FLINTVILLE BRIDGE
(Maryland Bridge 12052)
Flintville Road (Maryland Route 623)
over Broad Creek
Castleton Vicinity
Harford County
Maryland

HAER No. MD-125

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

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HISTORIC AMERICAN ENGINEERING RECORD

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(Maryland Bridge 12052)

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LOCATION: Flintville Road (Maryland Route 623) over Broad Creek, Castleton Vicinity, Harford County, Maryland

USGS Conowingo Dam, Maryland-Pennsylvania Quad
UTM Coordinates: 16:393330:4394550

DATE OF CONSTRUCTION: 1909, 1927

ENGINEER: Stone and Webster, Inc., New York, New York

CONTRACTOR: American Bridge Company, Pittsburgh, Pennsylvania

BUILDER: Philadelphia Electric Power Company

PRESENT OWNER: Maryland Department of Transportation

PRESENT USE: Highway bridge

SIGNIFICANCE: Flintville Bridge is a representative example of an early twentieth-century riveted steel Pratt-type through-truss bridge with plate girder deck approach spans. It replaced a covered bridge inundated by the construction of the Conowingo Dam across the Susquehanna River in 1927. The two truss spans of the Flintville Bridge were salvaged from the former Conowingo Bridge, built in 1909 (U.S. Route 1) across the Susquehanna, prior to its inundation. Route 1 was relocated to run across the top of the dam.

PROJECT INFORMATION: Flintville Bridge was recorded in February 1998 by the Cultural Resource Group of Louis Berger & Associates, Inc. (Berger), Richmond, Virginia. The documentation, prepared for the Maryland State Highway Administration, was undertaken in accordance with a Memorandum of Agreement between the Maryland State Historic Preservation Officer and the Federal Highway Administration, and was accepted by the Advisory Council on Historic Preservation. The written documentation was prepared by Richard M. Casella, Senior Architectural Historian at Berger. Rob Tucher of Berger served as Project Photographer.

DESCRIPTION

Flintville Bridge (Maryland Bridge 12052) is a four-span structure with two 40'-9" deck-girder approach spans and two 138'-8" riveted steel Pratt-type through-truss spans. The bridge is 366' in length overall, and carries two lanes of Flintville Road (Maryland Route 623) in a northwest-southeast direction over Broad Creek approximatcly one mile west of the mouth of the creek on the Susquehanna River. The bridge is set in a ravine formed by the creek between rolling hills that rise over one hundred feet. Seasonal cottages cling to the hillsides above the creek, which, due to the impoundment of water behind Conowingo Dam, resembles a pond.

The bridge spans are supported approximately 10' above the water level on three open, reinforced concrete piers, and by straight, reinforced concrete abutments. The bridge is 21'-6" wide overall at the trusses, 19'2" wide at the approach spans, and has an 18'-wide roadway between the curbs.

The trusses are of the Pratt type, with parallel chords, posts in compression, and diagonals in tension. All members of the bridge are steel, with riveted connections. The trusses are 25' in height overall and are divided into eight panels, each 17'-4" wide. End posts and top chord members consist of back-to-back 10" channels spaced 16" apart and joined with a ⅝" cover plate on the top and single lacing bars on the bottom. Bottom chord members consist of two 6" by 6" angles joined back to back with batten plates, except at the two center panels, which utilize 6" by 8" angles.

The vertical members (posts) are built-up I-sections consisting of four 5" by 3" angles joined with lattice bar webs, except for the hip verticals, which are constructed with 3½" by 2½" angles. Diagonal members are two angles joined back to back with batten plates. The angles at panels 2 and 7 measure 6" by 4", the angles at panels 3 and 6 measure 5" by 3½", and the angles at panels 4 and 5 measure 3" by 2½".

The portal struts are double-intersecting truss girders constructed with angles. Upper lateral struts are built-up I-sections consisting of four 3" by 2½" angles joined with lattice bars. The lateral struts are sway braced with two 3" by 2½" angles back to back. Upper and lower lateral cross-bracing members are 3" by 2½" angles.

