NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

235

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Gloucester City Water Works Engine House

other names/site number

2. Location

street & number Johnson Boulevard at foot of Gaunt Street N/A ☐ not for publication

city or town Gloucester City ☐ vicinity

state New Jersey code 034 county Camden code 007 zip code 08030

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☒ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☒ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☐ statewide ☒ locally. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title — Date 2/2/98

Assistant Commissioner for Natural & Historic Resources/DSHPO
State of Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title — Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

☑ entered in the National Register. ☐ See continuation sheet.
☐ determined eligible for the National Register ☐ See continuation sheet.
☐ determined not eligible for the National Register.
☐ removed from the National Register.
☐ other, (explain:) _____

Signature of the Keeper — Date of Action

Patrick Andrus — 3/30/98

Glou.City Water Wks.Engine Hse.
Name of Property

NJ Camden Co.
County and State

5. Classification

Ownership of Property
(Check as many boxes as apply)

- ☐ private
- ☒ public-local
- ☐ public-State
- ☐ public-Federal

Category of Property
(Check only one box)

- ☒ building(s)
- ☐ district
- ☐ site
- ☐ structure
- ☐ object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
1		buildings
		sites
		structures
		objects
1	0	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

N/A

Number of contributing resources previously listed in the National Register

0

6. Function or Use

Historic Functions
(Enter categories from instructions)

GOVERNMENT/public works

Current Functions
(Enter categories from instructions)

WORK IN PROGRESS

7. Description

Architectural Classification
(Enter categories from instructions)

Late 19th & 20th Century Revivals

Materials
(Enter categories from instructions)

foundation concrete
walls brick
roof asphalt shingle
other

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

Glou.City Water Wks.Engine Hse.
Name of Property

NJ Camden Co.
County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- ☒ **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.
- ☐ **B** Property is associated with the lives of persons significant in our past.
- ☐ **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- ☐ **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations N/A
(Mark "x" in all the boxes that apply.)

Property is:

- ☐ **A** owned by a religious institution or used for religious purposes.
- ☐ **B** removed from its original location.
- ☐ **C** a birthplace or grave.
- ☐ **D** a cemetery.
- ☐ **E** a reconstructed building, object, or structure.
- ☐ **F** a commemorative property.
- ☐ **G** less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)

Engineering
Health/Medicine
Industry
Social History

Period of Significance

1883-1924

Significant Dates

1883
1899
1922-24

Significant Person
(Complete if Criterion B is marked above)

N/A

Cultural Affiliation

N/A

Architect/Builder

Yocum, Jacob (civil engineer)
Birkenbine, Henry P.M. (civil engineer)
Leeming, Thomas (builder)

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

Bibilography
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS): N/A

- ☐ preliminary determination of individual listing (36 CFR 67) has been requested
- ☐ previously listed in the National Register
- ☐ previously determined eligible by the National Register
- ☐ designated a National Historic Landmark
- ☐ recorded by Historic American Buildings Survey # _____
- ☐ recorded by Historic American Engineering Record # _____

Primary location of additional data:

- ☐ State Historic Preservation Office
- ☒ Other State agency NJ Historic Trust
- ☐ Federal agency
- ☐ Local government
- ☐ University
- ☒ Other

Name of repository:

Remington & Vernick, Engineers, Haddonfield, NJ; David C. Munn, Glou.City

Glou.City Water Wks.Engine Hse.
Name of Property

NJ Camden Co.
County and State

10. Geographical Data

Acreage of Property 0.1

Camden, NJ=PA

UTM References
(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing
1	18	490200	4416060
2			
3			
4			

☐ See continuation sheet

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title Paul W. Schopp, Principal

organization Paul W. Schopp, Historical Consultant date October 1997

street & number P.O. Box 648 telephone (609) 786-1499

city or town Palmyra state NJ zip code 08065-0648

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name City of Gloucester City

street & number 512 Monmouth Street telephone (609) 456-7105

city or town Gloucester City state NJ zip code 08030

Summary Statement

The Gloucester City Water Works Engine House building, the primary building on the property, is a four bay rectangular brick structure measuring 43' by 103'. First construction of the building was completed in 1883 as a two bay engine and pump house, with an additional bay erected on each end in 1899 to house additional equipment. The structure currently features a roof that is hipped on the east end (photograph 11) and gabled on the west end (photograph 1). Detailing includes a rotated soldier brick frieze and brick corbelling at the cornice (photograph 9). Window and door fenestration infilling and replacement has occurred throughout the building. The brickwork of the masonry wall is running stretcher bond throughout. Today the building is used for storage and maintenance by the Gloucester City Water Department.

Construction History

The name of the architect for the Gloucester City Water Works building is unrecorded in the City's history. In all likelihood, Henry P.M. Birkenbine, the engineer retained by the City to supervise the project, drafted the building's design. Birkenbine had been the Chief Engineer to the City of Philadelphia Water Works. However, it is known that the actual builder was city resident Thomas Leeming. By 1883, Leeming had earned a substantial reputation as a builder of public buildings. In 1859, he erected a two story brick schoolhouse at the corner of Monmouth St. and Broadway. In 1869, he was awarded the contract to build Gloucester City's first City Hall. Both buildings were designed by Camden architect, Stephen Decatur Button. The Water Works building is Victorian Gothic in influence and reflects the experience of Leeming with other brick buildings of the same period in the City.

The initial water works building, constructed in 1883, was a two bay, one and one half story brick structure, slightly wider (north and south) than long (east and west). Only an engine room and a pump room were necessary, as the first system did not contain filtration equipment. The exterior walls featured running stretcher bond brick, topped with an 8" high frieze made of pressed brick laid in a rotated soldier course. A cornice completed the elevations (photograph 9). It was constructed by corbelling the brick around the perimeter in thirteen successive brick courses overlapping each other, forming a horizontal projection. It is the most distinguishing feature about the building. The cornice contains metal built-in gutters and down spouts. The original windows were pointed arch lancet style as were the exterior door openings. All of the fenestration featured end or shoulder voussoirs (photograph 8). Two iron trusses supported the slate shingled hip roof. A square 85' smoke stack was built on the north side of the

building. A date stone and title stone was installed adjacent to the original entryway on the south elevation (photograph 8).

For the next sixteen years, the only change recorded for the engine house building was the addition of a ventilator to the roof of the boiler room in 1886. In 1889, the site was improved by the addition of a railroad siding from the Atlantic City Railroad's Grenloch Branch to facilitate the delivery of coal.

By 1899, improvements in the processing of water, both in treatment and delivery, made additions to the building necessary. City records provide no indication of the engineer/architect or builder for these alterations. However, Robert Wetherill & Company, supplier of the new equipment to be installed, may have provided substantial input to the design work. Two additional bays were added, one on the west end, and one on the east. The altered building, as it exists today, measures 103' by 43'. There are continuous vertical mortar joints from the ground to the frieze where the sections meet (photograph 1,2,7). The window and door fenestration mimicked the pointed arch lancet styling of the original structure (photograph 8).

The rotated soldier course frieze was continued around the entire structure. The corbelled cornice was also continued (photograph 8,9). In the east end of the building, another truss was added to the roof structure for maintaining its original shape and slate shingles. The west wall of the original building, now an interior wall, was gabled to support the roof in lieu of a fabricated truss.

During the same time period, there were many changes made to the interior including the addition of filtration beds in the eastern two bays, raising the floor level in those bays approximately 6'-0". More significant to the structure was the addition of a frame pump house on the northeast corner of the building. Between 1899 and 1930, various structures were appended to the north side of the building (close to the reservoir). The structures added in the first decade of the twentieth century reflected the evolving technology of water treatment. In 1904, a four-tank Pittsburgh Filter was added between the east end of the building and Newton Creek. In 1908, another small pump house was added to the east side to serve the filtration tanks. None of these are extant today.

On 17 February 1916, a fire broke out on the roof of the building. With engineers at the pumps in the building, firemen managed to confine the damage to the roof only. The roof was rebuilt, presumably to its original hip design. Another roofing fabric was substituted for the original slate shingles. The new roof was possibly covered in asbestos shingles, which were popular at that time.

During 1922 and 1923, a complete renovation of the water treatment and delivery system was undertaken by the City. Under the supervision of the City Engineers (Remington and Vosbury) a new separate and detached pump house was built to the south and perpendicular to the original 1883/1899 engine house building, which was also altered during this phase of construction.

The original pointed arch lancet window fenestration of the engine house were infilled with brick, and new industrial style larger metal casement windows and wood doors installed with accentuated keystones and shoulder voussoirs in a segmental arch (photograph 1,2,3,5,6,7,8). This alteration work was done to architecturally correlate the old Victorian Gothic style engine house building with the new Classical Revival pump house building. The original stack on the north side was razed and a new round stack was built of brick on the west end. To accommodate the new stack and its attendant flue, the west elevation was changed to a simple gable, creating a half-hip roof. The corbelling was broken, and the oblong flue connected the stack to the boiler room (photograph 1). A lighted clerestory was added to the roof to improve central illumination. The old boiler, engines and pumps were removed and a new heating plant/incinerator installed in the westernmost bay. The old settling tanks and pipe chases were left in place in the eastern two bays of the building.

Over the next several years, the City removed the appended structures to the engine house building, and by 1930, the original building had returned to its 1899 mass. In the 1960s, the round stack on the west end of the building was removed when the heating plant/incinerator was dismantled. The stack's destruction left the broken cornice and filled-in flue vent as a reminder of its presence (photograph 7).

Within the last few decades, steel tanks have been added to the grounds of the water works. Uses for these tanks include chlorine and other chemical storage and water pressure equalization chambers. None of these tanks contribute to the interpretation of the engine house, nor does a small wellhead building at the extreme south end of the property.

Current Conditions

Today, the Gloucester City Water Works Engine House building has the same footprint as it did in 1899. A roll up garage door had been installed in the westernmost door of the southern elevation. Until a restoration project, partially funded by a New Jersey Historic Trust grant, was undertaken at the site, deterioration had occurred throughout the structure, particularly to the roof, corbelling, frieze and walls. The northern elevation had been singularly hard hit with a complete failure of the corbelling in sections; bowing out of the wall from the weight of the roof; and a loss of single soldier bricks from the frieze, caused, in part, by the unchecked growth of vegetation (photograph 4,5). The wall had been temporarily braced until remediation efforts can be effected. Evidence of the infilled pointed arch lancet doors and windows abound throughout the walls of the structure, particularly from an interior vantage point. The flue to the second stack was removed and infilled, leaving a gaping hole in the corbelling on the western elevation (photograph 7). Little evidence remains of the original square smoke stack on the north side of the building.

On the interior, none of the equipment is extant except the filter beds in the two eastern bays. Temporary dividing walls have been erected in places; a lavatory has been installed in the northeast corner of the westernmost bay. Workbenches, testing and maintenance equipment now occupy the floorspace that once supported boilers and pumps.

The roof structure and fabric was in imminent danger of partial collapse. Soffits and support members had literally rotted away on the north side creating a serious breach in the supporting wall. Metal-flashing showed signs of decay and corrosion, caused, in part, by the integral built-in gutters and many of the metal downspouts are missing.

