DALECARLIA WATER TREATMENT PLANT
5900 MacArthur Boulevard, N.W.
Washington
District of Columbia

HAER No. DC-54

HAER
DC,
WASH,
691-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

HISTORIC AMERICAN ENGINEERING RECORD

DALECARLIA WATER TREATMENT PLANT HAER No. DC-54

HAER DC, WASH, 691-

Location: 5900 MacArthur Boulevard, N.W.
Washington, D.C.

USGS Washington West, Washington, D.C. Quadrangle
Universal Transverse Mercator Coordinates:
18.316830.4312130
18.316440.4312010
18.316710.4311540
18.316920.4311540

Engineer: Edward D. Hardy

Dates of Construction: 1922 - 1939

Present Owner: U.S. Army Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203-1715

Present Occupant: Baltimore District, U.S. Army Corps of Engineers
Washington Aqueduct Division

Present Use: Water Treatment Plant

Significance: The Dalecarlia Water Treatment Plant is a component of the Washington Aqueduct, a utility operated by the U.S. Army Corps of Engineers that provides water to Washington, D.C., Arlington County, Virginia, and approximately forty square miles of Fairfax County, Virginia. The Dalecarlia Water Treatment Plant has been identified as a contributing element to the National Register-eligible Washington Aqueduct Historic District. The Washington Aqueduct is an operational municipal water supply system important for its association with engineering history. The district documents the technological evolution of potable water systems. The district also is important for its association with architects-engineers Montgomery C. Meigs and Allen Hazen, who were the principal designers of the system.

Project Information: This documentation was undertaken in February 1997 in accordance with a Memorandum of Agreement between the Baltimore District, U.S. Army Corps of Engineers; the District of Columbia Historic Preservation Office; and, the Maryland State Historic Preservation Office. The documentation was prepared to mitigate the demolition of six employee dwellings located at Dalecarlia Water Treatment Plant. The demolition was required for future expansion of the plant.

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Introduction

The focus of this documentation is six single-family dwellings (HABS No. DC-816 through HABS No. DC-820, and HABS No. MD-1104) that originally comprised an employee housing area at the Dalecarlia Water Treatment Plant. The Dalecarlia Water Treatment Plant is part of the Washington Aqueduct, a municipal water system owned and operated by the U.S. Army Corps of Engineers. The following discussion presents an overview of the system and the Dalecarlia Water Treatment Plant to establish a historic context for data on the six dwellings.

Overview of the Washington Aqueduct

The Washington Aqueduct is an extensive linear water system for the collection, purification, and transmission of water. The Washington Aqueduct extends from the intake works at the Great Falls of the Potomac River in Montgomery County, Maryland to the McMillan Reservoir in Washington, D.C. Five operational areas are incorporated in the system: the Dalecarlia Reservoir and Water Treatment Plant, Great Falls Intake, Little Falls Pumping Facility, Georgetown Reservoir, and McMillan Reservoir and Treatment Plant. The Aqueduct's service area includes the District of Columbia, Arlington County, Virginia, and approximately forty square miles of Fairfax County, Virginia.

The Washington Aqueduct was established in 1853 by the U.S. Army Corps of Engineers. Lieutenant Montgomery C. Meigs, a highly influential architect-engineer, designed and supervised the initial construction of the Aqueduct. The Aqueduct was designed as a gravity-fed system. A descent of nine inches every 5,280 feet allowed water to flow through the conduit by gravity.[1] To maintain this constant slope, the conduit required the construction of eleven tunnels, twenty-six culverts, and six bridges. Air vents, waste weirs, gatehouses, a receiving reservoir (Dalecarlia Reservoir), and a distributing reservoir also were built as part of the original system. These support structures were integral elements of the Meigs plan. The system first delivered water to the city of Washington in 1864.[2]

The Aqueduct was expanded several times in response to population increases in the Washington area, to health concerns, and to general technological advances. Subsequent additions to the original system have included a second distributing reservoir; two water filtration plants (including the Dalecarlia Water Treatment Plant) to provide safer and cleaner water; a second conduit (the "new conduit") to increase the water-carrying capacity of the system; new high reservoirs to facilitate the delivery of water to areas of Washington at a higher elevation; and, a supplemental intake facility at Little Falls. Unlike other municipal water systems, however, the original system was not replaced during expansion activities.

