NPS Form 10-900
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NAT. REGISTER OF HISTORIC PLACES
NATIONAL PARK SERVICE

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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 any 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: Brielle Road Bridge over the Glimmer Glass (W-9)

other names/site number: Brielle Road Bridge W-9

2. Location

street & number: Brielle Road over The Glimmer Glass — not for publication: n/a

city or town: Borough of Manasquan — vicinity ___

state: New Jersey — code: NJ — county: Monmouth — code: 25 — zip code 08732

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this x___ 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 _x_ 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] 2/28/08

Signature of certifying official — Date

Amy Cradic, Assistant Commissioner Natural & Historic Resources/DSHPO

State or Federal Agency or Tribal government

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

Signature of commenting official/Title — Date

State or Federal agency and bureau

4. National Park Service Certification

I, hereby certify that this 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: Patrick Andrus

Date of Action: 4/25/2008

5. Classification

Ownership of Property (Check as many boxes as apply)

___ private
_x_ public-local
___ public-State
___ public-Federal

Category of Property (Check only one box)

___ building(s)
___ district
___ site
_x_ structure
___ object

Number of Resources within Property

Contributing	Noncontributing	
____	____	buildings
____	____	sites
1	0	structures
____	____	objects
1	0	Total

Number of contributing resources previously listed in the National Register: n/a

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

6. Function or Use

Historic Functions (Enter categories from instructions)
Cat: TRANSPORTATION/road-related

Current Functions (Enter categories from instructions)
Cat: TRANSPORTATION/road-related

7. Description

Architectural Classification (Enter categories from instructions)
Other: BASCULE-TYPE DRAWSPAN

Materials (Enter categories from instructions)

Other: STEEL, WROUGHT IRON, WOOD

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

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.

_x_ 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 (Mark "X" in all the boxes that apply.)

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

Areas of Significance (Enter categories from instructions)
ENGINEERING
TRANSPORTATION

Period of Significance: 1938 - 1950

Significant Dates: 1938, 1950

Significant Person: n/a

Cultural Affiliation: n/a

Architect/Builder unknown

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

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9. Major Bibliographical References

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

Previous documentation on file (NPS)
___ 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
___ Federal agency
_X_ Local government
___ University
___ Other
Name of repository: Monmouth County Engineering Department

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10. Geographical Data

Acreage of Property .45 Acres

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

Zone Easting Northing	Zone Easting Northing	Zone Easting Northing	Zone Easting Northing
1 18 581439 4440601	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: Margaret M. Hickey
organization: HJGA Consulting Architecture & Preservation date: July 2006 (update July 2007)
street & number: 36 Park Street telephone: 973-746-4911
city or town: Montclair state: NJ zip code: 07042

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 the SHPO or FPO.)
name County of Monmouth, Department of Public Works and Engineering
street & number Hall of Records telephone 732-431-7760
city or town Freehold state NJ zip code 07728

OVERALL

The Brielle Road Bridge over the Glimmer Glass Creek W-9 (commonly referred to as Brielle Road Bridge) in Manasquan Borough is a movable bridge where the bascule leaf opens by pivoting about a horizontal axis and the position of the leaf is controlled by counterweights set on a curved track. The Brielle Road Bridge, which includes the drawspan (also known as the bascule) and the timber trestle approach spans, crosses the Glimmer Glass in an approximate east/west direction at the confluence of three tributaries, Debbies Creek, Watson Creek and the Glimmer Glass. The Borough of Manasquan is located to the north and east of the bridge, and Brielle Borough is located to the south and west of the bridge. For orientation purposes, the north side of the bridge is the upstream side and the south is the downstream side; therefore, crossing under the drawspan via a water vessel from north to south provides access to the Manasquan Inlet. The bridge, inclusive of both the timber trestle approaches and the drawspan, measures 279 feet in length; the timber trestle approaches measure 30 feet in width; the drawspan measures 20 feet in width and 31 feet in length (Photos 1 and 2).

LOCAL AREA

The Brielle Road Bridge W-9 is located in the Borough of Manasquan, Monmouth County, New Jersey. Set within the Atlantic Coastal Plain, the largest physiographic region in New Jersey, stretching from Sandy Hook to the Delaware Bay, the Borough of Manasquan is located just north of the Manasquan River Inlet. The Manasquan River, a major New Jersey waterway, flows 23 miles from central Monmouth County to the Atlantic Ocean and is the northernmost terminal of the Intercoastal Waterway. The Manasquan watershed is approximately 82 square miles. The Brielle Road Bridge W-9 is one of two bridges and a culvert that provide vehicle access over Debbies Creek and the Glimmer Glass. These three vehicular access routes essentially straddle the Boroughs of Manasquan and Brielle. The Brielle Road Bridge W-9 is located less than three-quarters of a mile south of Squan Village[1] and less than three-quarters of a mile west of the Atlantic Ocean; Brielle Road ends at Beach Front Road, aptly named.

SITE

The Glimmer Glass is one of a number of tributaries that feed the Manasquan River and the Manasquan River Estuary. From the Glimmer Glass, the waterway flows to the Manasquan Inlet and further out to the Atlantic Ocean. Today, the Glimmer Glass serves as a harbor supporting primarily recreational vessels. The Brielle Road Bridge W-9 (W-9) is located at the confluence of two other structures spanning the Glimmer Glass and Debbies Creek including the Fisk Avenue Culvert W-8 (W-8) to the west of W-9 and Bridge W-7 (W-7). W-8 and W-9 are separated at their east and west ends respectively by a small land-filled island at the juncture of the Glimmer Glass and Debbies Creek. Bridge W-7 is located to the south of W-8 and W-9 and is set approximately perpendicular to each and approximately center of the in-filled island. W-8 is described as a road embankment retained by sheet pilings which accommodates two lanes of traffic and two sidewalks. An 80-inch diameter culvert supported on timber piles bisects the fill permitting the flow of water under the roadway.[2] W-7 is a fixed timber trestle bridge consisting of 8 timber pile bents supporting a two-lane roadway with a sidewalk on one side.[3] W-9 is a 17-span bridge composed of 16 continuous nail laminated timber deck spans topped with asphalt and the bascule span. Each of the approach spans is supported by braced timber pile bents. The bridge

[1] Squan Village is the historic center of the Borough of Manasquan.