The deck-girder spans are identical and consist of two riveted plate girders, 42" deep with flanges of 6" by 4" angles and no cover plates. The floor system for all spans is the same: 24" rolled I-shape deck beams are spaced 13'-7" apart and carry 15" rolled I-beam stringers spaced 4'-6" apart. The deck is reinforced concrete, with an asphalt riding surface and concrete curbs.

The bridge railings are simply two rows of 2" angles, one row set at a height of 18" and the other at a height of 36", supported by 2" angle posts or directly welded to truss members. The bridge was

never equipped with lighting. The bridge remains as originally built with the exception of the bearings, which were replaced in 1988.

HISTORICAL BACKGROUND

Background

The northeast corner of Harford County in the vicinity of Flintville Bridge, bordered on the east by the Susquehanna River and on the north by Pennsylvania, remained sparsely settled through the first half of the nineteenth century. Completion of the Susquehanna and Tidewater Canal in 1839 along the west bank of the Susquehanna River from Wrightsville, Pennsylvania, through Harford County to Havre de Grace was an important stimulus to the further economic development of the areas along its route. The canal passed approximately one mile east of the bridge site and was the impetus for the development of Flintville and the construction of the original Flintville Bridge. The canal was 45 miles long, 15 to 20 feet wide, and utilized 29 locks to overcome 1,000 feet of elevation change. The canal's primary purpose was for the transport of timber, grain, and Pennsylvania coal to the fast-growing city of Baltimore. The remaining forests of Harford County were soon cleared, sawn into timber at mills along the creeks that fed the Susquehanna, and sent down the canal. Farms sprang up on the cleared land and grain replaced timber as the county's primary export (Wright 1967:121).

Roads were built along the creeks leading from mills down to the canal. Construction of the canal included the building of small dams and aqueducts across the mouths of the larger creeks which crossed the canal and emptied into the Susquehanna. The dams allowed the regulation of floods, provided additional water for the operation of the canal locks, and formed basins for the landing and loading of canal boats. On Deer Creek the impounded water allowed canal boats to ascend as far as Stafford, where forges and iron mills received ore and shipped iron products. Large grain elevators were also built at Stafford to service the canal trade (Jennings and Herrick 1858; Wright 1967:125).

The close proximity of cheap transportation afforded by the canal appears to have provided a major incentive for the development of the flint mining industry in eastern Harford County. Outcrops of flint occurred in the vicinity of Bald Hill and extended northwest along Broad Creek and southeast to Castleton. The Allen (or Stafford) Flint Mill was in business by 1850, mining flint at Bald Hill and transporting it down the canal and up Deer Creek to Stafford for processing (Wright 1967:158).

Flint is a hard white quartz, best known for its fracturing and sparking characteristics but also used in the manufacture of porcelain, sandpaper, grindstones, glass, and other materials. The rock was mined with hammer and drill and transported by mule to a flint mill where it was further broken up, softened in furnaces, and reduced to powder by waterpowered grinding wheels. The flint powder

was then bagged and shipped, the majority of Harford's production going to porcelain manufacturers in the Trenton, New Jersey, area (Wright 1967:157).

Between 1858 and 1865 the flint industry expanded along Broad Creek with the establishment of the Whiteford Flint Company and the Trenton Flint and Spar Company, located on either side of the present Flintville Bridge. Broad Creek offered readily accessible flint deposits along its ravine, plus a waterpower source and a direct route to the canal. Initially the processed flint was probably transported by mule down the creek to the canal and loaded on barges at the Broad Creek lock located a few hundred yards downstream from the mouth. Plat maps from 1865 show that by that time a dam had been constructed across Broad Creek approximately 1,000' upstream from its mouth. Several hundred feet up the canal from the Broad Creek aqueduct was a branch canal which ran along the north side of the creek, connecting the dam pond with the main canal. A lock at the dam provided barges with a water route up the creek to the flint mills. It is thought that the dam and lock were built by one or both of the flint companies rather than the canal company (*Harford Historical Bulletin* 1993:159-160; Jennings and Herrick 1858).