Beyond what has already been described, the walls exhibited major cracks and featured advanced deterioration of the mortar. As noted above, the loss of mortar integrity had allowed vegetation to take root and grow and had caused the loss of individual bricks from the wall fabric. The foundation had also suffered from damage and neglect, with spalling, cracking and movement quite evident.

Despite these areas of deterioration, the engine house building retains a moderately substantial degree of physical integrity relating to the original period of construction. Later alterations, completed within the period of significance, all relate to the evolving technology of water supply, distribution and purification.

The exterior of the building is currently being restored under supervision and funding of the State of New Jersey and this ongoing restoration project is reversing much of this deterioration. With some exceptions, the engine house is being restored to its 1923 appearance. The project began by removing all exterior paint from the walls. The masonry walls are being strengthened and repointed, with all of the crumbling and missing bricks being replaced. This work includes full restoration of the frieze and corbelling. The section of corbelling removed for the flue pipe installed in 1923 is being restored to once again create a continuous belt of corbelling around the building. The roll up garage door is slated for replacement and all of the metal-framed window sashes were stripped, etched and repainted. They currently await glass installation. The roof was totally rebuilt with retention of the iron trusses a priority. During the roof reconstruction, new flashing was installed and a new guttering and downspout system was created. Due to the myriad of pipes in the old filtration plant area of the building, the raised floor level will be retained with wood or cement slab floors covering the now open filtration beds. Current plans call for the city water department to continue using the two westernmost bays of the building as a maintenance shop. The two eastern bays (the old filtration plant) will be used as a meeting room and possibly for storage of city records currently stored in basement areas of city hall.

Summary

The changes that occurred to the 1883 building are directly related to advances in technology. The building originally had coal-fired boilers which provided steam to drive the engines and pumps. These gave way to diesel-powered pumps, and finally electrically operated pumps. Improvements in the water treatment process also motivated change. The original plan to take water directly from Newton Creek was altered when springs were discovered during the construction of the reservoir. Artesian wells were drilled in the 1890s to provide a more suitable supply of water. Pumps and machinery were added and deleted to keep up with the state-of-the-art methods of processing and delivering water. The additions and changes to the 1883 building were a direct result of one or a combination of these factors. It is a tribute to the designers or engineers of the structure that the building was so adaptable to provide a service basic to the City needs for nearly 115 years.

Significance

The former Gloucester City Water Works Engine House is significant in the areas of engineering, public health, industry and social history. The engine house represents the evolution of potable water engineering and technology as it was applied in a small city setting. It illustrates the advancements made in the field of public health and medicine as local community leaders became aware of the dangers inherent in shallow domestic wells for supplying drinking water. While its original purpose is obsolete today, its industrial heritage harkens back to a time when Philadelphia and the area surrounding it was known as "the workshop of the world." The building is also the physical manifestation of the sociological changes that occurred in a city set on a course of civic improvement and growth.

As the technology of domestic water treatment and distribution evolved, change was inevitable to the Gloucester City Water Works engine house. Over time, half of the building was converted into a filtration plant. However, the very nature of technological advancement requires the change and adaptation that has occurred in the engine house; therefore, the period of significance is from 1883 to the 1924. For all of the reasons stated, the Gloucester City Water Works engine house is locally significant under criterion A for "association with events that have made a significant contribution to the broad patterns of our history" in engineering, public health, industry and social history.

Background History of Gloucester

Gloucester City has been the site of human habitation since before the arrival of Columbus in the new world in 1492. Archeological evidence strongly suggests that members of the Lenni Lenape Indians occupied the river shore prior to 5000 BC. In 1626, colonists attached to the Dutch West India Company, a trading group, sailed up the Zuydt (Delaware) River and erected a fort at the southern boundary of New Netherlands. This coincides with the municipal and county line formed by Timber Creek in today's Gloucester City. The fort was built more for trade than protection from the local natives. This Dutch settlement was brief in nature, but represents the first permanent structure erected by Europeans in Gloucester.

In 1664, the Dutch yielded control of the Delaware River and its shores to the English. Through a series of events, the land eventually came under the control of the West Jersey Proprietors and divided into tenths. The area that Gloucester City fell into was the third tenth, also known as the Irish Tenth because the Quakers who settled here emigrated through Dublin, Ireland. The population grew until a local form of government was demanded by the residents. Gloucester County was formed in 1686 by the

creation of a county constitution. Gloucestertown was first laid out in 1677 and became the shiretown for the new county. A county courthouse was erected in 1696, under order of the grand jury.

Gloucestertown became a growing community complete with a ferry service to Philadelphia. John Oldmixon, writing in 1708, indicates 100 houses had been raised within the town. While this number may be a bit exaggerated, it points to the apparent desire of landed gentlemen to reside in the county seat.

The burgeoning community came through the Revolutionary War relatively unscathed, but disaster struck in 1786. The Court House was destroyed in a terrible conflagration. In the fire's aftermath, the county courts bowed to population concentration and relocated to Woodbury, leaving Gloucestertown without its *raison d'être*. Already bypassed by roads, and isolated between two main streams of water, Newton and Little Timber Creek, Gloucestertown became a sleepy fishing and farming village. Most of the land within the town bounds was employed in the raising of crops. Isaac Mickle, writing in his 1845 *Reminiscences*, described the town as "a deserted village". The former county seat was further disenfranchised by the creation of Union Township in 1831. Gloucestertown was merely a small settlement within this township.

However, Gloucester was endued with new life. Like the proverbial phoenix rising from the ashes, the industrial revolution reached the town's shores in the 1840s. David S. Brown, a Philadelphia textile merchant, chose Gloucester as the site for his planned mill complex. In 1844, the Washington Manufacturing Company began operations. This was followed by the construction of other business enterprises. Gloucester Manufacturing Company was formed a year later for the production and maintenance of the textile equipment. Subsequently, the Gloucester Print Works, also known as "the Bleachery", was formed. The Gloucester Land Company, started in 1846, managed the surplus land purchased by Brown for housing and not needed for mill construction.

Homes were constructed for the desperately-needed labor force. The housing called the "Mill Blocks" was provided by Brown himself. This, in turn, attracted stores and businesses, catering to the needs of the workers and the fruits of their labor—money. Churches were also formed and sanctuaries built. Dickensheets & Green, W.S. McAllister, J.H. Banks, W. Lenny, and M. Boylen all operated lumber yards prior to 1865. This fueled the housing construction boom. At least six carpenters were also present in town during the same time period. Three physicians could be found along with dry good stores, green grocers, shoemakers, bakeries, tobacconists and hotels. The industrialization of Gloucester created a micro-economic cyclone, drawing in more and more business and professional people as the labor pool for the textile factories increased.

Other industries became attracted to the activities in this formerly quiet town. A sugar refinery opened in 1853. The West Jersey Railroad was constructed through Gloucester in the mid-1850s, after

being incorporated by the State Legislature in 1853. The Gloucester China Company began operations in 1858. The town was continuing to expand. In 1840, Gloucester's population was estimated to be 200 people. Ten years later, after the introduction of industry, that number had soared to almost 2,200. The census-takers of 1880 found over 5,300 residents within the city limits.

Political divisions were also occurring during this time. In 1844, a legislative act erected Camden County out of Old Gloucester County. This placed Gloucester, the former shiretown, in a new county completely foreign to its former identity. However, Gloucester signified and strengthened its identity by incorporating as a city in 1868. This was symbolic of the community's newfound wealth and industrialism.

The Gloucester Iron Works went into production in 1864, followed by the Gingham Mill in 1870, Ancona Print Works in 1871 and the Terra Cotta Works in 1872. During the financial panic of 1857, Brown was forced to suspend operations for a season. By the time the next panic occurred, in 1873, David S. Brown and his compatriots literally flew in the face of danger by incorporating the Camden, Gloucester & Mt. Ephraim Railway. This narrow-gauge railroad was constructed from Kaighn's Point Ferry to Gloucester. Operational by February 1874, the line was extended to Mt. Ephraim in 1875. Brown used this rail line to deliver his goods to Camden for trans-shipment to Philadelphia.

In the 1880s, Gloucester City took on yet another role. Touted as the "Poor man's Cape May", the waterfront was transformed into a series of hotels, pavilions, amusement rides, gambling establishments, saloons and brothels. Most of these were under the control of one William J. Thompson, the so-called "Duke of Gloucester". The Gloucester Ferry Company's boats were filled to capacity as the blue-collar workers of Philadelphia flocked to this new resort. In 1887, the "Duke" constructed a baseball field on the site of the former terra cotta works. The passage of the "blue laws" in Philadelphia brought major league baseball to Gloucester as the Athletics played ball on Thompson's field on Sundays. Thompson created the Gloucester Race Track in the 1890s and held sway over the "Jockey Legislature" of 1893 in New Jersey. Nothing was too outrageous for the Gloucester waterfront. It was not at all usual for the city population to swell by 20,000 on the weekends. All of this recreational activity culminated in the erection of Washington Park on the Delaware in 1895, constructed at Eagle Point in West Deptford, Gloucester County. This park suffered two major fires; the second, in 1913, closed the park permanently. Thompson's "reign" in Gloucester also ushered in new industrial enterprises including an ice plant and a carpet factory.

Most of the textile mills continued to hum with production. However, in 1887, the former Ancona Print Works buildings stood empty. They were purchased in that year by the Welsbach Company, a gas mantle manufacturer. This firm was started under the aegis of U.G.I. (United Gas Improvement) of

Philadelphia and produced top-quality mantles and various gas-associated appliances. The mantles were processed using radioactive thorium nitrate as a coating. The light generated by these mantles rivaled electric bulbs due to the thorium. The 1900s saw an increase in the product line of the Welsbach Company, including water heaters and refrigerators operated by gas. The plant closed during the depression.

Immediately over the Camden City-Gloucester City boundary at Newton Creek, the New York Shipbuilding Corporation began erection of their shipyard in 1899. This innovative shipbuilding firm provided jobs for thousands and created a huge demand for housing in the area, including Gloucester City. The shipbuilding capacity of New York Ship was tripled in size during World War I, expanding the yard into the northern end of Gloucester City. Two additional yards were constructed in South Gloucester, The Pennsylvania and The New Jersey Shipbuilding Corporations, to aid the war effort. It was the creation of these two yards that provided the impetus to build Noreg Village, now known as Brooklawn.

Housing development in Gloucester City continued in the twentieth century with the creation of sub-divisions like Monmouth Terrace, Highland Park, Gloucester Heights, Riverview Heights, Park Manor, Cloverdale and Cypress Gardens. Some of this development actually took place on land originally part of Haddon and Centre Township, but annexed by Gloucester City in 1927.

Today, in 1997, the textile mills and shipyards are gone and most heavy industry has disappeared from Gloucester City. However, the city remains a stable, middle-class blue-collar community that symbolizes and typifies a New Jersey-based Delaware River waterfront town.