[2] Cultural Resource Consulting Group (CRCG), *Phase I and II Cultural Resource Investigation; Bridge 2-7, Culvert W 8, and Bridge W-9, Manasquan and Brielle Boroughs, Monmouth County, New Jersey* (Highland Park, NJ: January 30, 2004), 32-33.

[3] CRCG, 32.

accommodates two lanes of traffic for a total roadway width of 23 feet with a 6-foot sidewalk located along the upstream side of the bridge. The roadway is located approximately 12 feet above water level. Each side of the bridge is enclosed by a steel guide rail supported by equally spaced wood posts. At the point of entry at each end of the bridge are operable guardrails and traffic lights. All three roadways, W-7, W-8 and W-9, date from the late 19th century; however, each was rebuilt in the mid-20th century to their current configurations.

OPERATION OF THE DRAWSPAN[4] (Photos 5, 6 thru 9, 14)

The operation of the bascule drawspan of Bridge W-9 works on the same principals as a drawbridge placed over a moat around a castle during the Middle Ages using counterweights and electric power instead of manpower for the operation of the bascule leaf and as seen in designed prepared by Bernard Forest de Belidor in 1729 for bridges used at military fortifications (refer to Section 8 Significance). The relationship between the mechanisms for operation (counterweights, curved track, cables and electric motor) and the bascule leaf are simple. The bascule leaf, which carries the roadway, is hinged at its east end. The portal, positioned adjacent to the hinged end of the bascule leaf, holds the counterweights, curved track, and electric motor. Two cables connecting the counterweights with the leaf maintain the relationship between each. However, it is the position of the counterweight along the curved track and the length of the ropes that dictate the position of the bascule leaf. When the counterweights are at the top of the tracks, the bascule leaf is closed. As the counterweights move down the track the bascule leaf is raised at its toe to a near vertical position. In this manner, whether opened, closed or somewhere in between, the bascule leaf and counterweights are in equilibrium – balanced. As such, "the bridge is balanced by means of weights rolling upon tracks, which are so curved that the work done by the weights in dropping from one position to another equals the work to be done in raising the bridge to a corresponding position."[5] The configuration of the track as a sine curve is a critical factor; it is the key element in permitting the counterweights to be of less weight than the bascule leaf while maintaining equilibrium throughout operation. This configuration also very successfully keeps the counterweights out of the water, one hurdle that must be overcome on all bascule bridges. The introduction of torque to drive the sheaves overcomes the balance (and frictional and other forces) to open and close the bridge. This operation is accomplished by the electric motor which operates a drive shaft and two sheaves set at the top of the portal. The motor turns the sheaves and shaft in a forward or backward motion depending on whether the leaf is being raised or lowered. The bascule leaf is locked into position at the toe manually but all other operations are controlled by an operator from the house.

BASCULE DRAWSPAN

The drawspan is composed of four basic components: the bascule leaf, the timber framed portal located to the east of the bascule leaf, the curved track supporting the counterweights which is supported by the timber framed portal, and the operator's house. The motorized components and driveshaft that control the raising and lowering of the bridge are

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[4] There are a couple of typical components to a bascule bridge. The "leaf" is the deck section of the bridge that moves whereas the "span" is the length of the bridge between two fixed supports, i.e., a double-leaf bascule bridge has two leafs but one span. The leaf consists of two sections: (1) the "toe" is the outer end of the span away from the pivot or hinge; and (2) the "heel" is the end of the leaf closest to the pivot or support. The "counterweight" is the heavy mass of material opposite the leaf that provides the balance and acts as the anchor for the dead loads at the leaf. (Terry L. Koglin, *Movable Bridge Engineering* (Hoboken, NJ: John Wiley & Sons, Inc., 2003), 33-34)

[5] "Counterweighted Lift Bridge on the Erie Railroad" *Scientific American*, Nov. 28, 1896, Vol. LXXV, No. 22, 389.

located at the top of the portal with the electric motor located atop the downstream tower column. A ladder and catwalk provide access from the ground to these components.

The bascule drawspan measures overall 20 feet in width (excluding the operator's house which would bring the overall width to about 30 feet 6 inches) and 31 feet in length. The bascule leaf is located west of the counterweights and timber portal. The channel is lined with timber fenders and each end of the span is supported by braced timber pile bents.

The bascule span carries the roadway and a sidewalk. The leaf framing consists of girder, floorbeam and stringer arrangement with the two longitudinal girders extending from the span hinges at the easterly end to the rest pier at the westerly end. Two end and two intermediate transverse floorbeams span between these girders and eight lines of stringers are framed into the floorbeams. Six sets of X-shaped lateral braces span below the stringers. (Photo 9). The sidewalk, located on the upstream side, is carried by girders in line with the transverse floorbeams. The whole assembly supports the open metal deck creating the roadway and sidewalk. At each side of the bascule leaf are simple metal railings composed of a series of vertical posts spaced an equal distant apart with three continuous horizontal members spaced an equal distant apart. The downstream side is fitted with metal bumpers. A sign is attached to the railing on each side of the bridge facing the water. The two operating cables are attached to the girders of the bascule leaf at either side of the roadway and are set a quarter of the length from the toe. (These cables are attached to the counterweights, described later.) The downstream side is set between the railing and the bumper. The upstream side is encased in a metal bumper which encircles the cable.

Set adjacent to the bascule leaf is the wood timber portal which carries the counterweights, and the machinery controlling the operation of the drawspan (Photos 3-5, 13). The U-shaped portal has two vertical supports (legs) located on either side of the roadway opening (Photos 10, 11). These legs are composed of a pair of wood posts joined horizontally just below their top, at approximately center, and at their base by horizontal wood memebers. The two portal legs are joined at their top position by a simple timber Howe truss with two panels, which creates a portal over the roadway. Two intermediate steel rods connect the top and bottom chords of this truss-like structure. Each portal leg is braced laterally by timber framing which project beyond the bridge and are connected to a supporting steel girder that runs under the roadway. The portal is further braced by pairs of guide wires at each portal leg tied to the upper part of the portal at their west end and the roadway at their east end. Each guide wire is fitted with turnbuckles.