By 1878 two roads had been built to the flint mills on Broad Creek. A north-south road (present-day Flintville Road) connected the mills with Castleton and crossed the creek, either by bridge or ford, approximately 150' downstream from the present bridge. Mill Road closely followed Broad Creek several miles upstream from its mouth and probably doubled as a canal boat towpath between the mills and the dam (Martenet 1878).

Canal business declined sharply during the latter part of the nineteenth century due to competition from the railroads. The flood of 1889, famous for its destruction of Johnstown, Pennsylvania, caused extensive damage to the canal. In 1894 another flood damaged portions of the canal beyond repair, resulting in the closing of the upper portion of the canal, from Peach Bottom north. The following year the company was foreclosed and its properties sold to the Susquehanna Water Power and Paper Company. The Harford County section continued in operation into the early years of the twentieth century, apparently supported in large part by the flint industry. Unfortunately, the Harford flint mining operations, like other small-scale mining operations dependent on manual labor, succumbed to large competitors equipped with machinery and direct rail service. The Flintville operations closed up shop along with the canal, and by 1920 the last of the Harford County flint mills were out of business (Wright 1967:158).

The 1902 Maryland Geological Survey map appears to be the first map to refer to the area where the road crosses the creek at Flintville. The map depicts a bridge carrying Flintville Road over Broad Creek, and it is known from original plans for the present bridge that the structure was a covered wooden bridge. Between 1825 and 1875 numerous covered wooden bridges were built by the county over many of the streams, and in 1900 over 29 were still in use. It is probable that the Flintville covered bridge was built in the late 1860s or the 1870s, along with or shortly after the

successful establishment of the flint industry in the area (Maryland Geological Survey 1902; Philadelphia Electric Power Company 1927; Wright 1967:113).

History of the Bridge

The present Flintville Bridge was built by the Philadelphia Electric Power Company in 1927 using two trusses salvaged from another bridge that had been built in 1909. The present bridge was part of the power company's Conowingo Dam hydroelectric project, built between 1926 and 1928 across the Susquehanna River from Conowingo, Maryland, in Cecil County, to a point in Harford County approximately four miles downstream from the mouth of Broad Creek. The dam, which is still owned and operated by Philadelphia Electric, is 4,648 feet in length and 105 feet high. The backwater or lake created by the dam is 14 miles long, with an average width of one mile. The entire village of Conowingo, the vestiges of the Susquehanna and Tidewater canal, and many buildings, roads, and bridges on both sides of the river were inundated. Anything that could reasonably be moved to higher ground was moved. The moving of 16 miles of the Pennsylvania Railroad to higher ground along the east side of the river was an immense project in its own right, requiring the blasting of large volumes of rock and the construction of bridges and tunnels. Roads and bridges, including the historic Baltimore Pike (U.S. Route 1), were rerouted or raised up in accordance with agreements between Philadelphia Electric and the respective county and state highway departments (*Aegis* 1926:1; Rincliffe 1953:12-13).

The areas that would be inundated were determined well in advance by the engineers, and the work of road and bridge relocation coincided with construction of the dam to ensure its completion before flooding began. It was calculated that the lake created by the dam would extend up Broad Creek well beyond Flintville, raising the level of the creek at the bridge 18.5 feet. Although Broad Creek was in a deep, relatively narrow ravine which helped limit the width of the flooded creek, the expanse of water to be bridged increased from 80 feet to 345 feet. The plan called for a new bridge to be built on tall piers 150 feet upstream from the existing covered bridge, and for the realignment of approximately 700 feet of Flintville Road (Philadelphia Electric Power Company 1927).