Early Water Works History

A community-based supply of clean, potable water was practiced by the Romans and a few other ancient civilizations. Europe is dotted with aqueducts constructed by the Roman Government of water transportation. By the middle ages, cast iron pipes were employed to deliver clean water to castles in Germany. London, Weilberg, Bruehl, Rheims and Clermont-Ferrand all featured installed water systems created exclusively of iron pipe.

Early American water works were not so progressive. Boston installed a water supply system based on wooden piping as early as 1652. However, this was based on gravity-feed, draining water from a stream at a higher elevation than the fledgling Massachusetts community. The first real water system in America was installed in Schaefferstown, Pennsylvania in 1732. Bethlehem followed suit in 1754 and has the distinction of creating the first "high-pressure" water works through a connection to a pump created by Hans Christopher Christianson, a Danish millwright.

By 1799 both Philadelphia and New York were installing extensive wood-based piping systems and steam-powered pumps. The wooden piping proved to be an endless source of problems. Benjamin Latrobe served as the first Superintendent of the Philadelphia Water Works. Quoting his 1801 report, he states, "Wooden pipes, like everything else that is wooden, are a perpetual source of expense, repair and interruption." Through the recommendation of a committee set up to examine this problem, some iron piping was imported from England a year later on an experimental basis. The trial proved a complete success and iron piping became the standard for any progressive city or town installing a water system. Importation of piping from Great Britain, however, was less than satisfactory due to the vagaries of tide, storms and war.

It appears that the first iron pipes cast in America were created at Weymouth Furnace, a New Jersey bog-iron furnace-foundry. These pipes were made for shipment to Philadelphia in the first decade of the nineteenth century. Other New Jersey furnace-foundries also obtained orders for pipe casting. Soon, specialized pipe foundries were constructed, with David C. Wood's Millville Furnace at the head of the Maurice River being the first. This specialized production began in 1825 at Millville. In 1840, Jesse Starr and his sons began production of iron pipe in Camden. This was the seed from which the Camden Iron Works grew. The Starr's sold the operation to R.D. Wood & Company in the 1880s.

Florence, New Jersey was the site of another foundry that specialized in pipe casting. Begun by the Jones family in 1854, its operations were assumed by R.D. Wood & Company. Richard D. Wood was the brother of David who operated the Millville Foundry. Richard and David had combined their business enterprises in 1845 and by 1854 were styled as R.D. Wood & Company.

Until the 1840s, pipe casting was accomplished by molds and cores laid in a horizontal manner. This inadequate technology prevented the casting of long sections of pipe. It also allowed pipe quality to fluctuate wildly and many pipes were rejected due to thin wall sections and topical brittleness. The first advance in pipe production was brought to America by George Peacock, an English ironmaster. Already perfected and patented in England, the advancement involved casting the pipe vertically in a pit. This allowed longer lengths of pipe to be produced with better quality control. The Millville Foundry first converted to this method in 1854.

In 1866, Andrew McNeal, a former managerial employee of R.D. Wood & Company, purchased land on the waterfront in Burlington, New Jersey and built a large pipe foundry. Production capacity was continuously increased until output was rated at 200 tons of pipe daily, ranging in size from 1½" to 48" in diameter. The McNeal plant became part of the United States Cast Iron Pipe & Foundry Company when this firm was organized in 1899. The advancements made in the iron pipe industry was the spark that ignited the construction of modern water works.

The improvements made to steam engines and boilers also contributed greatly to the technology of water works. Production of high-pressure, efficient boilers, combined with compound engines, permitted the movement of vast quantities of water. The compound engine featured both a high-pressure and low-pressure cylinder, the latter reusing the exhaust steam from the former. Double-acting pumps and fire protection systems, which could dramatically increase line pressure in event of a fire, laid the foundation of present-day water work methodology.

Philadelphia was an atypical pioneer in water work technology. The Schuylkill Pumping Station, erected in January 1801 at Philadelphia, employed a wooden boiler (with an iron firebox) and a steam pumping-engine running at 16 revolutions per minute. The engine pumped almost 1.5 million gallons of water from the Schuylkill River in a 24 hour period. During this trial, 70 bushels of coal was consumed. The Schuylkill Station was complimented by the Centre Square Pumping Station, which served to distribute the water to the pipe system. The water customers at that time included 63 private homes, four breweries and one sugar refinery. By the end of the nineteenth century, water supply technology in Philadelphia had evolved from these two small pumping stations to a series of five pumping stations with five large reservoirs. All but one of these pumping stations employed large steam pumping engines to move the water.

The Need for Clean Water

The first pumping stations in Philadelphia were constructed to answer concerns about repeated epidemics of yellow fever. Possibly recognizing disease causation, Benjamin Franklin willed £1000 to Philadelphia in 1790 for use in procuring an abundant supply of water to, "insure the health, comfort and preservation of the citizens." In 1793, the city suffered a pandemic yellow fever outbreak. Dr. Benjamin Rush theorized that the water supply had been contaminated by cesspools and sewerage. The doctor's groundbreaking work initiated the later work of Drs. Pasteur and Koch in Europe. Meanwhile, water supply based on wells and cisterns continued to be the dominant technology in ante-bellum America.

The decade following the Civil War was a period of accelerated industrialization in America. The war had ushered in new technologies, but also new problems. A building crescendo of voices across the country stressed the need for sanitation to defend public health. Stemming, in part, from the war work and publications of U.S. Sanitary Commission, America was marching on the path of reform that culminated in the first two decades of the twentieth century. During the Civil War, outbreaks of "camp and campaign" diseases were caused by overcrowded and unsanitary conditions in the field. To remedy this, the U.S. government created the U.S. Sanitary Commission in June 1861. Preaching the virtues of

clean water, good food, and fresh air, the commission pressured the Army Medical Department to improve sanitation and build large well-ventilated hospitals.

In 1876 representative engineers met at the Philadelphia Centennial Exposition and discussed the necessity of water works and sewerage installations. Strides had been made in understanding the issues and needs of public health. The medical field had reached the end of "the medical middle ages"; physicians began studying the work of Pasteur and Koch, illuminating bacteria and its effects.

New Jersey formed its own State Sanitary Commission during the Civil War. Publishing a report in 1866, the commission outlined the general sanitary condition of the State. In 1874, the state legislature created a Health Commission. The enacting legislation specifically charged the commission with surveying and reporting sanitary conditions in New Jersey preparatory to disease prevention efforts. The commission, in their report, discussed the state of the water supply and sewerage handling in New Jersey. Based on this report, the State Legislature passed a bill in 1877, creating the State Board of Health. The state of New Jersey's water supply, sewerage and the use of wells, springs and cisterns for drinking water were frequent subjects featured in the Board of Health's annual reports.

In 1876, the New Jersey State Legislature passed an act to encourage the state's cities to "supply the inhabitants thereof with pure and wholesome water." Allowing the communities to fund the construction costs through bond issues, this act also required a majority of the electorate to approve the erection of water works. Many smaller cities and towns were empowered with progressivism because of this bill.

Between the years 1883 and 1893, the promotion of water works and installation of supply systems reached its peak across America. At the beginning of the Panic of 1893, the July issue of the *Water & Gas Review* listed one hundred and eight water projects then being initiated. The American Water Works Association was formed in 1883 to promote the construction of water works and disseminate information about them.

The development of clean, palatable community water supplies was vital to the growth of American civilization. In the past two centuries, cities and towns have built facilities that provide potable and wholesome water to about 80 percent of the United States population. Thus, the public wells and feeble attempts at water distribution of the colonial era have evolved into sophisticated public work systems comprising collection, treatment and transmission of the finished product to domestic and industrial consumers.

Construction of the Gloucester City Water Works

Prior to the construction of the Gloucester City Water Works, domestic potable water was obtained principally from wells and cisterns. The employment of outhouses and cesspools for waste combined with drawing water from relatively shallow wells did not serve to insure the public welfare from disease. The mill buildings maintained its own water system, for both processing and fire protection purposes. Steam engines and pumps kept a continuous supply of water available at all times. Fire hydrants were placed in front of most buildings and residences owned by the mills to protect their investment. Hose carts supplied by the mills served as the city's only fire-fighting equipment.

When the enabling legislation was passed in 1876 for the construction of water works, Gloucester City was already involved in three large construction projects for the improvement of the city: curbing and sidewalks were being installed on King Street, Jersey Avenue and Broadway; one half of the battle to safeguard public health was undertaken with the installation of a city sewer system; and major improvements were undertaken at the Mercer Street Wharf. This work was completed by 1880 when, in October, the City Council adopted a resolution calling for the placement of a question in the election to be held November second. This would answer the question of public sentiments regarding a water works project. Not enough time was available to place the question on the ballot, however, and council canceled the question.

City Council then announced a special election to be held in December, 1880. The electorate approved the question by a margin of 44 votes. The general citizenry questioned the validity of the election and declared it illegal. Over 600 people protested in writing.

The residents' protests caused the State to investigate the election and its results. The State obtained a restraining order against the City Government to block any further action on the water works issue. Council resolved to fight the restraining order, but the Court of Errors and Appeals nullified the election results at its February 1882 session. The court found that the election was improperly advertised and conducted. It expressed concern that the city considered bonding $85,000 with so few of the 5,000 city residents voting. At the March Council meeting, the court's decision was read and the water committee was promptly discharged of their duties.

The water works issue then became the crusade of Benjamin M. Braker, editor of the Gloucester City Reporter. His well-penned editorials revitalized the citizenry's interest in the subject and forced Council to re-appoint an investigative committee. In June 1882, Council received a petition from property owners and residents for a new election to be held on the question. The election was held at the end of June and the question was passed. Council then scheduled public hearings on the subject with little tangible results.

The Council committee reported that they had listened to the public and found no one willing to provide "an idea or a plan".

Prior to the issuance of the restraining order after the December 1881 election, the water works committee had engaged the services of Jacob H. Yocum, a civil engineer of Camden. Yocum returned with two plans: The first called for water to be obtained from the headwaters of Newton Creek, near Mt. Ephraim at an estimated cost of $100,000; the second called for a location near Newton Creek within the City limits at an estimated cost of $60,000. At that time, residents expressed concern over obtaining drinking water from Newton Creek.

After the legitimate June 1882 election, Council approved Yocum's second plan due to economic considerations. In February 1883, Council purchased two lots from David M. Chambers for $3,000. The first lot contained six acres and was located between Hudson and Gaunt streets, Johnson Boulevard and Newton Creek. This would become the site of the water works. The second lot, containing one acre, was situated on the south side of Paul Street. A stand pipe would be erected on this tract.