Three counterweights at each side of the portal are supported by timber framed tracks braced against each portal leg and paralleling the roadway extending eastward. Each track is a pair of timber trusses consisting of horizontal lower chords at the roadway level, inclined upper chords and diagonals between chords; the portal columns function at the end verticals for the trusses. Timbers are affixed to the tops of the upper chords to form the curved tracks to which steel plates are bolted. Built-up wood blocks serve as bumpers for the counterweights at the base of each track (Photo 19). The three counterweights vary in size and composition, and progress from big to small from top to bottom (Photos 16, 17, 18). The top and bottom weights are made of steel and the center weight is a composite of steel and concrete. The two topmost counterweights have a solid center guide while the bottom one has disk guides. The counterweights are connected by a pair of steel straps attached to a steel yoke which is connected to the cable at the bascule leaf. The cables are carried over the wood frame portal via single-track sheaves which are attached at the top of the timber portal over each leg. The sheaves are interconnected by a drive shaft attached to the top chord of the portal and then connected to the motor positioned atop a single post set adjacent to the downstream portal leg. The motor, sheaves and drive shaft are all in line at the upper end of the portal (Photo 16). A metal catwalk hung from the portal on the bascule leaf side of the bridge is accessed via a wood ladder set at the downstream side of the bridge (Photo 15).

The bridge is controlled from the operator's house located on the downstream side adjacent to the curved track and set just east of the portal opening (Photo 12). The house is set on a small platform which projects from the bridge and includes a narrow deck the perimeter, a one-room frame building with an asphalt shingle gable roof, aluminum siding, and a small portico at its west side. The house is positioned to optimize the operator's view of both sides of the channel and the roadway approaches.

The bascule drawspan for the most part reflects its appearance when installed in 1938 (see Summary Description of the Physical Changes below). Components of the bridge have been repaired and replaced since installation due to continuous use and exposure to the environment. The bridge appears to have originally operated with a single counterweight on each track rather than the three present today. Despite this modification, the overall configuration, the design intent, and the operation have remained unchanged.

SUMMARY DESCRIPTION OF THE PHYSICAL ALTERATIONS TO THE BRIDGE SINCE CONSTRUCTION[6]:

The dates indicate the earliest evidence of the change but may not indicate the date of the change.

c. 1889

- Timber trestle fixed bridge 16 feet wide and 585 feet long with 40 bents constructed at location of current Brielle Road Bridge W-9.

1938

- Bascule drawspan inserted into the fixed timber trestle bridge at Brielle Road (W-9) and dedicated as part of Manasquan's Big Sea Day on August 13, 1938.

1949-50

- Several changes to the Brielle Road Bridge W-9:
  - Timber trestle portion of Brielle Road Bridge W-9 was rebuilt in-kind including the infill of land at either end of the bridge. This change reduced the overall span of the bridge to 279 feet being supported on 17 bents.
  - The deck of the fixed timber trestle was widened from 16 feet to 30 feet including a two lane roadway and a six-foot wide sidewalk.
  - Bascule leaf widened to include a sidewalk; the 20 foot roadway was maintained.
  - Timber portal including the mechanical components and curved track were rebuilt in-kind and the electrical controls updated.

[6] Source: CRCG, 29-31 and an undated and untitled list of changes to the bridge found within the Monmouth County Engineer's Office. It appears the document was prepared by their personnel based on a review of County's files on the bridge. These changes were further documented on plans and elevations of the bridge highlighting type of change and year of change using a color-coded system.

   - Two additional counterweights were added to each track to compensate for the additional weight of the bascule bridge.
   - A new operator's house was built on a new timber platform.

1957-58
- Modifications to the bascule drawspan:
   - New cables and yokes at the counterweights installed on the bascule span.
   - The timber frame portal was rebuilt in-kind.
   - Catwalk was rebuilt in-kind.

1963
- A new bascule leaf was installed with metal grid deck.

1971
- Modifications to the bascule drawspan:
   - Timber frame portal was rebuilt in-kind.
   - New counterweights provided.
   - The catwalk was rebuilt in-kind.
   - The curve of the tracks modified.

1981
- Three counterweights removed and shafts replaced. Counterweights greased, cleaned and reinstalled.

1994
- Repairs made to the draw span drive system.

c. 1990s
- Operator's house clad with aluminum siding, and vinyl replacement windows and asphalt shingle roofing installed.

1995
- Structural steel members of the bascule span replaced and repairs made to various components within the navigational channel, at the traffic gates and other components including painting the bridge.

STATEMENT OF SIGNIFICANCE

Summary Statement

The Brielle Road Bridge over the Glimmer Glass W-9 in Manasquan Borough, Monmouth County is eligible for the National Register of Historic Places under **Criterion C** as a bascule-type movable bridge which is a representative example of a technology first developed in the early 1700s in France[1] and later used in the United States in the late 19th and early 20th centuries. The bridge design- that of a single leaf steel bascule span lifted by a pair of chains connected to a counterweight running along a curved track behind the lifting span- was first developed by Bernard Forest de Belidor in 1729 for bridges used at military fortifications.[2] The bridge is technologically and historically significant as the only example of its type in New Jersey and exemplifies the need for movable bridge technology in the late 19th and early 20th centuries for the transportation of vehicles over navigable waterways. Originally designed to temporarily span Ocean County's Bay Head-Manasquan Canal in the early 20th century (but never installed), [3] the bridge components became the property of Monmouth County in 1925 and were stored near its current location until 1938. In 1938, the bascule leaf and associated counterweights and supports were inserted into an existing fixed timber-trestle bridge that connected Manasquan with Brielle (the original timber trestle bridge was constructed over the Glimmer Glass c. 1889). The timber trestles, which serve as the approach spans for the bascule span were last rebuilt in 1949-1950, and are included in the nomination as part of the greater bridge structure and due to their association with the bascule span. The bridge has been modified since its original insertion into the timber trestle to accommodate expanding traffic in the region as well as to maintain its operable components for an effective and efficient use of the bascule drawspan. These modifications have included work at the leaf, counterweights and supports; however, the bridge continues to operate as originally constructed and retains the basic technologies first introduced in the early 1700s. These improvement have retained the bridge's historic engineering qualities, and through continued maintenance and operation, the bridge's integrity of design.

