehem Waterworks. Bethlehem Heritage Series, vol. 1 (Bethlehem, Pa.: Historic Bethlehem Inc., 1976).

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Blake, Nelson Manfred, Water for the Cities: A History of the Urban Water Supply Problem in the United States (Syracuse: Syracuse University Press, 1956).

Henry, James, Sketches of Moravian Life and Character (Philadelphia: J. B. Lippincott & Co., 1859).

De Chastellux, Marquis, Travels in North America in the Years 1780, 1781 and 1782, vol. 2. Translated by Howard C. Rice, Jr. (Chapel Hill: University of North Carolina Press, 1963).

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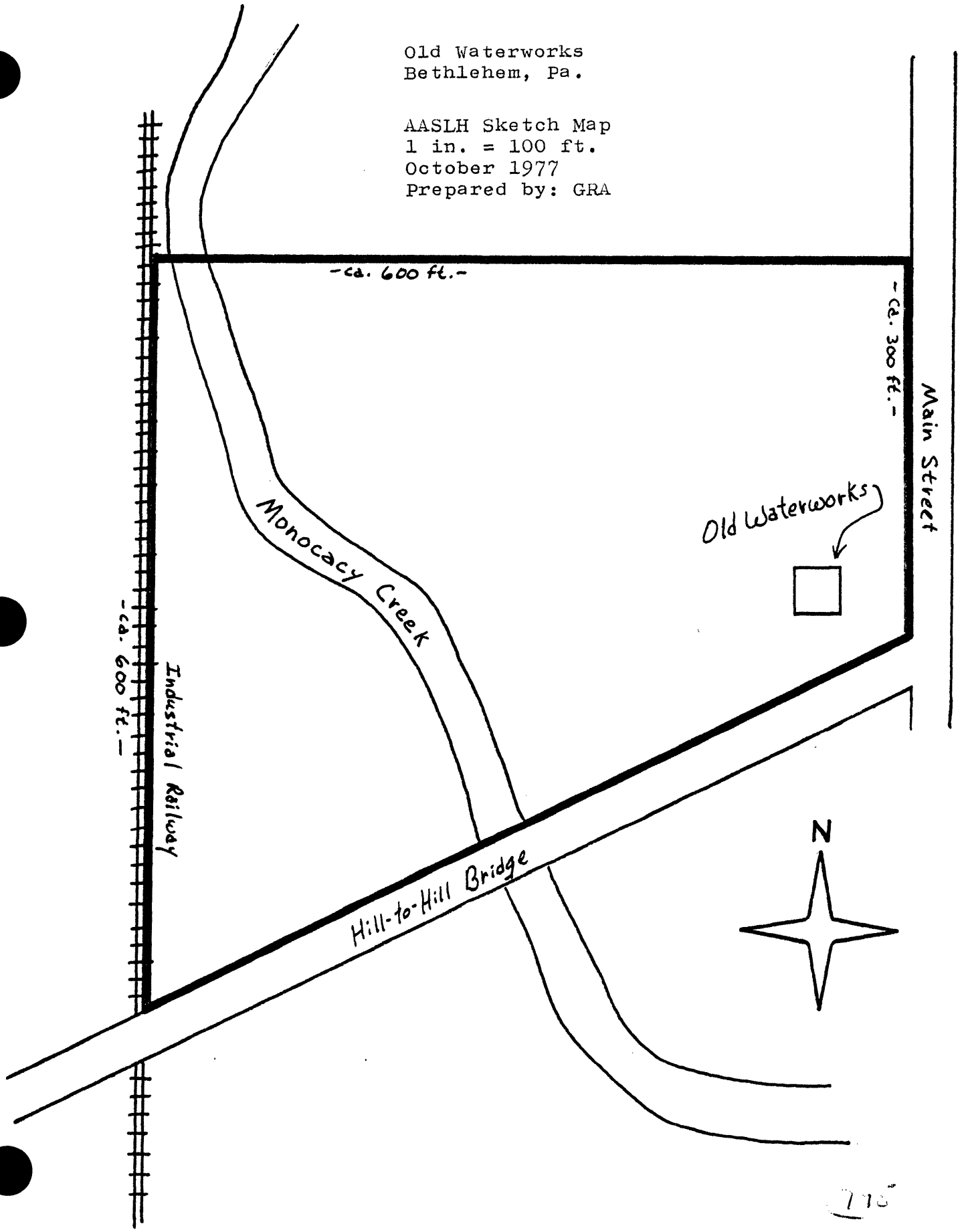
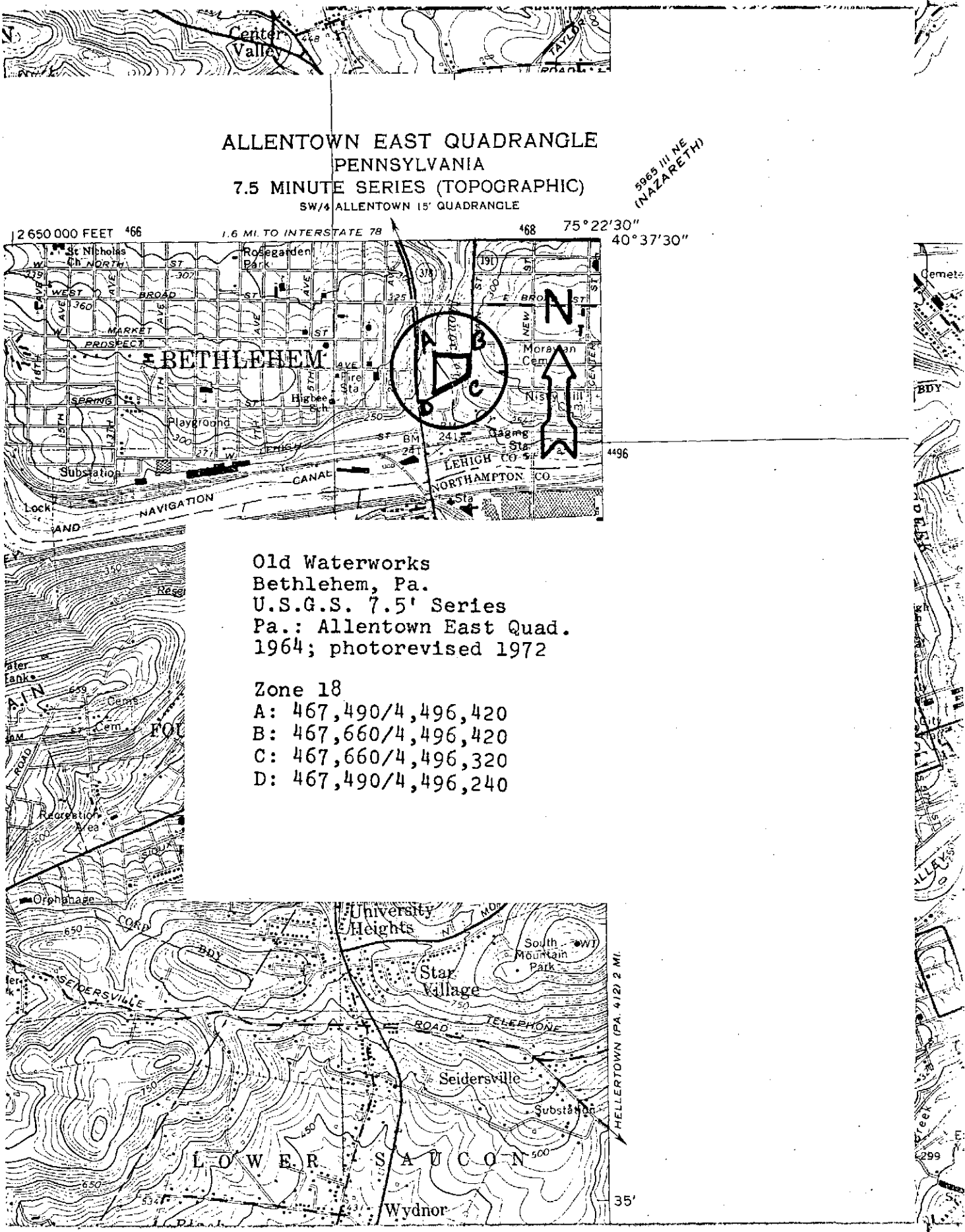
Old Waterworks
Bethlehem, Pa.

AASLH Sketch Map
1 in. = 100 ft.
October 1977
Prepared by: GRA




ALLENTOWN EAST QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SW/4 ALLENTOWN 15' QUADRANGLE
5965 III NE (NAZARETH)
2 650 000 FEET
1.6 MI. TO INTERSTATE 78
75°22'30"
40°37'30"
BETHLEHEM
Rosegarden Park
St Nicholas Ch
Playground
Substation
Lock
NAVIGATION
CANAL
LEHIGH CO
NORTHAMPTON CO
Moravian Cem
Higbee Sch
Fire Sta
Tagmg Sta
Old Waterworks
Bethlehem, Pa.
U.S.G.S. 7.5' Series
Pa.: Allentown East Quad.
1964; photorevised 1972
Zone 18
A: 467,490/4,496,420
B: 467,660/4,496,420
C: 467,660/4,496,320
D: 467,490/4,496,240
Cems
Recreation Area
Orphanage
University Heights
South Mountain Park
Star Village
SEIDERSVILLE ROAD
TELEPHONE ROAD
Seidersville
Substation
HELLERTOWN (PA. 412) 2 MI.
LOWER SAUCON
Wydnor
35'