City Council advertised for construction bids in a variety of publications. Proposals were submitted for both the entire project and separate phases of work. Interest in the project was shown by individuals and companies from Philadelphia and York, Pennsylvania; Jersey City, Elizabeth, Burlington City, Camden City and Gloucester City, New Jersey; New York City; Providence, Rhode Island and Charlestown, Massachusetts. At the February Council meeting, the following contracts were awarded:

John Eschbach	
reservoir	$5,600.00
piping, complete	$34,534.81
Thomas Leeming	
engine house	$5,565.97
tank foundation	$2,275.00
John Baizley	
water tank	$5,870.00
Robert Wetherill	
Corliss pumping engine	$14,500.00
Henry P.M. Birkenbine	
fire protection apparatus	$2,500.00
engineering	$2,500.00
Total	$73,395.78

John Eschbach was a general contractor from Philadelphia. Thomas Leeming was a local carpenter and builder of some renown. Prior to this contract, Leeming built numerous brick and frame structures throughout the city. In 1859, he erected a two-story brick school house at Broadway and Monmouth Street for the Third School District of Union Township. Mr. Leeming was awarded the contact to build the first City Hall for Gloucester City. Both of the preceding buildings were designed by Camden architect, Stephen Decatur Button.

The owner of a blacksmith and machine shop in Philadelphia, John Baizley was quite knowledgeable about ironwork and very capable of erecting the water tank. Chester, Pennsylvania was the home of Robert Wetherill & Company. This firm was founded in 1872 and was renown for its boilers and Corliss engines. The company was capable of producing one complete engine per week and had installed these units in many American water works.

Henry P.M. Birkenbine styled himself as a civil engineer with a particular acumen for hydraulics and water works technology. After a short stint as the Chief Engineer of the Philadelphia Water Works in the late 1860s, Birkenbine gained recognition as a qualified expert regarding boilers and pumping engines. Several pamphlets have been published reporting the results of engine and pump testing he has undertaken. He also was an inventor, providing his own patented fire protection apparatus to Gloucester City. This piece of equipment will be explained in the "Specifications..." section of this report.

It is unfortunate that the Gloucester Iron Works bid for furnishing and laying pipe was $689.69 more than Eschbach's. The City Council would rue the day they awarded the contract to John Eschbach. Henry Birkenbine was contracted to serve as engineer on the project, due to the absence of Jacob Yocum.

Groundbreaking for the engine house occurred February 26, 1883 with several officials taking part in the ceremonies. Eschbach began construction of the reservoir on March 2. However, by May 5, the contractor reported hitting quicksand and the brick walls of the reservoir were in danger of sinking. All work on the storage basin was stopped. Thus began the most troublesome episode of the entire construction effort. The original specifications for the reservoir denoted a brick floor. Birkenbine recommended a modification of the contract to allow for a plank sub-flooring. Council members questioned the original specifications and the apparent lack of soundings at the reservoir site prior to the commencement of excavation work. While Birkenbine was indicating to Council that the work would be completed by August, Council was chiding him for "not paying enough attention" to the progress of the work.

Meanwhile, contractor Baizley began construction of the water tower on June 15 and Leeming was prosecuting the engine house work to speedy completion. Solid footing for the engines and boilers were

found at a depth of 7'-0". Foundations were created and the engines and boilers installed. Testing of this equipment occurred in July 1883.

Opening an office on Hudson Street for water connection transactions, Eschbach continued installing water mains in the city streets even though he had halted all work on the reservoir. He attended the July Council meeting and declared the reservoir impossible to complete at its present location. Eschbach further stated that he would not expend any of his own money to complete the work. Reminded of his contract, he placed the blame squarely on the shoulders of Engineer Birkenbine. By the end of July, Eschbach was no where to be found and vouchers issued by him were not redeemable. He arrived back in Gloucester in August, redeemed the vouchers and continued to lay pipe. At the August Council meeting, Eschbach's contract was revoked and his bond ordered cashed. These problems caused a long delay in completing the water works and making them operational.

The reservoir contract was finally awarded to a James Chapman in October. He was ordered to complete the work according to the specifications of Engineer Birkenbine. Laying a plank floor and covering it with mud to keep it in place, Chapman did what Eschbach found impossible. He proceeded to add layers of sand and gravel to the reservoir floor, topping it off with a solid finished floor of brick.

The water tank was finished in October and pronounced one of the finest in the state. The December 15 *Camden Post* reported that the engine and pump were operational and the reservoir was complete. The water tank was filled to a depth of 52'; four days later, it was filled to overflowing. Pressure-testing of the pipe system was carried out with several bad pipe breaks. The day after Christmas, the fire hydrants were proved with a resulting stream of water 60' in height. This was stream was based solely on the pressure of the water tank, the fire protection equipment not being operational yet.

The cold weather created problems for the water tank. As rivets broke, water began to leak from the tank, forming an ice coating on the sides. Testing continued through the first two months of 1884. Burst pipes were almost a daily occurrence. The *West Jersey Press* issue of February 6 indicated, "The [Gloucester City] water works pipe system has proved a rotten concern throughout–every test proves it." Eschbach had not only left the reservoir unfinished, but his pipe-laying bordered on incompetence. A month later (March 5 issue), The *Press* reported "On Thursday last, a test of the water mains was made. When a pressure of 125 lbs. was made, the large main on Hudson Street near the West Jersey Railroad bursted." After repairs were made, the water works became operational about the middle of March. This event went unreported in the Camden press. Final contract settlements occurred in May 1884.

The construction trials and start-up problems associated with the Gloucester City Water Works did not go unnoticed by the general public. Certainly the unfinished reservoir was the subject of derision–it became known as "the mud hole" or "the bottomless pit". It appears the ultimate contempt for the work

was manifested in a program held by the Gloucester City Social Club in April 1884. After several vocal numbers, a burlesque was featured entitled, "Our Water Works". It was reported to be "a production of genuine merit and was well received." This was followed by a tableau, "*Testing the Pipe System,* with John Watson in the foreground as director [which] was a rich and amusing feature of the programme."

While this sarcasm was a bit disconcerting to the Water Works Committee, water service continued to be installed in various houses throughout the city. The local plumbers were kept busy and many other plumbers from the surrounding area descended on Gloucester in hopes of obtaining contracts from residents and businesses. Even the Gloucester Iron Works was retained to lay city piping on Willow Street. Despite its early difficulties, the Gloucester City Water Works has proven to be a valuable asset to the city–safeguarding public health and supplying water to new sections of the city as they were developed.

Gloucester City Water Works Specifications

Original Engine House

Today, the former engine house is a four-bay building measuring 103' by 43'. When first constructed by Thomas Leeming, the building contained only the two center bays of the present structure. The 1883 building's exterior featured running stretcher bond brick walls topped with a 8" high frieze made apparently of pressed brick laid in an rotated soldier course. This was capped with a corbelled cornice consisting of 13 brick courses overlapping to form a horizontal projection.

The mortar used in the engine house construction was a point of contention between the contractor, Engineer Birkenbine and City Council. At one point, Leeming was ordered to cease all work until the mortar could be tested. After testing was completed, Leeming was approved to proceed with the work.

The interior of the structure featured wood ceilings and plastered walls. Door and window openings were constructed in a pointed arch lancet style. A large square chimney, 85 feet in height, was erected by Leeming near the northwest corner of the engine house and flued to the boilers. In 1886, a ventilator was added to the roof over the engine and the boiler room. The original engine house was constructed with a slate-shingled hip roof supported by two iron trusses which are still *in situ* today.

A new bay was added to each end of the original building in 1899 to provide the space needed for a new boiler and compound pumping engine. The final form of the building, as it exists today, took shape with these two added bays. When the additions were completed, a new hip roof was placed over the entire structure. This roof consisted of wood framing and planking topped by slate shingles.

Architectural detailing on the additions was matched closely with the original 1883 construction, including the pointed arch lancet fenestration design.

Mechanical Equipment

With the exception of the fire protection apparatus supplied by Henry Birkenbine, all the mechanical equipment in the engine house was supplied by Robert Wetherill & Company. The two original engine house bays, when completed, served as an boiler room and engine/pump room, respectively. The boiler room contained two 54" diameter by 14' long return-tube boilers arranged in separate nests. Each was capable of supplying steam to the full capacity of the pumps. This redundancy was by design, to provide a measure of safety in case of fire. Each boiler featured a 30" by 30" steam dome and 35 boiler tubes, each 4" in diameter.

The Wetherill Company also supplied a Corliss compound engine. Specifications on each were as follows: high-pressure cylinder, 14" diameter by 30" stroke; low-pressure cylinder, 26" diameter by 30" stroke. The engine was supplied with a 12' diameter flywheel weighing 11,000 lbs. Being a compound, the low-pressure and high-pressure cylinder were each designated as an engine and were enumerated as no. 193 and no. 194 by Wetherill. Two water pumps were also furnished, operated by the extended piston rods of the high and low-pressure cylinder. Each was a 9" diameter by 30" stroke double-acting pump. Contract specs called for each pump "to work under a pressure of 125 lbs. per square inch."

A 14" by 14" air pump was also delivered by the Wetherill Company. Much of the piping for the engine house, pumps, fire apparatus and reservoir was also furnished by this company. It is interesting to note that the engines delivered to Gloucester were identical to ones being used at the Chester Pumping Station.

In 1899, the Water Works Committee again contracted with Robert Wetherill & Company for the construction and installation of another engine, Wetherill's nos. 685 and 686. Specifications were: high-pressure cylinder, 14" diameter by 30" stroke; low-pressure cylinder, 26" diameter by 30" stroke. This was classified as a cross-compound pump engine and added a 2,500,000 gallon-per-day rating to the pumping capacity already present. The older pumps, long overdue for maintenance, could be taken off-line and rebuilt once this new pump was installed.

The pumping engines did not work on a continuous basis. Although the boilers were always maintained in steam, the pumping engine only operated when the level in the water tank dropped, decreasing line pressure and the amount of available water. When that occurred, the pumping engines

would be put in motion to refill the tank. The engines were also used to fill and maintain the level in the reservoir and during firefighting efforts, when water was pumped directly into the lines.

The Reservoir and Artesian Supply Wells

Original specifications for the reservoir designated a capacity of 1.5 million gallons. This was increased to 2 million gallons by 1890. Extra capacity was added by raising the side walls 4'-0" to prevent overflow by Newton Creek. As previously stated, the reservoir is constructed with a plank sub-floor and a brick finished floor. The side walls are also composed of brick and mortar. The reservoir was originally supplied with water from nearby Newton Creek. In 1891, the Water Works Committee responded to numerous complaints of foul smelling and tasting water. Following the current water works trend, the first artesian well were ordered drill. Henry Birkenbine and a P.A. Sanguinetta were retained to design and draw a set of plans for the proposed work. P.H. & J. Conlan of Newark was awarded the drilling contract. The premier well driller of that day, Conlan drilled an 8" well 276', hit rock, continued an additional 4", thereupon the well was abandoned. The following year, Leach Brothers contracted to drill eleven 4½" wells on the banks of Newton Creek. The depth of these wells are as follows:

(A) Three with depths ranging from ..... 67 to 79 feet
(B) Four with depths ranging from ..... 85 to 96 feet
(C) Three with depths ranging from ..... 149 to 162 feet
(D) One with depth of ..... 270 feet

These wells drew water from various strata. Nine of these wells were connected and pumped at one time, drawing 700,000 to 1 million gallons in a 24 hour period. Until the wells were drilled, the reservoir was the singular primary source of water for the City. This was problematic, since this storage basin could not be drained and cleaned.