The insertion of the bascule drawspan into the timber-trestle fixed bridge (Bridge W-9) along Brielle Road in 1938 marks the beginning of the period of significance, and the last significant modification to the bridge in 1950 marks the end of its period of significance. Although some of the modifications were made within the last fifty years, they were in response to the continued use and operation of the bridge within a marine environment and to accommodate increased automobile traffic in this location.

Moveable Bridge Technology: Bascule Bridges

It has been said that "Bridges, more than any other product of industry, exemplify the technological potential, the powers of imagination, and the aesthetic taste of a generation."[4] A bascule bridge is defined as a "drawbridge over a waterway; essentially one that is counterbalanced, permitting it to be tilted at the abutments to allow the passage of vessels."[5] *Bascule*

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[1] Donald J. Fraser and Michael A.B. Deakin, "Curved Track Bascule Bridges: From Castle Drawbridge to Modern Applications" *Proceedings of the 7th Historic Bridges Conference*, (Cleveland, Ohio: Cleveland State University, Sept 2001), 30.
[2] Charles Birnstiel, "Popular Obsolete Movable Bridges", *Proceedings of the 7th Historic Bridges Conference*, (Cleveland, Ohio: Cleveland State University, Sept 2001), 139.
[3] The bascule span was designed in 1922 to cross the Bay Head-Manasquan Canal two miles south of the drawspan's current location. Further information on the 1938 insertion of the drawspan into the Brielle Road Bridge will be discussed in subsequent sections. It should be noted that the Bay Head-Manasquan Canal is now called the Point Pleasant Canal.
[4] L.F. Webster, Ed., *The Wiley Dictionary of Civil Engineering and Construction* (New York: John Wiley & Sons, Inc., 1997), 106.
[5] Webster, 98.

is derived from the French term *bacule*, meaning "seesaw" or "balance" and bascule-type bridges operate along those same basic principles. Their principal advantage is they require little energy to operate. The bascule-type bridge is one of three common forms of movable bridges- swing, lift and bascule:

> All movable bridges that are counterbalanced and open by pivoting about a horizontal axis should be called **bascule** bridges.
>
> All movable bridges that open by pivoting about a vertical axis should be called **swing** bridges.
>
> All movable bridges that open by lifting, without rotating or translating horizontally, should be called **vertical lift** bridges.[6]

The most common early form of movable bridge is the popularized image of the drawbridge found spanning moats and leading to castles and other types of fortifications (Figure 8-A). Bernard Forest de Belidor (1693-1761), a military and civil engineer who authored several books on engineering, artillery, ballistics and fortifications is credited with the first design for raising draw bridges at fortifications using a curved track with counterweights for operation of lifting and lowering the bascule span of the bridge. The technology was published in his book on military fortifications *La Science des Ingenieurs dans la Conduite des Travauz de Fortification et D'Architecture Civile* in 1729.[7] In his sketches of the bridge, the curve track was hidden within the fortified walls.[8] The design intent for the configuration of the curved track was to both simplify the operation of the bridge and to put the mechanical components within the fortified walls to protect them from attack. Belidor's concept of the curved track allowed a constant counterweight to exert its maximum effort near the top of the tower and "as the bridge rose, the position of the counterweight would change so that its work decreased, matching that required by the rising bridge."[9] The curve had to satisfy conditions of both geometry and balance, and Belidor recommended that the best curve to satisfy such conditions was the sine curve or sinusoid.[10] In the Belidor type, "The track is curved in order to obtain balance of the rotating leaf with a counterweight of fixed value at all angles of leaf opening. The curve, which gives equilibrium of bascule leaf and counterweight, is called a sinusoid".[11] The Brielle Road Bridge employs this sinusoidal curve on each side of its span.[12] The Belidor bridge was first used as part of military infrastructure in 18th century Europe at the entrances to forts. Like many other movable bridge types, the Belidor later became popular at road and rail crossings, and many were built during the late 19th century American railroad expansion when wide movable bridges consisting of a short span were desired.[13]

By the late 19th century movable bridge span technology throughout the United States had become integral to the development of railroad and highway transportation systems, and was critical in states with low coastal zones, such as New Jersey. It was primarily the development of the railroad and the canals that created the demand for movable bridge technology. Movable bridges were one of the more economical ways to carry rail lines and highways across navigable

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[6] Terry L. Koglin, *Moveable Bridge Engineering* (Hoboken, NJ: John Wiley & Sons, Inc., 2003), 20.
[7] Birnstiel, 139.
[8] Birnstiel, 139.
[9] Fraser and Deakin, 30-31.
[10] Fraser and Deakin, 31.
[11] Birnstiel, 139.
[12] Birnstiel, 139.
[13] Birnstiel, 139.

waterways.[14] The first type was a timber truss span located at a river bank, hinged at one corner and swung into position thereby permitting water traffic and rail traffic to coexist. This technology was later advanced to permit the bridge to swing at its center point.[15] Swing bridges were the most common movable bridge used throughout the 19th century because they did not require sophisticated engineering and were quick to open and close.[16] It was not until the end of the 19th century that the bascule and lift type bridges became popular. These types of bridges took advantage of the advances in engineering and technology, e.g., the development of satisfactory methods for counterbalancing and the electric motor. With these two components, bascule and lift bridges could be economically developed.[17] One of the principal advantages of movable spans is they can be constructed over flat terrain and therefore do not require trains to climb a large gradient in order to cross a navigable waterway. The swing bridge quickly fell out of favor once the bascule and lift bridge technologies were employed because the newer types did not have center piers and therefor allowed for unobstructed navigable channels.[18]

Despite having its origins in the Middle Ages, the first of the modern bascule bridges did not appear in the United States until 1893 with the construction of the Van Buren Street Bridge in Chicago which was a rolling-lift bascule bridge.[19] The use of counterweights to pivot a bridge about a horizontal access is a key difference between a bascule bridge and all other types of movable bridges. One of the critical hurdles that all bascule bridges face is preventing the counterweight from dipping into the water when the bridge is open.[20] There were and are many variations on bascule bridges and many patents were developed as the railroad companies invested in improvements to their infrastructure.