Talk about damming the Susquehanna and plans to dam it for various purposes date back to the eighteenth century, but it was the advent of hydroelectric power that stimulated the most serious efforts. The Susquehanna Water Power and Paper Company was granted authority by the Maryland legislature in 1884 to build a dam across the Susquehanna for water power and to acquire, with rights of condemnation, any property required for its construction, including property to be flooded by the backwater of the dam. Numerous other companies were also formed for the purpose of developing the river in the vicinity of Conowingo and were granted various rights. Ambitious plans were put forth, but because there was not an immediate market for the power, financing remained out of reach. Gradually, over the years, the competing companies were sold or were purchased by one another and consolidated until they all came under the single ownership of the Susquehanna Power Company

in the early twentieth century. With all of the pieces pulled together, the Susquehanna Power Company developed plans for a dam to be financed by French capitalists. This effort fell through in 1914 when the French withdrew due to the onset of the First World War (Aegis 1926:1; Rincliffe 1953:12-13).

By 1922, the Philadelphia Electric Power Company possessed the market and the infrastructure to undertake the dam project and in that year acquired an option on the rights and properties of the Susquehanna Power Company. Following years of planning, permitting, and arrangements for financing, in early 1926 the deal was finally consummated, and construction began in March (Rincliffe 1953:16).

The engineering and construction firm of Stone and Webster was the primary contractor. The American Bridge Company, a division of United States Steel and the largest bridge building company in the world, was subcontracted to move or replace, as the case required, bridges within the project area. The decision to locate the dam just below the Conowingo Bridge, which carried the Baltimore Pike over the river, required the re-routing of the highway and demolition of the bridge. The new river crossing for the highway would be located across the top of the dam (Philadelphia Electric Power Company n.d:13).

The original Conowingo Bridge, which dates to about 1820, was carried away by a flood in 1846 and was not replaced until 1859. As the only bridge over the lower Susquehanna during the Civil War, it played a strategic role in the war and was the site of numerous skirmishes. In 1907 a fire destroyed several spans of the bridge, and in 1909 a replacement steel truss structure was opened. The state purchased the bridge in 1911 for $73,000 and removed the tolls (*Aegis* 1927a:1; Wright 1967:113).

In the course of planning their work for the dam project, Stone and Webster and American Bridge engineers determined that several spans of the Conowingo Bridge would be suitable for reuse in the replacement of bridges that would be inundated. Two spans would be used to carry Flintville Road over Broad Creek, one span would be used on a road in Cecil County, and the remaining spans would be demolished. In the case of the Flintville Bridge, the design was planned around the two 140-foot trusses as the primary spans, with a single deck-girder approach span at each end (Philadelphia Electric Power Co. 1927; Stark 1998).

Detailed records or accounts of the construction of the Flintville Bridge were not located in the course of this research. According to Augustus Little and Austin Rowan, two local residents who have lived near the bridge all their lives, construction of the abutments, approaches, and piers for the new Flintville Bridge began in the early summer of 1927. This information coincides with the date of the signatures on the site plan of May 26, 1927. Mr. Rowan, age 90, recalls that a "state highway inspector camped out" at the bridge site for the duration of the construction, living in a cave with a

canvas tarp across the opening. The area had been so infested with copperheads when it was mined for flint, that every morning the miners had to clear their work area of the snakes before commencing work. Mr. Rowan warned the inspector of the possibility of strange bedfellows, but he continued to use the cave (Little and Rowan 1998).

As construction of the dam progressed through 1927, the water level was gradually raised behind it. By November the water depth had climbed up the face of the dam nearly 40 feet, which would have been sufficient to float a barge up Broad Creek to the bridge location. Field splices on the top and bottom chords of the Flintville Bridge trusses indicate that each truss was cut into three roughly equal sections and then moved to the site. It was common practice to float a barge under the bridge to be moved, build up to the bridge with cribbing, and then lift the bridge off its foundations by jacking. On November 15, 1927, the new Route 1 highway across the top of the dam was opened to traffic and the Conowingo Bridge was closed. During the next two weeks, the truss sections to be reused for the Flintville Bridge were apparently removed. On November 28, the remaining sections of the Conowingo Bridge were dynamited and allowed to settle to the river bottom, where they remain submerged today along with the stone piers (*Aegis* 1927a:1, 1927b:1).