Dalecarlia Water Treatment Plant

Location and Description

The Dalecarlia complex is located along MacArthur Boulevard, straddling the border between the District of Columbia and Montgomery County, Maryland. The Dalecarlia property consists of approximately

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[1] A. M. Miller, *Filtering Water Supply of Washington, D.C.*, Senate Doc. No. 259 (Washington, D.C.: U.S. Government Printing Office, 1900).

[2] U.S. Army Corps of Engineers, Washington District, *History of the Washington Aqueduct* (Washington, D.C.: U.S. Army Corps of Engineers, 1953), 36.

277 acres and includes the Dalecarlia Reservoir basin that receives water from the intakes at Great Falls or Little Falls; a water treatment plant; two underground water storage reservoirs; an administration building; a pump station; and, a maintenance building. Buildings, structures and engineering features located at Dalecarlia account for approximately 30 percent of the resources of the Washington Aqueduct.

Establishment of the Dalecarlia Reservoir

The reservoir basin was the first feature constructed at Dalecarlia. The reservoir was created between 1854 and 1858 by damming Powder Mill Creek. Meigs designed the structure as the Receiving Reservoir for the Aqueduct. The Receiving Reservoir existed to serve as a settling area or tank where excess sediments in the Potomac water could settle before the water continued on into the distribution system.[3] Little Falls Branch and East Creek also fed the reservoir. The Receiving Reservoir was first officially referred to as the "Dalecarlia Reservoir" in 1893.

In 1858, three structures were built at the Receiving Reservoir to regulate its water level. The first structure constructed was a stone octagonal sluice tower. Gates within the tower wall could be opened by the reservoir gatekeeper by manipulating valve mechanisms located within the tower; these enabled the gatekeeper to accelerate emptying of the reservoir for maintenance purposes, and provided an additional emergency release during high water. Influent and effluent gatehouses were added shortly thereafter. By 1859, the system between Dalecarlia and the city of Washington was placed in operation.

In 1875, a substantial brick dwelling was constructed to house the reservoir's gatekeeper, who had lived in a deteriorating frame structure located within the Aqueduct property prior to the completion of the brick dwelling. This is one of three caretaker residences constructed by the Aqueduct between 1874 and 1875. These three dwellings were built according to the same plan but using different materials. These residences exemplify the Army's early usage of standardized plans as a means of controlling costs and establishing consistent construction standards.[4] The dwelling, which currently is abandoned, is situated on a hill overlooking the reservoir.

Between 1864 and 1867, a by-conduit was constructed around the reservoir basin to allow water to bypass the Receiving Reservoir and flow directly to the Distributing Reservoir if the water in the reservoir were more turbid than the water arriving directly from the river.[5] Concern over water quality led to the exclusive use of this by-conduit and the abandonment of the Receiving Reservoir in 1888. To alleviate concerns over pollution, a system of open channels was established between 1894 and 1895 to divert the tributaries of Powder Mill Creek around the reservoir. Once the diversion channels were completed, the reservoir was reintegrated into the Aqueduct system. Colonel George H. Elliott, Chief Engineer of the Aqueduct between 1889 and 1895, designed the diversion system and oversaw its construction.[6]

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[3] Robert J. Hellman, *The Corps of Engineers U.S. Army and the Water Supply of Washington, D.C.* (U.S. Army Corps of Engineers, Historic Division, 1983), 28.

[4] Deborah Cannan et al., *National Historic Context for Department of Defense Installations, 1790-1940*, Legacy Demonstration Project No. 75 (U.S. Army Corps of Engineers, Baltimore District, 1995), 440.

[5] Hellman, *The Corps of Engineers*, 49.

[6] Hellman, *The Corps of Engineers*, 67-68.

Construction of the Dalecarlia Water Treatment Plant

The most ambitious expansion of the Washington Aqueduct occurred during the 1920s. The demand for water rose dramatically due to the population increase in Washington after World War I. To meet the increased demand, plans were developed to expand the Aqueduct. Part of the expansion plans was the construction of a water filtration facility at Dalecarlia.

The new Dalecarlia water filtration facility was designed as a rapid sand filtration system. Rapid sand filtration processed raw water at about fifty times the rate of a slow sand filter due to the use of a coarser sand in the filter. Though much faster than the slow sand method, the rapid sand filtration method alone did not produce a pure water supply. Therefore, aluminum sulfate was used as a coagulant to clarify the water before it passed through the sand filter. By mid-century, the preferred method of water filtration combined processes of chemical coagulation of impurities and rapid sand filtration. This method was faster than a slow sand filtration system, required less acreage, and the chemical additives proved to be harmless.[7] A filter building (now the East Filter Building) was constructed in 1928 to house twenty rapid sand filters.