In the November 28, 1896 issue of *Scientific American,* an article appeared about a new counterweighted lift bridge that was built by the Erie Railroad company near Rutherford, New Jersey across Berry's Creek. This bridge is said to have been "the first application of this system of counterweighting to a structure of this magnitude."[21] This bridge is similar to Bridge W-9 in its configuration of the counterweights to the bascule leaf; however, the vertical supports including the track appear to be constructed entirely of metal. In addition, this bridge was constructed to bear the weight of a train, not a motor vehicle. This bridge, as described below, was hand operated and was designed by C.W. Buchholz, chief engineer for the Erie Railroad. The bridge was constructed by the Union Bridge Company of New York City. It has been cited as one of the first applications of the Belidor type bascule bridge used in America.[22]

> The draw itself consists of four spans of ordinary deck plate girders, one beneath each rail. The spans are framed as stringers to a header girder at each end, and they are so braced together that when the draw is raised the header girders form the chords of a deep truss, and are, therefore, subject to direct tension and compression, the shear being carried to the end stringers by the bracing. The hoist ropes are attached to the ends of the outer header girder, as are also the counterweight ropes, any bending moment that is

[14] Wai-Fah Chen and Lian Duan, Eds. *Bridge Engineering Handbook* (Boca Raton, FL: CRC Press, LLC, 2000), 21-1.
[15] David Plowden, *Bridges: The Spans of North America* (New York: W.W. Norton & Company, 1974), 186 -187.
[16] Koglin, 5-6.
[17] Plowden, 186.
[18] Plowden, 187.
[19] Plowden, 187.
[20] Koglin, 35.
[21] 'Counterweighted Lift Bridge on the Erie Railroad," *Scientific American (1845-1908);* Nov. 28, 1896; Vol. LXXV, No. 22.; APS Online, 389.
[22] "Counterweighted Lift Bridge," 389.

caused by the pull of these ropes being resisted by the latticed struts shown at the sides of draw. The hinges are located at the ends of the shore girder, and the reaction when the bridge is raised is transferred to them by struts similar to those above mentioned, except that they are made of plates and angles.

The bridge is balanced by means of weights rolling upon tracks, which are so curved that the work done by the weights in dropping from one position to another equals the work to be done in raising the bridge to a corresponding position. It will be evident to our readers that if the counterweights were permitted to fall vertically, the bridge would be raised at an accelerated speed, and would be brought up violently against the vertical posts of the counterweight frame; and this, for the reason that, while the pull on the counterweight end of the rope would be constant, the pull of the bridge as it was raised would constantly decrease, the weight being taken by the hinges.

To compensate for the decreasing load of the bridge, the counterweights are run out upon a curved track, the curve being so regulated that the counterweight and the bridge shall be almost in equilibrium at any position. The weights, however, are made less than the weight of the draw span, the difference being that which closes the draw.

The office of hoist ropes above mentioned is to lift this difference of weight. They run over 23 inch sheaves at the top, and down to winches at the bottom of the posts, which are arranged to work by hand power. These sheaves are connected at the top by a shaft and gearing, so as to insure that the men on either side will work evenly. The counterweights, each of which weighs about 25 tons, consist of two sets of nine cast iron disks, 6 feet in diameter, which are solid except for four holes in which cast iron adjustment weights can be placed for regulating the load. The counterweights run upon tracks which are built of two 15 inch channel beams spaced 20 inches apart, the tracks being braced to the posts and the bottom members by means of lattice struts and ties as shown in the illustration. The two frames are kept in line by the latticed portal, which is 16 feet deep. The inshore end of each counterweight frame is anchored down to the foundation masonry by two 1 ¾ inch bolts. The hoist ropes are 9/16 of an inch and the counterweight ropes 1 ¾ inches in diameter; the latter consisting of six strands of nineteen wires wound around a hemp center. The total weight of the draw span is 138,120 pounds, and the counterweights can be so nicely adjusted, if it were desired, that one man could open and shut it in three or four minutes."[23] (Figure 8-C)

There were at least five other bascule bridges of the Belidor type constructed for various railroad companies in New Jersey in addition to the one mentioned above. These five were located along the Morris Canal in Morris, Passaic and Hudson Counties and were constructed for a number of different railroad companies. The first was located east of Plane 3 West near Waterloo;[24] the second was located over the guard lock, Lock 7 East;[25] the third crossed the canal at Mountain View near the Pompton Feeder;[26] (Figure 8-D) and the last two were located in Jersey City.[27] All bridges appear to have been hand-operated, similar to the bascule bridge near Rutherford. The railroads which crossed the Morris Canal typically transported anthracite coal from Pennsylvania to points east and experienced their height of operation in the last

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[23] "Counterweighted Lift Bridge on the Erie Railroad," *Scientific American*, Nov. 28, 1896, Vol. LXXV, No. 22, p. 389-390.
[24] Robert R. Goller,. *Images of America: The Morris Canal Across New Jersey by Water and Rail* (Charleston, SC: Arcadia Publishing, 1999), 45.
[25] Goller, 74.
[26] Goller, 90.
[27] James Lee, *The Morris Canal: A Photographic History* (Bethlehem, PA: Lehigh Litho, 1979), 122.

quarter of the 19th century through to the early 20th century. The frequent use of this type of bascule drawspan within a distance of 102 miles is an indication that this type of bridge was at least widely used in northern New Jersey, but appears to have had a short-lived application along the railroad corridors. None of these Belidor type bascule bridges (the one near Rutherford or the five along the Morris Canal) remain today.

The bascule bridges constructed for the railroads provided the means by which heavily loaded trains crossed waterways at low elevations, whether they were man-made as at the Canal or part of the natural low coastal waters along the eastern coast and inland in New Jersey. They appear to have served their purpose while the railroads were at the height of operation; however, the railroad was quickly replaced by the automobile in the early 20th century, creating the need for more numerous and efficient highway systems. These highways, however, had to overcome the same obstacles as the railroads, particularly along the Atlantic coastline. As a result, movable span bridges of the varying types were also constructed to accommodate automobile traffic.