Upon completion of these wells, the engineer ordered water to be pumped from them continuously and the reservoir drained. The latter was then thoroughly cleaned and placed in good repair. The walls were raised four feet in height and a berm constructed to support the wall. In the past, Newton Creek had overflowed the reservoir, carrying debris and refuse into it. With a population approaching 6,500, Gloucester's water consumption topped 1 million gallons per day during 1893. In 1900, four additional artesian wells were drilled by Senator George E. Pfeiffer, the contractor. Three of these wells were 8" in diameter and one was 6". They varied in depth from 82 to 167 feet and served the water works in pairs.

Like the previously drilled wells, the new wells were located along the bank of Newton Creek about 350 feet apart. These new wells provided an additional source from which to draw water; however, water supply technology and consumer perception of water quality was in a state of flux.

Water Processing

When originally constructed, the Gloucester City Water Works derived its water from springs located directly under the reservoir and, in case of fire, Newton Creek. The reservoir served as a constant supply and water was pumped from there to the water tank. It was then distributed to the consumer on a gravity-feed system. When the wells were drilled, again water pumped from the wells was distributed directly to the consumer (via the water tank) without any type of treatment. However, technology was changing. Slow-acting sand filtration of water had occurred at a few water works since the early nineteenth century, with some improvement in taste, color and smell. In the 1880s, scientific experimentation on filtered water was carried out. New understanding about disease and bacteria lent additional credence to these trials. As this understanding increased, and as local sewerage treatment plants began to be located on streams, filtration was not only desirable, but demanded.

In 1904, Gloucester City awarded contracts for construction of a filter plant. The Pittsburgh Filter Company erected a four-tank gravity filter bank at the exterior northwest corner of the engine house. Each tank was filled with sand and featured a mechanical, sweep-arm agitator with spray bars to distribute the water. Filtering down through the sand, the water was collected at the bottom and pumped into the delivery system. Preparatory to entering the filtration plant, the water was first pumped to two settling tanks, installed outside the east end of the engine house. These two tanks removed sedimentation and heavy particles. This filtration plant served the needs of Gloucester City until the major plant changes of 1923.

Coady & Cheesman constructed an extension to the small pumphouse on the east side of the filtration plant to house a new pump in 1908. A W.P. Dallett centrifugal pump was placed in this structure to assist in moving water from the filtration plant to the reservoir. The new pump supplemented the Union Iron Works pump installed with the filtration plant in 1904.

In 1915, the water works moved into the realm of modern water processing through the installation of a liquid chlorine apparatus. Chlorine compounds had been used as early as the 1830s to combat foul smells emanating from water supplies. But its effects were not understood until the 1880s, when the germ theory of disease transmission was established. Experimentation with chlorine water treatment was initiated in Europe and Louisville, Kentucky in the 1890s. The first continuous chlorination facility was

constructed at the Boonton Reservoir, supplier of water to Jersey City, New Jersey in 1908. With this installation, the Gloucester Water Works had truly come of age.

At the same time the chlorine apparatus was installed, an extension was constructed on the engine house's north side at the northeast corner. A valve house was also built. Installed in this addition was a 125 h.p. auxiliary engine. Two 30" suction pipes originating in Newton Creek continued to be used as required, particularly during a fire.

Water Delivery System

As previously indicated, the initial installation of delivery piping by John Eschbach was not without problems. Frequent leaks were normal and pipe failures did occur. The original lines installed ringed the city. Pipes were laid on Hudson Street and down Broadway to Pine Grove. Lateral connections to homes and businesses were being installed at a rapid rate. By 1888, it was reported that pipelines had been installed on the following streets: Broadway, Hunter, Market, Cumberland, Linden, King, Water, Charles, Fourth, Somerset, and Powell streets. By 1904, additional piping had been laid on Burlington Street, from Salem Street to Broadway; Filmore Street, from Essex north beyond Salem Street; and on Powell Street, from Broadway to the West Jersey Railroad. In that year, the Water Works Committee reported the following list of attachments:

Hydrants	1449
Baths	374
Water Closets	430
Wash Paves	123
Screw Nozzles	17
Wash Tubs	16
Hotel Bars	48
Horse Troughs	6
Barber Shops	9
Drug Stores	5
Boilers	5

Water metering first occurred in 1892, when the water works ordered two meters. These served as a tracking tool for the system's largest industrial consumers. In 1894-95, the Water Works Committee

reported pumping enough water to supply a city of 45,000, yet the population of Gloucester was less than 7,000. This was deemed a great waste of water by the Committee and general metering was recommended.

The water tank erected by John Baizley in 1883 was constructed of iron sheeting and riveted together. The tank's capacity was 200,000 gallons and it served a dual purpose. The standpipe not only stored supply water and equalized pressure on the pipe system, but this tank also assisted the fire protection equipment. Problems with the tank were common and included severe rusting and buckling at the bottom and the need for frequent painting. By 1915, the tank's water capacity was diminished to 120,000 gallons, presumably due to age-related problems.

The Birkenbine patented fire protection apparatus was installed when the water works was first constructed in 1883. This equipment was an attempt to adequately protect the city in case of fire. Essentially, when a fire occurred in the city, the Birkenbine equipment began operation and boosted the line pressure from the standard 40 lbs. to 125 lbs. per square inch. The additional pressure provided a robust stream of water capable of overshooting any building in the city. This technology worked superbly and allowed the city to delay purchasing any mechanized fire-fighting equipment until 1914. Until then, the Gloucester City Fire Department was only outfitted with hose carts and a hook and ladder truck. Fire hydrants were strategically located throughout the city for immediate connection by the hose cart attendants.

Pipe and hydrant installation continued in the twentieth century. When development of various sub-divisions occurred within the city, the water works was quick to connect supply lines to the new neighborhoods.

The Fire of 1916

Fire struck the water works engine house in the early morning of February 17, 1916. The roof was discovered to be in flames at 2:45 A.M. and the fire company called. While the firemen worked feverishly to gain control over the fire, Operating Engineer Murphy and Assistant Engineer Green stayed at their stations and kept the boiler fires stoked and the pumps operating. This was done to provide water pressure to the firefighters manning hoses and with no thought of the engineers' own safety. After two hours, the fire was brought under control. The conflagration totally destroyed the roof, but did little damage to the costly equipment below. During the fire, water was played on the filter plant to prevent its destruction. The full financial loss was $5,000, most of which was covered by insurance and the roof was quickly rebuilt. It was reported in the Camden Daily Courier after the fire that almost $25,000 had

recently been expended on the building over the previous five months. The work involved the installation of equipment, i.e., the chlorine apparatus, the auxiliary engine and addition to house it, etc.

The 1923 Improvements

In 1919, the engineering firm of Remington & Vosbury was retained to assist in planning major improvement projects at the Gloucester City Water Works. The overall scope of these projects was a changeover from steam to internal combustion pumping engines. The engineering firm redesigned the old steam pump room to become a new filtration plant. A set of stairs were installed in the second bay to provide access to the new elevated door and walkway installed in the filtration rooms. The old filtration plant was dismantled, as were the adjacent pumps. The auxiliary engine was also removed. A new, separate pump house building was constructed adjacent and perpendicular to the old engine house. This new structure was built to house two Busch-Sulzer 150 h.p. diesel engines and six Ludlow electric directly-connected pumps. The diesels were connected to generators supplied by Electric Power Equipment Co. These generators supplied electricity to the pumps.

At the same time, the steam boilers and engines were removed from the old engine house and substantial changes were made to the exterior appearance of the building. The old pointed arch lancet style window fenestration were infilled with brick and new larger arched-topped industrial style metal windows installed. Door fenestration were also changed during these improvements. The original square smokestack was no longer needed and razed. A new oil-fired heating plant/incinerator was installed in the west end of the engine house. This heating plant featured two boilers placed side by side in the westernmost bay and heat circulation equipment in the adjacent room. The west wall was reconstructed to a simple gable and a section of the cornice was removed to accommodate a flue pipe and round brick chimney for the new heating plant. The remaining space in the former boiler rooms became a tool room, storage and work area for the plant. The suction pipes from Newton Creek would no longer be used and were removed. By 1930, all of the additions constructed on the old engine house were removed and the building once again assumed its 1899 mass.

The changeover from steam to diesel was a profound economic move made possible by technological advances. No longer would coal be continuously expended to maintain steam pressure in the boilers for occasional pumping activity. Instead, the diesels could either idle on standby or be started on a moment's notice to provide power for the pumps, dramatically decreasing fuel cost and consumption. The diesel engine was a decided advantage in lowering fuel and pumping costs and it rendered the steam pumping engine obsolete overnight, even though some water works did not modify their systems immediately.

Also constructed during the 1923 improvements was a new 100,000-gallon settling basin which replaced the old two-tank system. The Chicago Bridge and Iron Works contracted to build a new 100-foot, 600,000-gallon capacity, water tank as the one erected by John Baizley in 1883 was in poor condition and inadequate for the twentieth century demands placed upon it.

By the completion of these improvements, Gloucester City was pumping water from five 8" artesian wells, filtering the water, storing it in the 100,000-gallon settling tank and the now renovated 2 million gallon reservoir. From there, it was pumped into the new 600,000- gallon water tank and gravity-fed into the water supply system. When warranted, water was pumped directly into the mains; this was primarily initiated when fires occurred in the city. The six pumps were rated as follows: two could pump 2 million gallons per day; two could pump 1.5 million gallons per day; and two could pump 1 million gallons per day. The city at that time contained 135 fire hydrants and the average daily water consumption was 3 million gallons.

The 1923 Improvements ushered in a new era for the water works. The changeover from coal to oil as a fuel for heating and pumping rendered the railroad coal siding passé; underground storage tanks were installed for the fuel oil. The four-car siding was installed in 1889 from the Atlantic City Railroad's Grenloch Branch to facilitate coal delivery to the plant. Prior to this, coal arrived by the West Jersey Railroad at Monmouth Street. This required every lump to be hauled by drayage between the station and the water works. In 1888, the West Jersey installed a siding at the station to accommodate the coal cars, but the over-the-road haulage still proved to be expensive and time consuming. The 1889 siding provided delivery of coal directly to the site.

Summary

The technology employed in creating and operating the Gloucester City Water Works was not unique. Its use was being repeated in hundreds of cities and towns across America in the 1880s, simultaneously with Gloucester City. The City was not the first nor the last community to install a water works. Advancements and changes in technology made it possible for the City's water supply system to be built, maintained and improved, not only in its health standards, but also its ability to deliver clean, potable water to an expanding population base.

Changes in technology continue to occur at the Gloucester City Water Works, 73 years after the 1923 improvements detailed in this report. During that subsequent 73 year span, a new filtration plant was constructed; new internal-combustion pumping engines and pumps installed; and water purification techniques improved to keep pace with the ever more stringent standards set by the various regulatory

agencies. With all of these changes, the basic premise of pumping water through a series of filters, placing it in a storage receptacle and finally delivering that water to the consumer through a below-street piping system has not really changed. This is why the plant was initially constructed in 1883 and why it continues to operate today.