Over the years following the construction of the dam, the area around Flintville Bridge was gradually developed with small seasonal cottages built along the steep banks of Broad Creek. The cottages were built on leased land which is still owned by the Susquehanna Power Company, a subsidiary of PECO Energy Company. Flintville Road remained a quiet dirt road until 1949, when it became a state road and was improved and paved. With the construction of the Peach Bottom Nuclear Power Plant in the 1960s, the road came to be heavily used by construction workers, and it remains well traveled today by the plant's operators and the growing suburban population in the area. In 1995, an engineering study determined that the Flintville Bridge was unsafe and could not be practically rehabilitated (Greiner 1995; Little and Rowan 1998).

American Bridge Company

The American Bridge Company has been the largest and most important bridge building company in the world during the twentieth century, having fabricated and erected the steel for a major portion of the world's greatest bridges and tallest buildings (Fisher 1951:181). The American Bridge Company was incorporated in 1900 by J.P. Morgan as a consolidation of 28 bridge companies, representing 80 percent of the structural steel fabricating capacity of the United States. The following year Morgan folded ownership of the American Bridge Company into his newly formed United States Steel Corporation in the form of a subsidiary. Four other bridge companies were purchased and added to the subsidiary over the years, including the Toledo Bridge Company (1901), the Detroit Bridge and Iron Company (1902), the Koken Iron Works of St. Louis (1912), and the Virginia Bridge and Iron Company of Roanoke (1936).

In 1902, American Bridge built a new plant outside Pittsburgh on the Ohio River. It was the largest plant of its kind in the world, with a structural steel capacity of 20,000 tons per month. The new town of Ambridge formed around the plant, and in 1904 corporate headquarters was moved there from New York. In 1909, to meet the ever-increasing demand for their bridges, a new 90-acre fabrication plant was built at Gary, Indiana. By 1927, when American Bridge was hired to construct bridges for the Conowingo Dam project, U.S. Steel had become the largest company in the world, with assets of nearly $2.5 billion (Chase 1927:1; *Engineering News* 1902:527-528; Talbot 1975:7).

Thomas Pratt and the Pratt Truss

Thomas Pratt, famous for the bridge truss he designed in 1842, was born in Boston in 1812. He entered Rensselaer Polytechnic Institute at age 14, became an engineer with the United States Army Engineers at age 18, and began a professional engineering career with Boston & Maine Railroad at age 21. Pratt worked his entire life in the employ of various New England railroad companies (American Society of Civil Engineers [ASCE] 1876:332-333; Condit 1960:108).

Pratt's bridge truss consisted of two parallel chords connected by vertical wood posts in compression and double wrought-iron diagonals in tension. Pratt's design was similar in appearance to an earlier truss patented by William Howe, but was structurally opposite in function. The Howe design put the verticals in tension and the diagonals in compression. The Pratt truss is considered to be the first scientifically designed truss, incorporating what are now seen as basic structural engineering principles (Condit 1960:109). Pratt used shorter compression members, allowing members of smaller cross section to be used without sacrificing overall strength. This innovation provided a lighter truss requiring less material, yet offered greater span and load-bearing capability than the other truss designs of the time.

In 1844, Pratt was granted a patent for two truss designs, one with parallel chords and one with a polygonal top chord. The polygonal version reflected Pratt's understanding of the application of mathematical principles in calculating the forces involved and the precise strength of material required to counter those forces. Pratt's patent was renewed in 1858. The use of the Pratt truss for the deck of John Roebling's Niagara River Suspension Bridge in 1855 drew worldwide attention to the design and undoubtedly contributed to its increased use. By 1889 the truss in its iron form ranked first in usage for railroad bridges. Thousands of bridges, both highway and railroad, have been built following the Pratt design or some variation (ASCE 1876:334-335; Condit 1960:111, 112, 302; Cooper 1889:11).

BIBLIOGRAPHY

Aegis (Bel Air, Maryland, newspaper)
1926 Permits Approved for Conowingo Dam. *Aegis*, January 15, p.1.