Bascule Drawspan of Brielle Road Bridge W-9

The bascule bridge at the Brielle Road Bridge W-9 was originally intended to transport vehicles that crossed the Bay Head-Manasquan Canal along Route 88. However, it appears based on correspondence on file at the County of Monmouth engineer's office (Figure 8-E), the bridge was designed (prior to 1925), the components acquired by Monmouth County but never installed, and by 1925 were in storage near the site of the bridge's present-day location.[28] The bascule drawspan at Brielle Road Bridge W-9 was installed in 1938 (Figure 8-F shows the permit drawings); it was officially opened August 13, 1938[29] as part of Manasquan's Big Sea Day.[30]

According to meeting minutes found in the files of the Monmouth County Engineer, there had been plans to insert a drawspan within the Brielle Road Bridge as early as 1924.[31] The exact impetus for the introduction of a drawspan in this location is not entirely known; however, providing inland access between waterways north of Manasquan Inlet had been proposed in prior years. One such proposal was made by a concurrent resolution of the New Jersey Assembly and Senate to study the cost of creating a canal route between Shrewsbury River and Bay Head which was to continue the Inland Waterway in New Jersey. The Legislature noted in their resolution that "The construction of the Inland Waterway along the New Jersey Coast has already shown in a marked degree the advisability of such an improvement."[32] It further states, "there is a general demand that the same be continued by means of a canal from Bay Head, in Ocean County, to the Shrewsbury River in Monmouth County." [33] Nothing appears to have progressed with regard to the creation of this canal other than the section that was built between Bay Head and Point Pleasant in 1926; however, it is unknown how long

[28] This canal, now called the Point Pleasant Canal, connects the Manasquan Inlet (at Point Pleasant) to Barnegat Bay (at Bay Head) and is part of New Jersey's Inland Waterway to Cape May. Construction of the Canal, after years of debate and planning, began in 1916, was suspended during World War I, and resumed in 1918; the canal became fully navigable in 1926.(Source: Woolley, Jerry and Jeff Heim. "Ninety Years of Dreaming and Planning: The Point Pleasant Canal"; available from http://home.att.net/~ppbhist/time_canal.htm.; Internet; accessed July 2006.)

[29] Jubilee Committee of the Manasquan Chamber of Commerce. *Manasquan.* Manasquan, New Jersey: 1962.

[30] "'Big Sea Day' Celebration Brings Crowd to Manasquan," The Coast Star, 19 August 1938, p. 1.

[31] "Special Meeting" Minutes and Resolution of Board of Freeholders of County of Monmouth, 3 March 1924.

[32] Kummel, Henry B. Bulletin 2: *A Report on the Approximate Cost of a Canal between Bay Head and the Shrewsbury River* (Trenton, NJ: MacCrellish & Quigley, State Printers, 1911), 3.

[33] Kummel, 3.

such a proposal may have been in the minds of the government and the residents. The report prepared as part of the study noted that several moveable bridges of either the rolling lift or bascule type would have to be constructed, including one at Brielle Road.

This discussion on the canal's development relates to the Intercoastal Waterway extending from Massachusetts to Florida. Investment was made on the part of federal, state and local governments linking, via canals, the various waterways along the Atlantic Coast beginning in the early 19th century through to the early 20th century. However, the "Missing Link" in this waterway occurs between New York Bay and the Delaware River, at New Jersey where boats are required to enter the Atlantic Ocean for a period before entering the Manasquan Inlet, a point just south of the Glimmer Glass and the beginning of the Inland Waterway in New Jersey. Although initially envisioned to benefit commercial traffic and to support military operations during times of war, the Inland Waterway provided access along the coast for recreational vessels.[34] Since World War II, there has been increased traffic of recreational vessels such as power and sail boats in popular recreational areas along coastal waters.[35] Today the drawspan provides access for boaters, primarily recreational boaters, north of the Glimmer Glass to the Manasquan Inlet and the Atlantic Ocean. In 1938, the insertion of the bascule bridge in this location was seen as a means of attracting people to the area where "fine bridges and waterways" are a must, according to Assemblyman J. Stanley Herbert.[36] The bridge was seen as just "the beginning in the development of our waterways" according to Sheriff Howard Height, speaking as president of the Manasquan Chamber of Commerce.[37]

The bascule drawbridge span was installed at the location of a fixed timber trestle bridge constructed prior to 1889. At that time, the timber trestle bridge was 16 feet wide and 585 feet long with 40 bents and spanned between a land-filled road embankment to the east and the peninsula created at the intersection of the Glimmer Glass and Debbies Creek to the west. The configuration found today of Bridge W-9 with Culvert W-8 further west and the perpendicular intersection of Bridge W-7 is similar to what was present when the bascule drawspan was inserted in 1938.

When inserted in 1938, the drawspan appears as it does today with the bascule leaf set between the timber trestle fixed bridge span, timber portal supporting the curved track and counterweights, the operating machinery and operator's house. (Figure 8-G is one of the drawings of the bridge found in the Monmouth County Engineer's office; there is no date but appears to be from 1938.)

In 1949-50, the bascule span and timber trestle approaches were rehabilitated.[38] The work included widening the deck of the approach spans from 16 feet to 30 feet consisting of two lanes and one sidewalk, and the deck was raised five feet. Fill was added at the east and west ends of the approaches decreasing their overall length from 585 feet to 279. The bascule span was also widened to include a sidewalk; however the roadway maintained a 20 foot width at the bascule leaf. The weight of the draw bridge changed from approximately 24,000 pounds to a weight of over 42,000 pounds as a result of the changes noted above. As a result, two additional counterweights were added to balance the additional weight.[39]

[34] US Army Corps of Engineers. *History of the Waterways of the Atlantic Coast of the United States* (available from http://www.usace.army.mil/usace-docs/misc/nws83-10/; Internet; accessed July 2006), 88-92.
[35] Koglin, 9.
[36] The Coast Star, 19 August 1938, p. 1.
[37] The Coast Star, 19 August 1938, p. 1.
[38] It should be noted that the timber trestles approach spans were replaced as part of this work.
[39] Chronology of Construction found in the files of the Monmouth County Engineer (no date, title or author).