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Gloucester City Water Works Engine House, Gloucester City, Camden County, New Jersey

Printed Sources: Maps

1. *Gloucester City, New Jersey.* New York: Sanborn Map Company, 1891; 1896; 1902; 1909; 1915; 1923; 1930.

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United States Department of the Interior
National Park Service

National Register of Historic Places Continuation Sheet

Verbal Boundary Description

The boundaries of the Gloucester City Water Works Engine House are contained within those of municipal tax parcel Lot #5 of Block #195 on Plate 52 of the Gloucester City Tax Maps. Said boundaries form a rectangle 43' x 103' which is situated approximately 43' from the top bank of Newton Creek to the east, 40' from the Conrail railroad right-of-way to the west, and running roughly between Paul and Gaunt streets if said streets were extended east of Johnson Boulevard

Boundary Justification

The boundaries include all that land, property and improvements currently and historically known as the Gloucester City Water Works Engine House building.

United States Department of the Interior
National Park Service

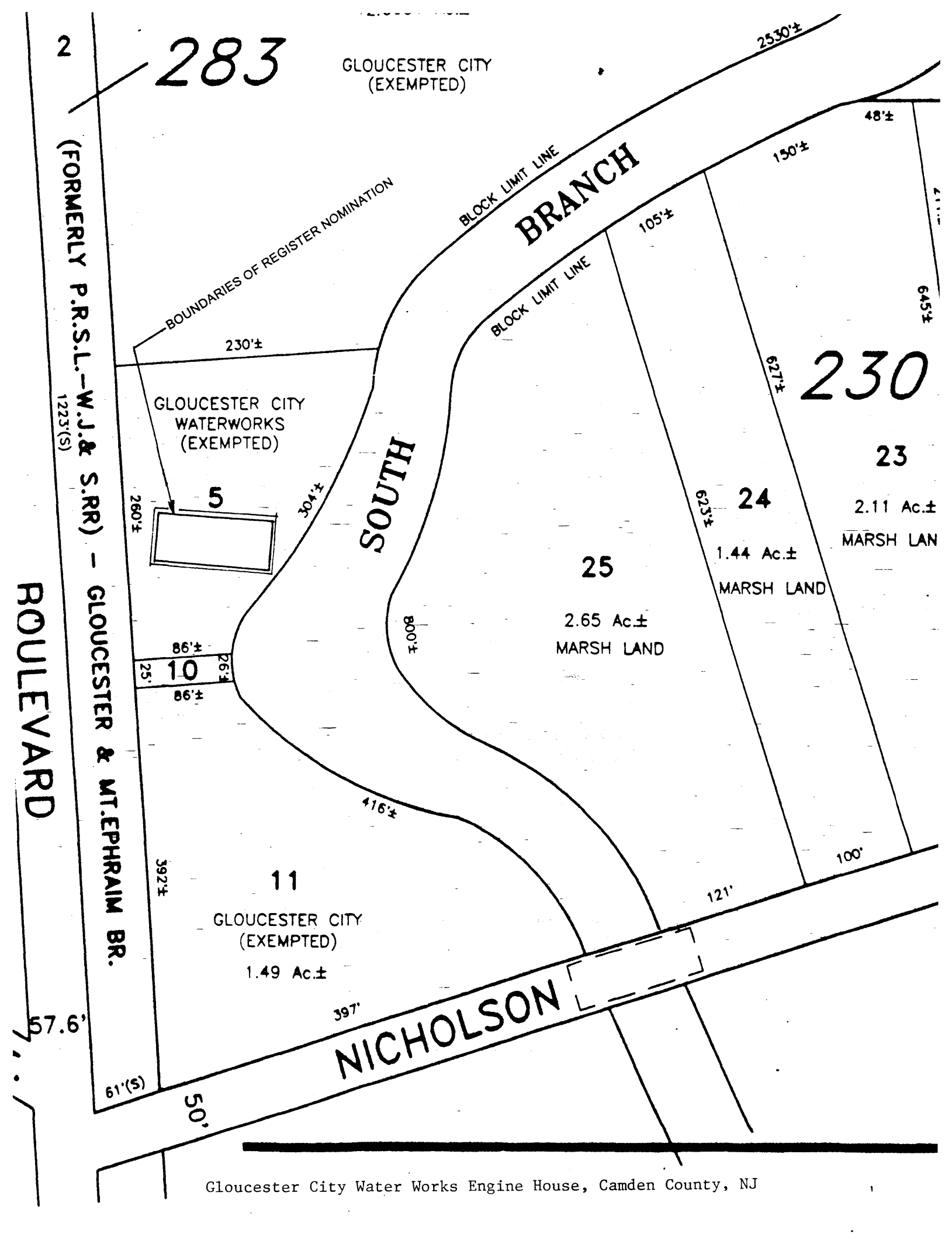
National Register of Historic Places Continuation Sheet

Section number Photos Page 1 Additional Documentation

Gloucester City Water Works Engine House, Gloucester City, Camden County, New Jersey

List of Photographs included with Nomination Document

1. View showing west elevation and (southern) facade of 1883/1899 engine house.
2. View showing (southern) facade and a portion of east elevation of 1883/1899 engine house.
3. View showing a small portion of (southern) facade and the east elevation of 1883/1899 engine house.
4. View showing eastern portion of the north elevation of 1883/1899 engine house.
5. View showing western portion of the north elevation of 1883/1899 engine house.
6. View showing a small portion of north elevation and a portion of the west elevation of 1883/1899 engine house.
7. View showing west elevation and a portion of (southern) facade of 1883/1899 engine house.
8. Detail view showing cornice, frieze, original entrance, date stone and dedication stone, and one 1923 replacement window on the (southern) facade of 1883/1899 engine house.
9. Detail view showing cornice and frieze on the north elevation of 1883/1899 engine house.
10. Detail view showing portion of an interior wall and doorway; this wall was the original west elevation in the initial 1883 construction of 1883/1899 engine house.
11. Distance view showing (from left to right): 1923 pump house; southeast corner of 1883/1899 engine house; 1923 100,000 gallon settling basin; the top of the 1923 water tank is seen in the distance.



Gloucester City Water Works Engine House, Camden County, NJ

NOTE.

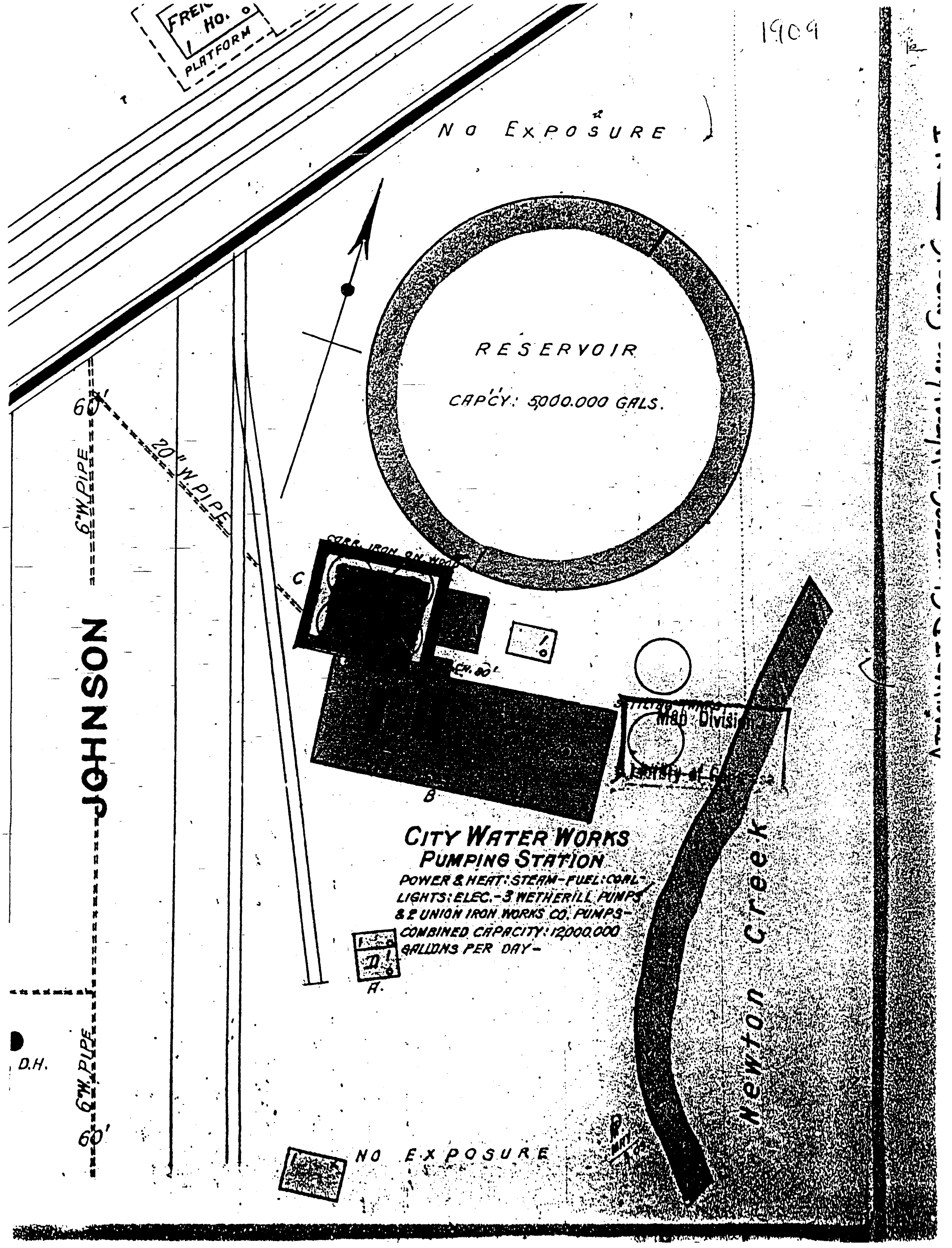
Water Works:

CORLIS SYSTEM.
LOCATED ½ MILE E. OF CITY HALL.
AVERAGE PRESSURE 40 LBS.
FIRE " 80 TO 125 LBS.
95 HYD'S.
STAND PIPE CAP: 200,000 GALS.
CAP. OF RESERVOIR AT PUMP HO. 2000,000 GAL.
" " PUMPS " " " 2000,000 "
PER. 24 HOURS.