One of the primary buildings constructed at the Dalecarlia filtration facility was the chemical building, or filtration "head house." Constructed in 1928, the two-story brick building features a five-story tower at the north end. Alum, bauxite, lime, and other dry chemicals were stored in the tower and mixed into the water below. Chemicals originally were added to the Aqueduct water supply to assist the coagulation process (alum), to kill bacteria, and to maintain a constant pH level.[8] Located in the basement of the chemical building was the central heating plant for the Dalecarlia complex west of MacArthur Boulevard. Monroe H. Blake designed the building.

Construction at Dalecarlia also included two sedimentation basins (Basins 1 and 2); chemical mixing basins; a laboratory for chemical and microbiological analyses; a chemical storage building; a fifteen-million gallon treated water storage reservoir (clearwell); and, a pump station. The pump station at Dalecarlia transported treated water to the high service reservoirs.[9] One of the reasons for constructing the Dalecarlia filter plant was to supply filtered water to the high areas of D.C. where pumping was necessary for water delivery.[10] Edward D. Hardy was the principal engineer and designer of the Dalecarlia Filtration Plant.

In 1927, six brick dwellings also were constructed at Dalecarlia (HABS No. DC-816 through HABS No. DC-820, and HABS No. MD-1104). The houses formed a row between the new filtration plant and the

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7 Katherine Grandine and Deborah K. Cannan, *Support and Utility Structures and Facilities (1917-1946) Overview, Inventory, and Treatment Plan* (Norfolk, Virginia: Department of the Navy, Atlantic Division - Naval Facilities Engineering Command, 1995), 193-195.

8 Harry C. Ways, *A History of the Washington Aqueduct* (Washington, D.C.: Washington Aqueduct, Dalecarlia headquarters, 1993), 161.

9 Ways, *Washington Aqueduct*, 161.

10 U.S. Army Corps of Engineers, *Annual Report of the Chief Engineer of the Washington Aqueduct* (Washington, D.C.: U.S. Army Corps of Engineers, Washington Aqueduct Division, Dalecarlia headquarters, 1926), 1922.

Potomac River, and were intended to house essential plant employees.[11] Like the gatekeeper residence built at Dalecarlia in 1875, these dwellings were examples of Army standardized plans. Similar standardized plans were utilized by the Army during the 1920s and 1930s in the construction of permanent officer quarters at Army installations throughout much of the country.[12] Like most of the structures built at Dalecarlia, the two-story houses were built in the Colonial Revival style.

A hydroelectric generating station was another 1920s addition to the Aqueduct. This structure, built below the Dalecarlia facility along the C&O Canal, was designed to generate energy to operate the treatment and pumping facilities at Dalecarlia. During the late 1940s, the station was converted to a raw water pump station to draw water from the C&O Canal. This change was one of several made to the water system to service the increased Washington population. The plant remained in operation until the late 1960s; the building was vacant in the mid-1990s.[13]

In 1926, due to the increased storage and treatment capacity of the Washington Aqueduct system, Congress approved the sale of water to Arlington County, Virginia. A twenty-four-inch water main was built from Dalecarlia across the Chain Bridge to connect with the Arlington system.[14]

After 1928, Dalecarlia Reservoir fed both the Distributing Reservoir and the Dalecarlia Filtration Plant. Water filtered at Dalecarlia was pumped to new underground storage reservoirs established at three high points in northern Washington.

During the 1930s, additional improvements were made to the Dalecarlia complex. In 1935 an influent bay to Dalecarlia Reservoir, known as the forebay, was constructed and enclosed with an earthen dam. A booster pump station was placed on the dam. Aqueduct engineers incorporated these changes to increase water volume by maintaining the forebay at 141 feet above sea level while filling Dalecarlia Reservoir to a higher level.[15] Greater volume of water within the Dalecarlia Reservoir increased water volume throughout the gravity driven portions of the Aqueduct system.

Contemporary Improvements

The Dalecarlia filtration plant was expanded slowly during the 1950s and 1960s to accommodate a projected population increase within the plant's service area. During the 1950s, a variety of projects were implemented at Dalecarlia. These included the construction of a third flocculation-sedimentation basin (Basin 4), a thirty-million gallon underground clearwell, and a new pumping station. The new pumping station supplanted the original pumping station that had pumped all treated water from Dalecarlia since 1928.