The timber portal (including the mechanical components and curved track) was also rebuilt and the electrical controls were updated. A new bridge-tender's house was built on a new timber platform.[40]

Apparently in 1957-58, the bascule span was once again rehabilitated including the installation of new wrought-iron yokes to support the counterweights, new eye-bolts for the cable and yoke connections, and new cables. The portal was rebuilt but the existing machinery was reinstalled. The catwalk and railing were also rebuilt.[41]

In 1963, a new steel bascule leaf with metal grid deck was installed and in 1971, the portal was rebuilt, new counterweights provided and the catwalk rebuilt. Between 1971 and 1995, there is documentation of repair work; however, in 1995, the steel girders, floorbeams and stringers of the bascule leaf and the metal grid deck were replaced in-kind.[42]

The most significant mechanical or design modification to the bascule drawspan is the addition of four (two at each side of the portal) counterweights and an adjustment to the curve of the track. Additional counterweights were installed in 1949-50 and curve modifications occurred in 1971. The additional counterweights were added to compensate for the change in the weight of the bascule leaf. However, this modification shows the simplicity behind the engineering, whereby the original design intent is retained despite modifications to the loading characteristics of the bascule leaf. It also shows implicitly the relationship between the counterweights and the bascule leaf. According to Terry Kogler, author of *Movable Bridge Engineering*, "counterweights are designed to allow for adjustment of the bridge balance, recognizing that during its lifetime, the weight and weight distribution of the bridge can change."[43]

Many of the modifications noted above, with the exception of the additional counterweights, could be deemed characteristic for a bridge of this age that has been subjected to a marine environment. Movable bridges located in a harsh environment such as the Jersey Coast with its temperature variations, humidity and salt air are likely to have their components replaced more frequently due to the complexity of the electronics and machinery, as well as their structural aspects.[44] In addition, the ropes and cables tying the counterweights and the bascule leaf are subject to mechanical wear, no matter their locale, as are other movable components.[45]

Significance of the Brielle Road Bridge W-9

"The latter half of the nineteenth century witnessed remarkable advances in materials of construction, the development of power-driven machines and understanding of the theory of structures."[46] This period saw the first modern movable bridges which came about because of two previously mentioned advances: operating machinery and a greater impetus for structural analysis beyond that of trial and error. The bascule span of Bridge W-9 exhibits technical excellence and expresses the understanding of the basic principals of structural analysis and design. It also takes the operation of the bridge a step further than that applied to the railroad bridges previously described with the use of electric motors to operate the bridge rather than hand operation.

[40] CRCG, 30-31.
[41] CRCG, 31.
[42] CRCG, 31.
[43] Chen, 21-10.
[44] Koglin, 11.
[45] Koglin, 10.
[46] B.H. Shirley Smith, *The World's Great Bridges* (New York: Harper & Row, Publisher, 1953), 91-92.

Unlike a building, "in a bridge, structure dominates and its form should reflect this. The essence of an elegant bridge is simplicity of line, in which the structural form is expressed to the full. The addition of superfluous features will in general detract from the beauty of a bridge rather than enhance it."[47] The bascule span of Bridge W-9 exemplifies this statement particularly in two of its features: (1) the physical relationship and the implicit simplicity as reflected in the appearance of the bridge between the counterweighting mechanism and the bascule leaf; and (2) the configuration of the counterweight mechanisms where the sine curve expresses the level of balance between the counterweights and the bascule leaf during the operation of the drawspan, and enforces the basic principals of equilibrium through its operation. Brielle Bridge W-9 embodies the spirit of late 19th and early 20th century aesthetics where its function is clearly seen and there is no ambiguity in its design.[48]

According to Koglin, "of the approximately 3000 movable bridges in existence in the United State today (2003), about two-thirds (1900, plus or minus) continue to operate. Of these operable bridges, approximately 770 are bascule bridges, 750 are swing bridges, 270 are vertical lift bridges, and the rest are other types."[49] The bascule drawspan of Brielle Bridge W-9 is a rare surviving example of a little used bridge type in comparison to other types of bascule bridges. The technology employed at this bridge is more reminiscent of the drawbridge used in the Middle Ages than any other type of bascule bridge. The engineering principals applied to the bridge's operation show a complete understanding of the principals of equilibrium in both application and structural configuration. It also shows, through its application as a bridge for the passage of automobiles, the transition from the reliance upon the railroad in the late 19th century to the automobile in the early 20th century for the transportation of people and goods.

There are at least seven known applications of the Belidor type of bascule bridge, including the W-9 Bridge, constructed in the late 19th and early 20th centuries in New Jersey. Of these seven only W-9 survives.[50] Research also has not revealed another remaining bridge of this type throughout the United States. Therefore, Brielle Road Bridge W-9 is a surviving rare type of moveable bridge – a Belidor type bascule – that exemplifies the advancement in transportation and engineering in the late 19th and early 20th centuries throughout the United States and New Jersey, enhances our understanding of transportation over navigable waterways during this period, and expresses the principals of equilibrium in its use and design.

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[47] Derrick Beckett, *Bridges* (Series: *Great Buildings of the World*), (London: Paul Hamlyn Publishing Group, Ltd., 1969), 7.
[48] Heritage and Conservation Register, Australia, "Carrathool Bridge over Murrumbidgee: Statement of Significance"; available from http://www.rta.nsw.gov.au/cgi-bin/index.cgi?action=heritage.show&id=4300165; Internet; accessed July 2006. (Parts of this statement were taken from a Significance Statement prepared for the Carrathool Bridge over the Murrumbidgee River in Australia, one of possibly three Belidor type bascule bridges constructed in the early 20th century in Australia that remain today and exhibit the same design characteristic as the bascule span of Bridge W-9; however, this bascule span of the Carrathool Bridge is constructed entirely of steel.)
[49] Koglin, 21.

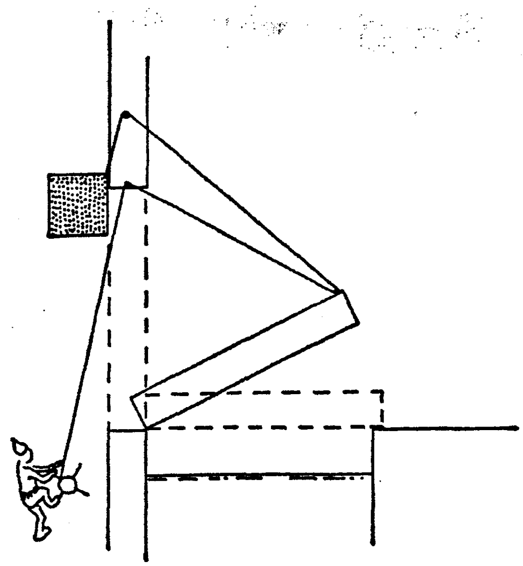

FIGURE 8-A

Simple graphic representation of a drawbridge in the Middle Ages. Note the use of cables and counterweights to engineer the operation of the drawbridge (the bascule leaf).