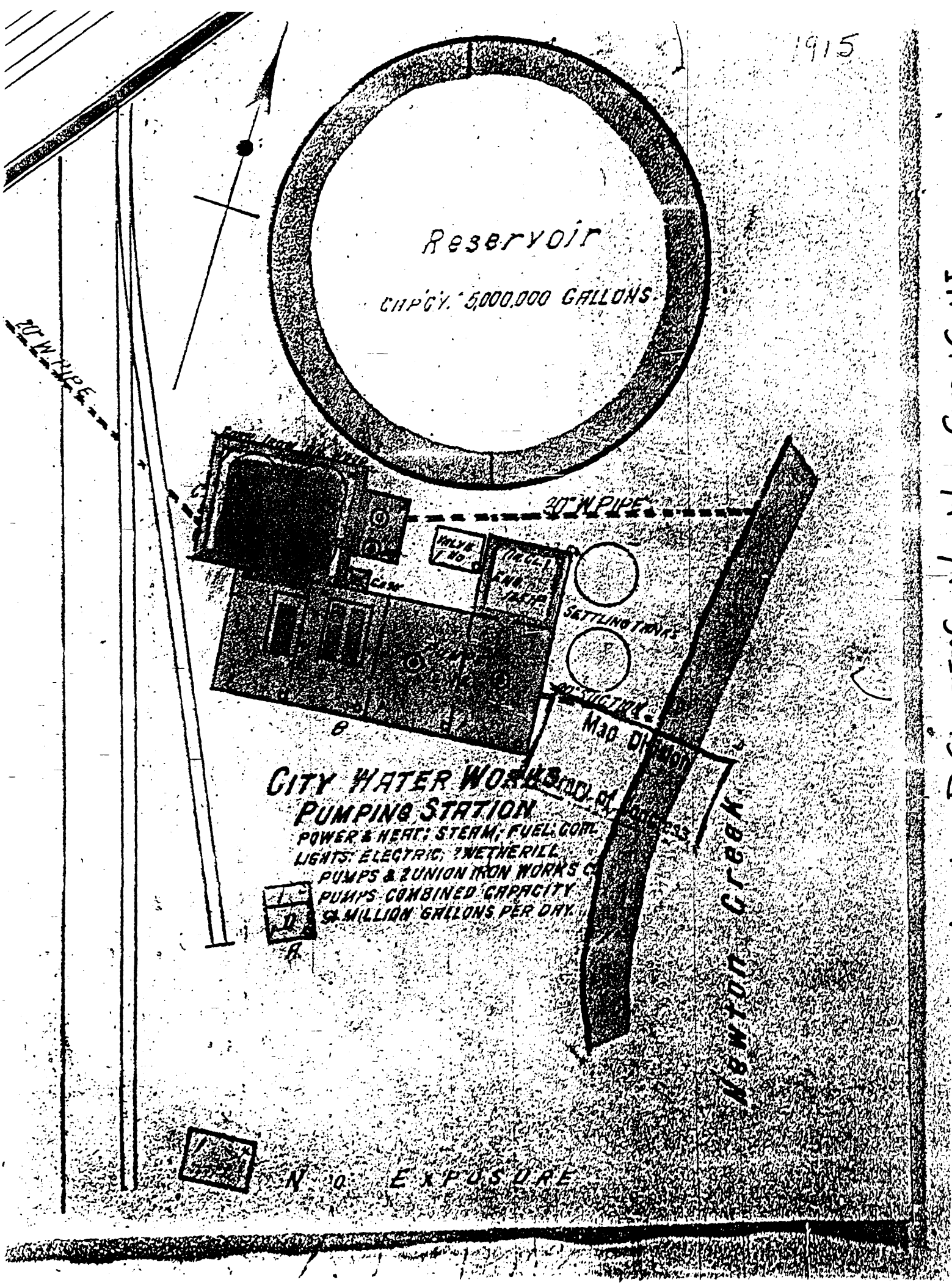
Fire Dep't:

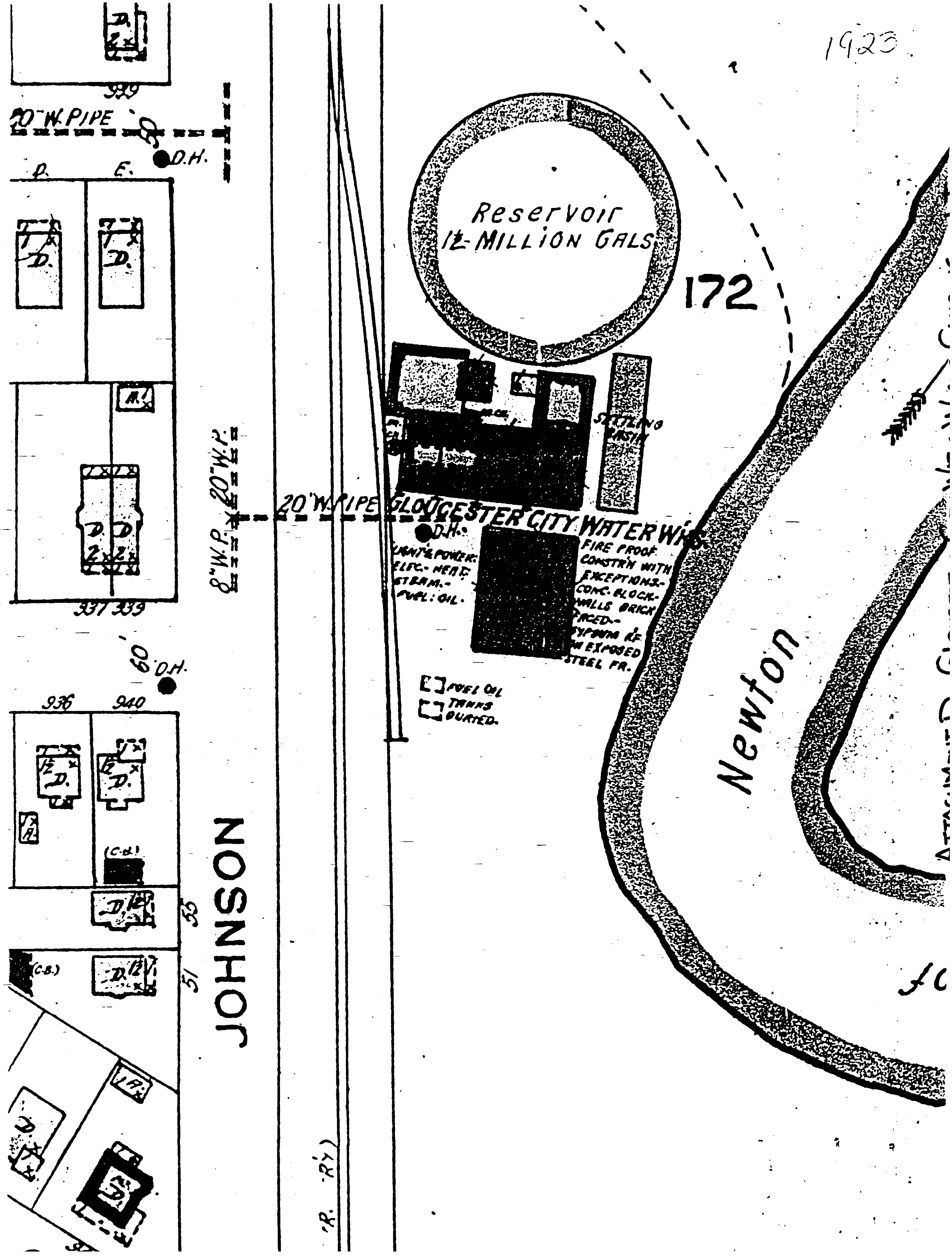
VOLUNTEER.
34 MEN.
1 HOOK & LAD. TRUCK.
3 HOSE REELS.
5000' RUBBER HOSE.
GAMEWELL FIRE ALARM SYSTEM, 8 BOXES.
EACH OF THE 6 LARGE MANUFG RISKS
HAVE FIRE CO. REELS & HOSE.

ATTACHMENT D - GLOUCESTER CITY WATER WORKS, CAMDEN CO., N.J.

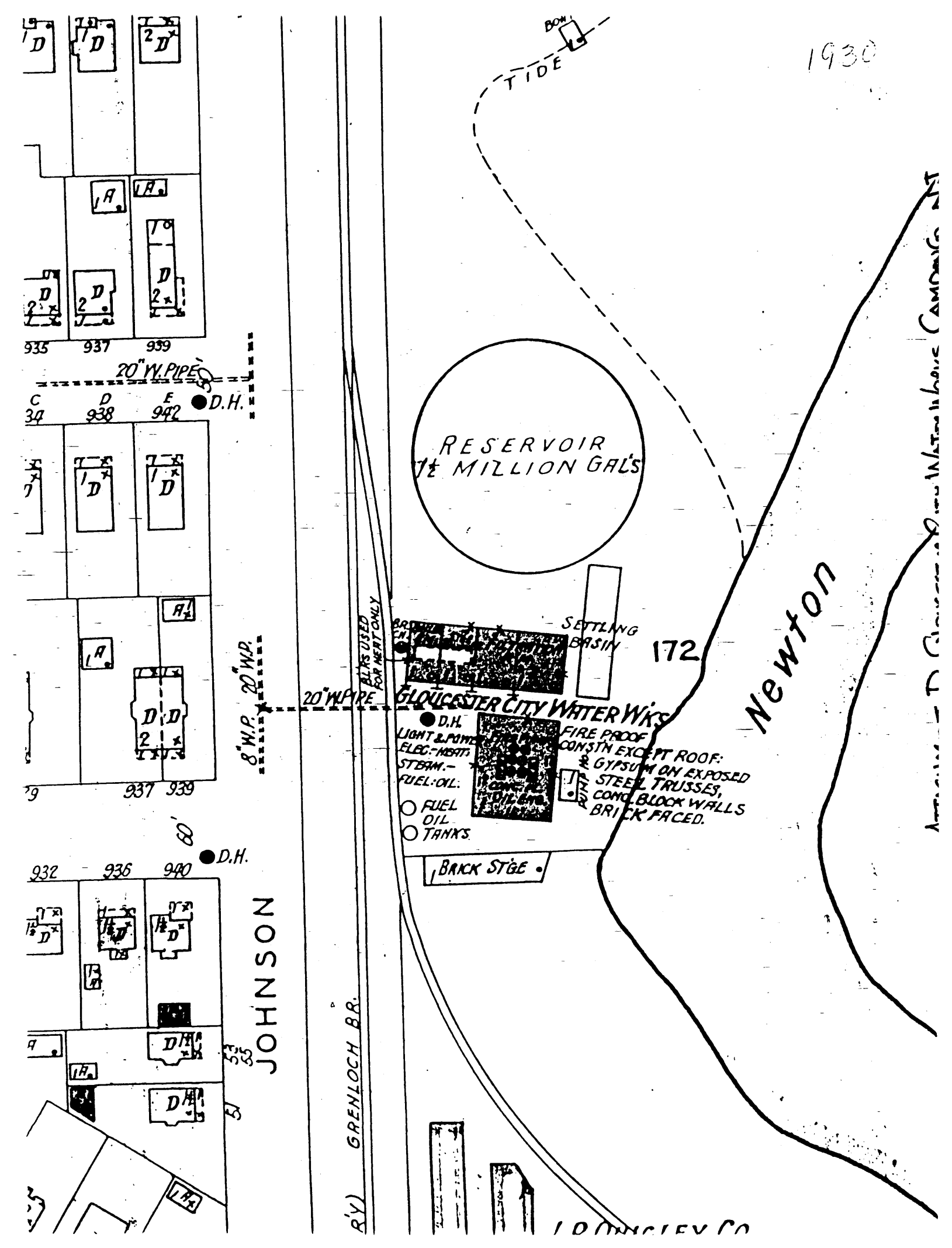

1909
PLATFORM
NO EXPOSURE
RESERVOIR
CAPCY: 5,000.000 GALS.
60'
20" W. PIPE
6" W. PIPE
JOHNSON
CORR. IRON ON WOOD
C
B
A.
CITY WATER WORKS
PUMPING STATION
POWER & HEAT: STEAM-FUEL: COAL-
LIGHTS: ELEC.-3 WETHERILL PUMPS
& 2 UNION IRON WORKS CO. PUMPS-
COMBINED CAPACITY: 12,000,000
GALLONS PER DAY-
Map Division
Newton Creek
D.H.
6" W. PIPE
60'
NO EXPOSURE