1927a History's Page Turns Tuesday. Conowingo, Century Old Crossing, Closes. *Aegis*, November 11, p.1.

1927b Old Conowingo Bridge Blasted Into River. *Aegis*, December 2, p.1.

American Society of Civil Engineers [ASCE]
1876 Memoir of Thomas Willis Pratt. *Proceedings of the American Society of Civil Engineers*, vol. 1, 1873-1875, pp. 332-335.

Chase, Stuart
1927 Ten Companies Reach the Billion Dollar Mark. *The New York Times,* March 27, sec. 8, p. 1.

Condit, Carl W.
1960 *American Building Art, The Nineteenth Century.* Oxford University Press, New York.

Cooper, Theodore M.
1889 American Railroad Bridges. *Transactions of the American Society of Civil Engineers*, vol 21, no. 418 (July).

Engineering News
1902 The New Pittsburgh Plant of the American Bridge Company. *Engineering News*, June 26, pp. 527-528.

Fisher, Douglas A.
1951 *Steel Serves the Nation, 1901-1951.* United States Steel Corporation, New York.

Greiner, Inc.
1995 *Bridge Inspection and Rehabilitation Study: Bridge No. 12052, Maryland Route 623 Over Broad Creek for Maryland State Highway Administration.* On file at the Maryland State Highway Administration, Baltimore.

Harford Historical Bulletin
1993 The Tidewater Canal. *Harford Historical Bulletin*, no. 58, pp. 159-161. Located at the Historical Society of Harford County, Bel Air, Maryland.

Jennings and Herrick (publishers)
1858 *A Map of Harford County, Maryland, 1858, Entirely from Original Surveys by C.W. Herrick.* Published by Jennings and Herrick. Located at the Historical Society of Harford County, Bel Air, Maryland.

Little, Augustus, and Austin Rowan
1998 Personal communication. Personal interview February 12 with Augustus Little, Susquehanna Hall Road, and Austin Rowan, Flintville Road, Whiteford, Maryland.

Martenet, Simon J.
1878 *Martenets Map of Harford County, Maryland.* Simon J. Martenet, Baltimore. Located at the Historical Society of Harford County, Bel Air, Maryland.

Maryland Geological Survey
1902 *Map of Harford County, Maryland. Showing Topography and Election Districts.* Maryland Geological Survey and United States Geological Survey, Washington, D.C. Located at the Historical Society of Harford County, Bel Air, Maryland.

Philadelphia Electric Power Company
1926 Drawing entitled "County Road Relocation-Broad Creek. Conowingo Project, Plan A-79717," dated March 31, 1926. On file at Susquehanna Electric Company, Conowingo Hydro Station, Darlington, Maryland.