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[11] Ways, *Washington Aqueduct*, 159-161.

[12] Cannan et al., *National Historic Context*, 441-442.

[13] Ways, *Washington Aqueduct*, 162.

[14] Ways, *Washington Aqueduct*, 163.

[15] Ways, *Washington Aqueduct*, 165.

The 1960s brought another wave of construction at Dalecarlia with the addition of Flocculation-Sedimentation Basin 3, a new chemical building, and a second filter building (the West Filter Building). The chemical building, which stores and dispenses alum, chlorine, lime, fluoride, and sulfur dioxide, replaced the head house; in 1968, the head house was converted to an administration building. The new filter building added twenty-two new rapid sand filter beds to the system.[16]

Overview of the Current System Operation

Water from the Potomac River enters the Aqueduct at the intakes located at Great Falls. The water is conducted by gravity through two parallel conduits, connected in a series by three cross connections, to Dalecarlia Reservoir or Georgetown Reservoir. Raw water also can enter the Aqueduct at Little Falls; this water is pumped through a separate conduit to Dalecarlia Reservoir. Water from Great Falls enters Dalecarlia Reservoir via the forebay, which is at a lower elevation. Water from the forebay is pumped up to the reservoir by a booster pump station. The water settles in the reservoir for less than twenty-four hours.

From Dalecarlia Reservoir, the water follows two distinct distribution paths. The older path consists of a conduit leading from the reservoir along MacArthur Boulevard, paralleling the Potomac River, to a second reservoir. This second reservoir is in Georgetown, approximately three miles southeast of Dalecarlia Reservoir.

In the second distribution path, water flows from Dalecarlia Reservoir to the Dalecarlia Filtration and Treatment Plant, immediately south of the reservoir. After the settlement period, the water is transmitted from the reservoir to a screen building that removes large debris (e.g., leaves, twigs). Flumes carry the water from the screen building to the chemical building, where the first dose of chemicals are added; these include alum and polymer. From the chemical building, underground ducts transport the water to one of four sedimentation basins. Solids are settled out within the six to eight hours the water remains in the basins. The water returns indoors to one of two filter buildings that are operated in parallel. The filtered water returns to the chemical building for its second, and final chemical dosages. During this pass, chlorine, fluoride, and lime for pH adjustment are added.

After treatment, the water is stored first in a fifteen-million gallon clearwell, and then a thirty-million gallon clearwell. These underground reservoirs store the water until it is pumped through the new pumping station out into distribution. Distribution pipes lead to four locations: a First High Reservoir located on Foxhall Road in Georgetown; the Second and Third high reservoirs in Washington, D.C.; and to Northern Virginia, including Vienna, Falls Church, Arlington, and part of northeastern Fairfax County. The treated water is tested periodically to ensure that the water meets the standards of quality established by the Environmental Protection Agency.[17]

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16 Ways, *Washington Aqueduct*, 185.

17 U.S. Army Corps of Engineers, Baltimore District, *Washington Aqueduct Division* (U.S. Army Corps of Engineers, Washington, D.C., 1991), 4-5.

SOURCES OF INFORMATION

A. Engineering Drawings:

Drawings in the collection of the Washington Aqueduct Drawing Files, Dalecarlia Reservoir, Washington, D.C. Photographs, plans, construction drawings, and reports, n.d.

B. Historic Views: None

C. Interviews:
Patty Gamby, Environmental Engineer at Washington Aqueduct, Dalecarlia reservation, Planning and Engineering Branch. Interviewed at Dalecarlia on 19 February 1997.

D. Bibliography:

1. Primary and unpublished sources:

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2. Secondary and published sources

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Grandine, Katherine, and Deborah K. Cannan. *Support and Utility Structures and Facilities (1917-1946) Overview, Inventory, and Treatment Plan*. Prepared by R. Christopher Goodwin & Associates, Inc. for Department of the Navy, Atlantic Division - Naval Facilities Engineering Command, Norfolk, Virginia, 1995.