1915


Reservoir
CAP'CY. 5,000,000 GALLONS
10" W. PIPE
30" W PIPE
SETTLING TANKS
CITY WATER WORKS
PUMPING STATION
POWER & HEAT; STEAM; FUEL; COAL
LIGHTS: ELECTRIC; WETHERILL
PUMPS & 2 UNION IRON WORKS
PUMPS COMBINED CAPACITY
MILLION GALLONS PER DAY.
NEWTON Creek
NO EXPOSURE



1923
929
20" W. PIPE
D.H.
Reservoir
1½ MILLION GALS
172
SETTLING BASIN
20" W. PIPE
GLOUCESTER CITY WATER WKS.
FIRE PROOF CONSTR'N WITH EXCEPTIONS - CONC. BLOCK WALLS BRICK FACED - GYPSUM RF. ON EXPOSED STEEL FR.
LIGHT & POWER: ELEC. HEAT: STEAM. FUEL: OIL.
20" W.P.
8" W.P.
337 339
60
D.H.
936 940
FUEL OIL TANKS BURIED
Newton
55
51
JOHNSON


1930
TIDE
BOM
RESERVOIR
1½ MILLION GAL'S
SETTLING BASIN
172
Newton
20" W. PIPE
D.H.
8" W.P.
20" W.P.
20" W.P. LINE
GLOUCESTER CITY WATER W'KS
D.H.
LIGHT & POWER
ELEC.-MOTIVE
STEAM.-
FUEL: OIL
FIRE PROOF CONSTN EXCEPT ROOF: & GYPSUM ON EXPOSED STEEL TRUSSES, CONC. BLOCK WALLS BRICK FACED.
FUEL OIL TANKS
BRICK STGE
ALKS USED FOR MEN ONLY
GRENLOCH BR.
JOHNSON
935
937
939
938
942
932
936
940

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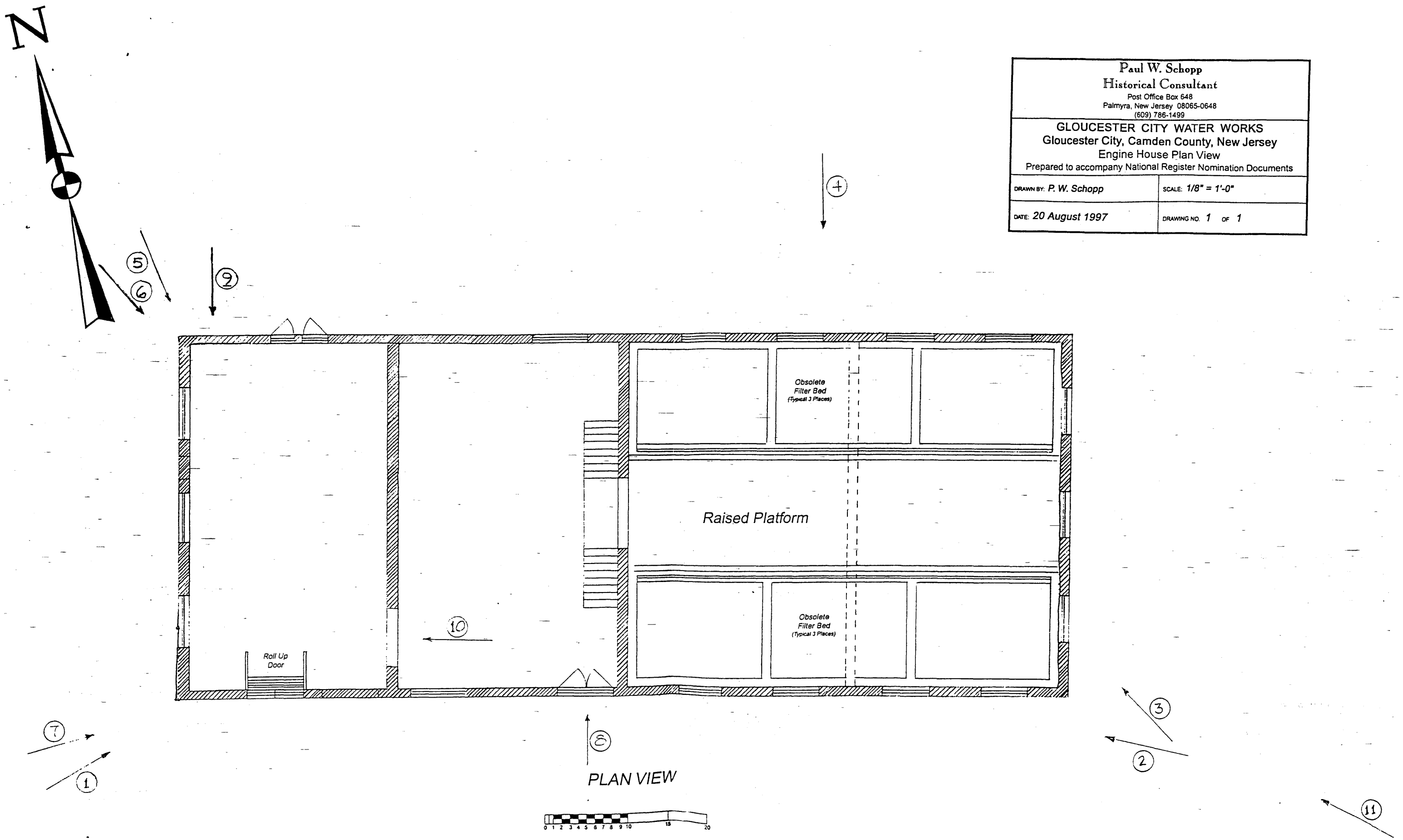
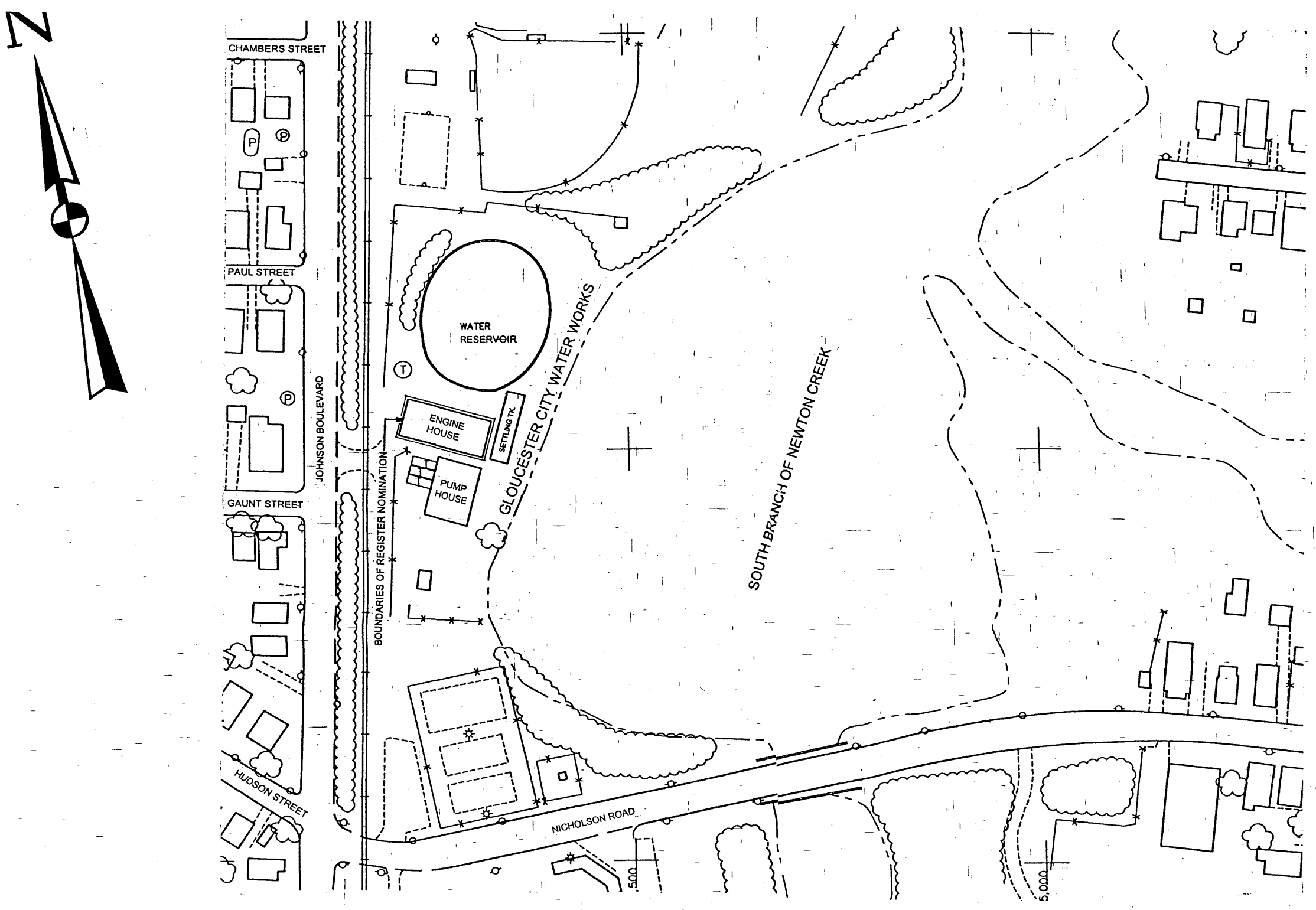
GLOUCESTER CITY WATER WORKS
Gloucester City, Camden County, New Jersey
Engine House Plan View
Prepared to accompany National Register Nomination Documents

DRAWN BY: P. W. Schopp	SCALE: 1/8" = 1'-0"
DATE: 20 August 1997	DRAWING NO. 1 OF 1



PLAN VIEW

PHOTO LOCATION KEY



0 20 40 60 80 100 150 200

SCALE: 1" = 100'

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GLOUCESTER CITY WATER WORKS
Gloucester City, Camden County, New Jersey
Site Plan
Prepared to accompany National Register Nomination Documents

DRAWN BY: *P. W. Schopp*	SCALE: *1" = 100'*
10 September 1997	*1 = 1*