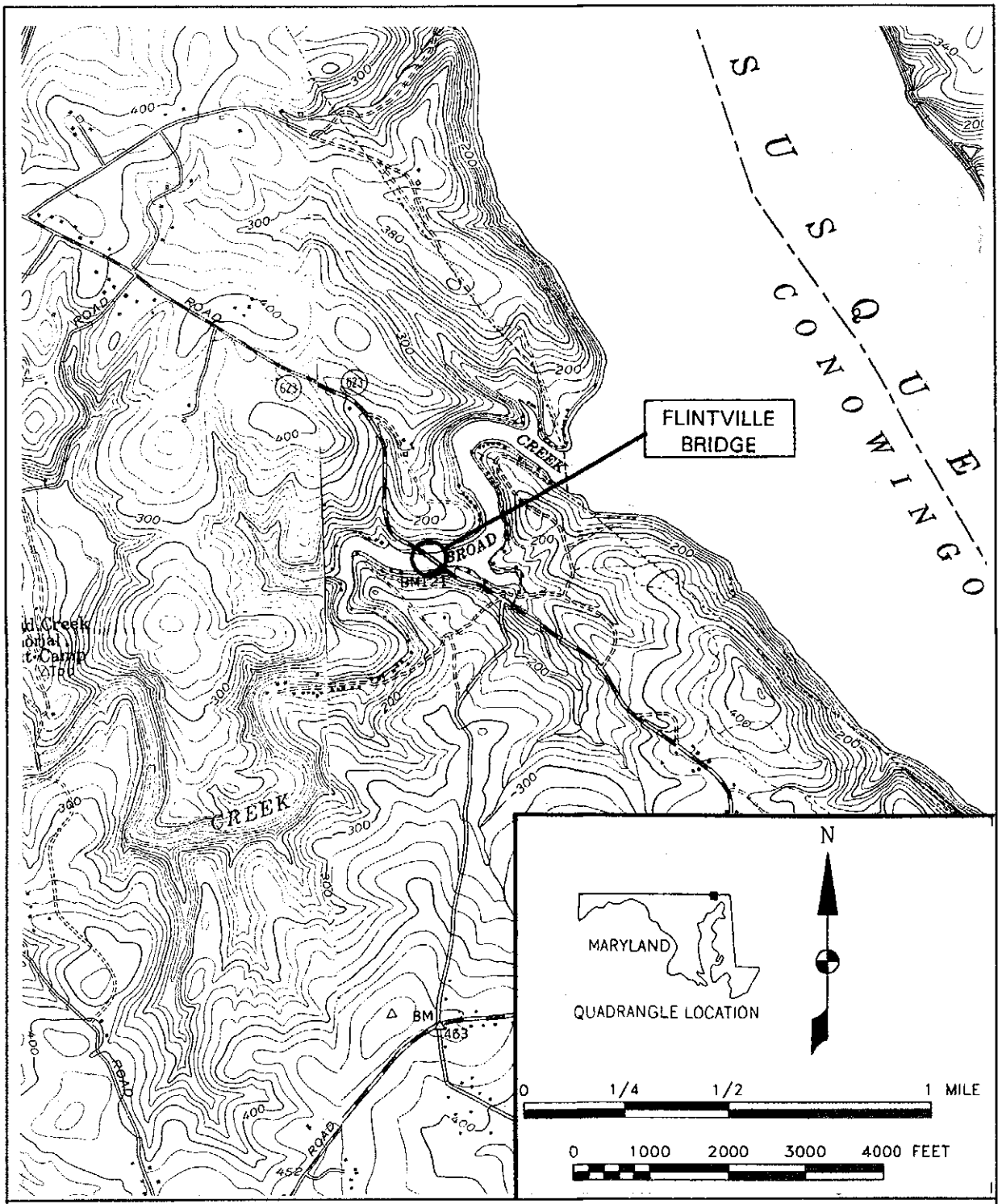
n.d. *Conowingo, Hydro-Electric Development of the Philadelphia Electric System.* Published by Philadelphia Electric Power Company, Philadelphia. Located at the Historical Society of Harford County, Bel Air, Maryland.

Rincliffe, Roy G.
1953 *"Conowingo!" The History of a Great Development on the Susquehanna.* Newcomen Society, New York.

Stark, Rodney
1998 Personal communication. Telephone interview, February 19. Real Estate Division, PECO Energy Company, Philadelphia, Pennsylvania.

Talbot, R.A.
1975 *American Bridge Division, History and Organization.* United States Steel Corporation, Pittsburgh, Pennsylvania.

Wright, C. Milton
1967 *Our Harford Heritage.* French Bray Printing Company, Glen Burnie, Maryland.