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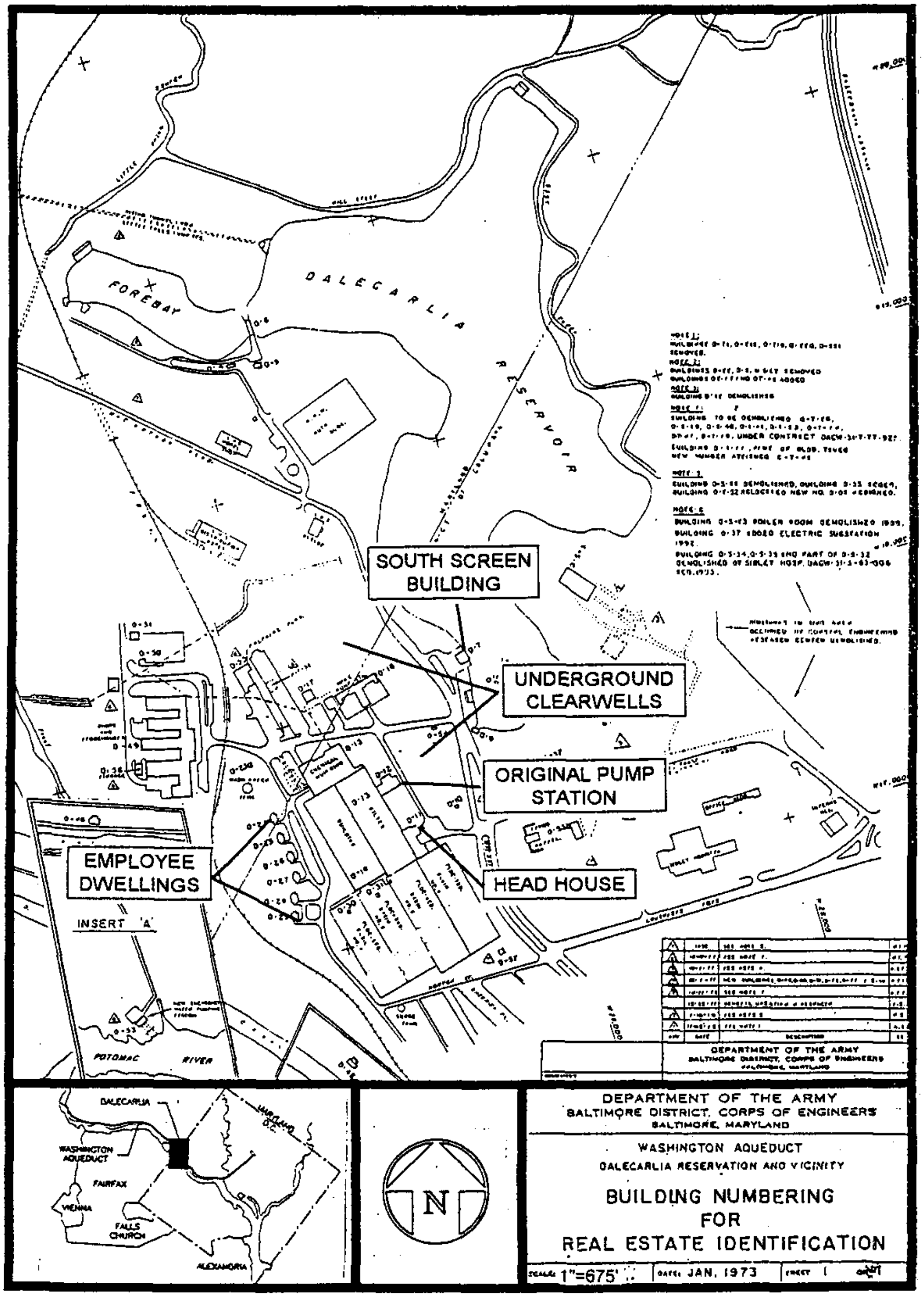
R. Christopher Goodwin & Associates, Inc. *Washington Aqueduct Architectural Survey, District of Columbia and Montgomery County, Maryland.* Draft. Prepared for U.S. Army Corps of Engineers, Baltimore District, 1995.

E. Likely Sources not yet Investigated: None known to date.


FOREBAY
DALECARLIA RESERVOIR
SOUTH SCREEN BUILDING
UNDERGROUND CLEARWELLS
ORIGINAL PUMP STATION
EMPLOYEE DWELLINGS
HEAD HOUSE
INSERT 'A'
POTOMAC RIVER
DALECARLIA
WASHINGTON AQUEDUCT
MARYLAND
D.C.
FAIRFAX
VIENNA
FALLS CHURCH
ALEXANDRIA
N
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
BALTIMORE, MARYLAND
WASHINGTON AQUEDUCT
DALECARLIA RESERVATION AND VICINITY
BUILDING NUMBERING
FOR
REAL ESTATE IDENTIFICATION
SCALE: 1"=675'
DATE: JAN. 1973
SHEET 1