Location Map

SOURCE: USGS Conowingo Dam, Maryland-Pennsylvania Quadrangle and Delta Maryland-Pennsylvania Quadrangle

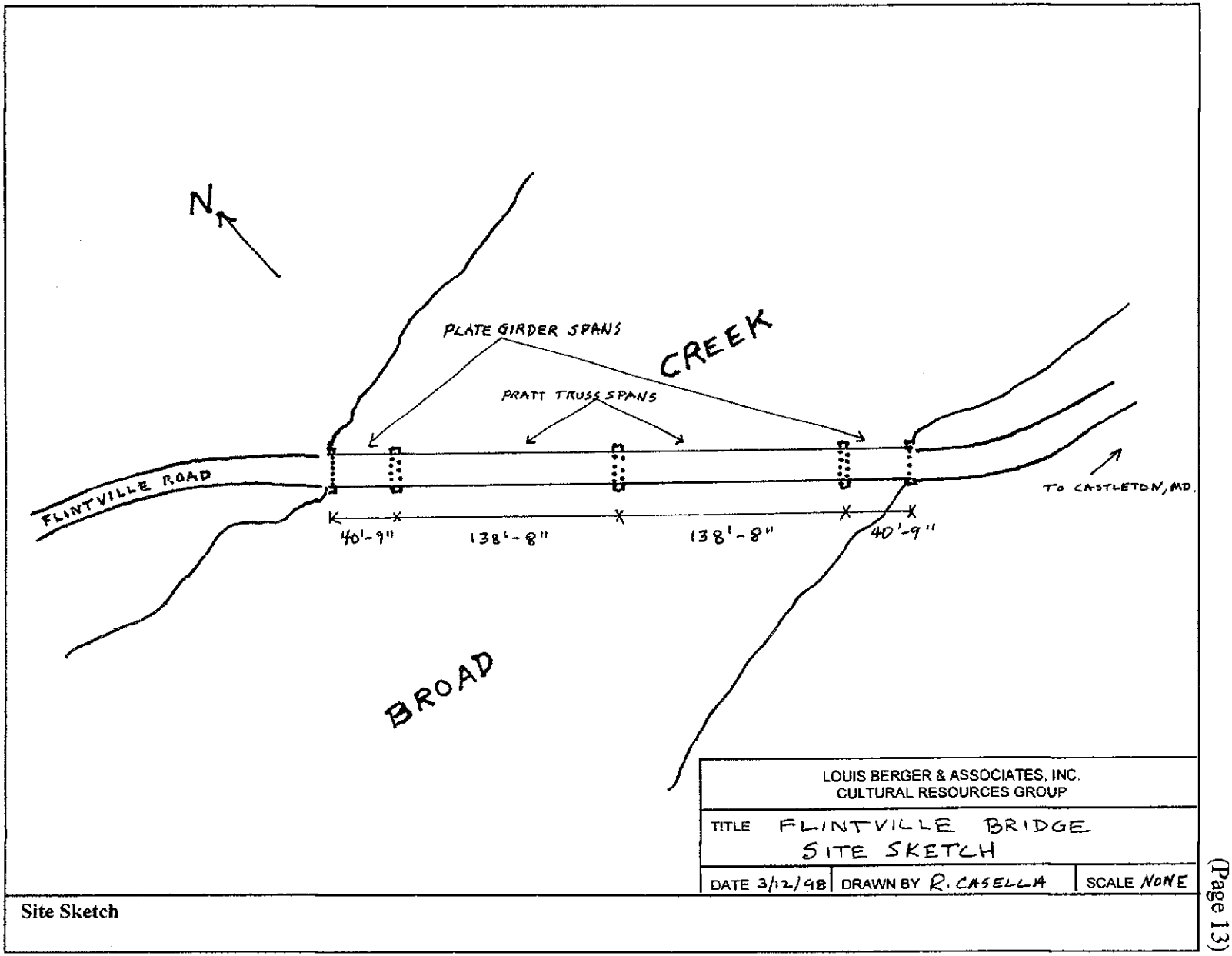

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PLATE GIRDER SPANS
CREEK
PRATT TRUSS SPANS
FLINTVILLE ROAD
TO CASTLETON, MD.
40'-9"
138'-8"
138'-8"
40'-9"
BROAD
LOUIS BERGER & ASSOCIATES, INC.
CULTURAL RESOURCES GROUP
TITLE FLINTVILLE BRIDGE
SITE SKETCH
DATE 3/12/98
DRAWN BY R. CASELLA
SCALE NONE

Site Sketch