Credit: Joseph Gies, *Bridges and Men* (New York: Grosset & Dunlap, 1966), Figure 63, p. 231

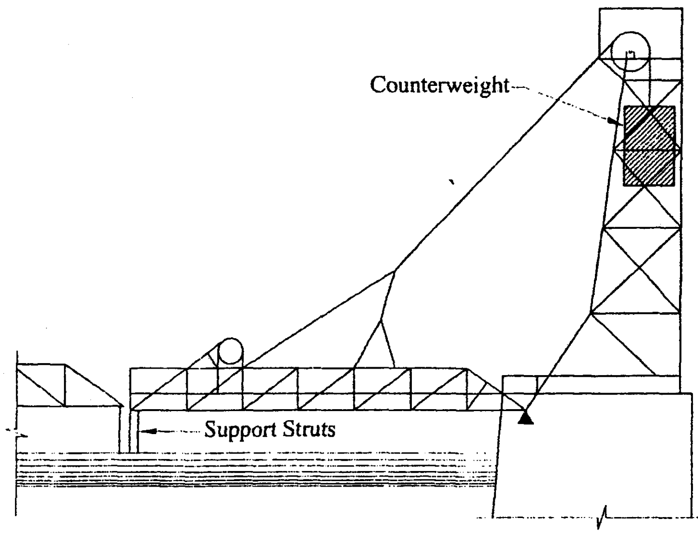

FIGURE 8-B

Simple graphic representation of a Brown-type bascule drawspan showing the relationship between the counterweights and the bascule leaf. .

Credit: Terry L. Koglin, *Moveable Bridge Engineering* (Hoboken, NJ: John Wiley & Sons, Inc., 2003), Figure 4-18, 57.

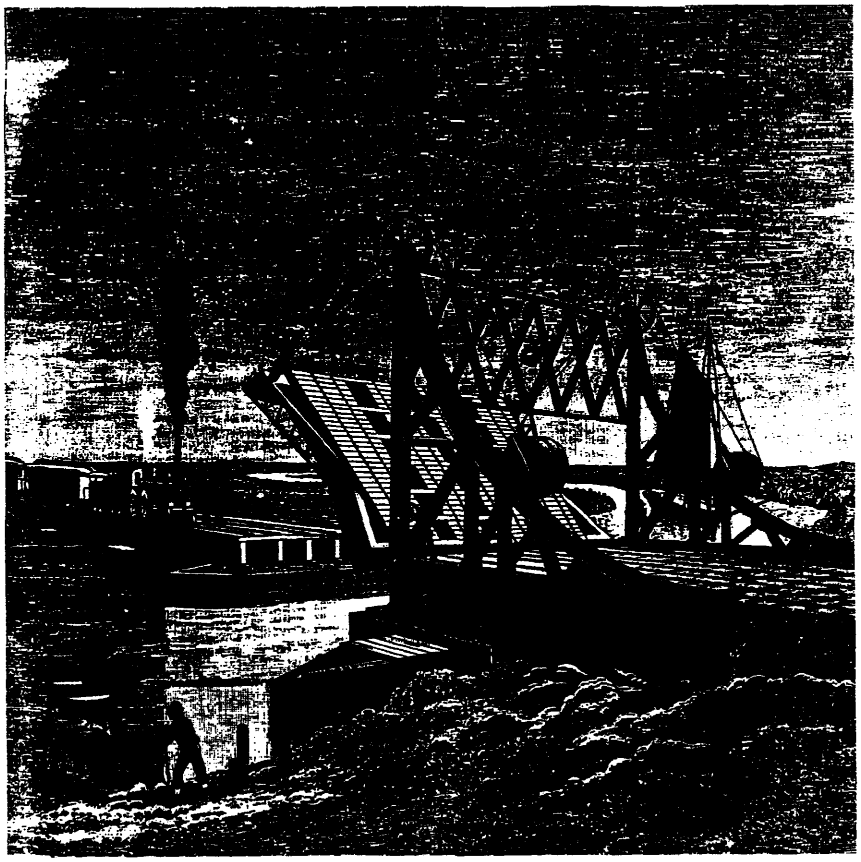

FIGURE 8-C

View of the "Counterweighted Lift Bridge on the Erie Railroad, near Rutherford, N.J." as depicted in the *Scientific American* in 1896.

Credit: "Counterweighted Lift Bridge on the Erie Railroad," *Scientific American (1845-1908);* Nov. 28, 1896; Vol. LXXV, No. 22.; APS Online, 389.

FIGURE 8-D

View of a bascule bridge crossing the main line of the canal after passing the Pompton Feeder Junction. This photograph shows a typical bascule bridge along the Morris Canal which permitted the railroads to cross the canal.

Credit: James Lee, *The Morris Canal: A Photographic History* (Easton, PA: Delaware Press, 1979), 104.

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GEOGRAPHICAL DATA

Verbal Boundary Description
The nominated structure is the bascule drawspan and wood timber trestle Brielle Road Bridge over the Glimmer Glass Creek (W-9) located along Brielle Road in the Borough of Manasquan. The bridge span runs east to west from the Atlantic Ocean inland. This timber trestle bridge with bascule drawspan is one of three bridges located at the confluence of the Glimmer Glass, Debbies Creek and Watson Creek and is located within the Borough of Manasquan, bordering the Borough of Brielle. Brielle Road Bridge W-9 spans the Glimmer Glass, a navigable waterway which connects the various lagoons within Manasquan and points north and west with the Atlantic Ocean via the Manasquan Inlet. The bridge, inclusive of both the timber trestle approaches and the drawspan, measures 279 feet in length; the timber trestle approaches measure 30 feet in width; the drawspan measures 20 feet in width and 31 feet in length.

Boundary Justification
The nominated structure includes the complete structure of the Brielle Road Bridge W-9, and the area historically associated with the bridge structure, inclusive of both the bascule drawspan and the timber trestle components and excluding the surrounding embankments. The bascule drawspan was placed at its current location in 1938 including the bascule leaf, the timber vertical portal which supports the counterweight mechanisms, the counterweight mechanisms and the operations house. The timber trestle components, while replaced in their entirety in 1949-50, are included here as they are an integral component of the Brielle Road Bridge; the timber trestle and bascule drawspan form a single structure and each component are significant to its operation.

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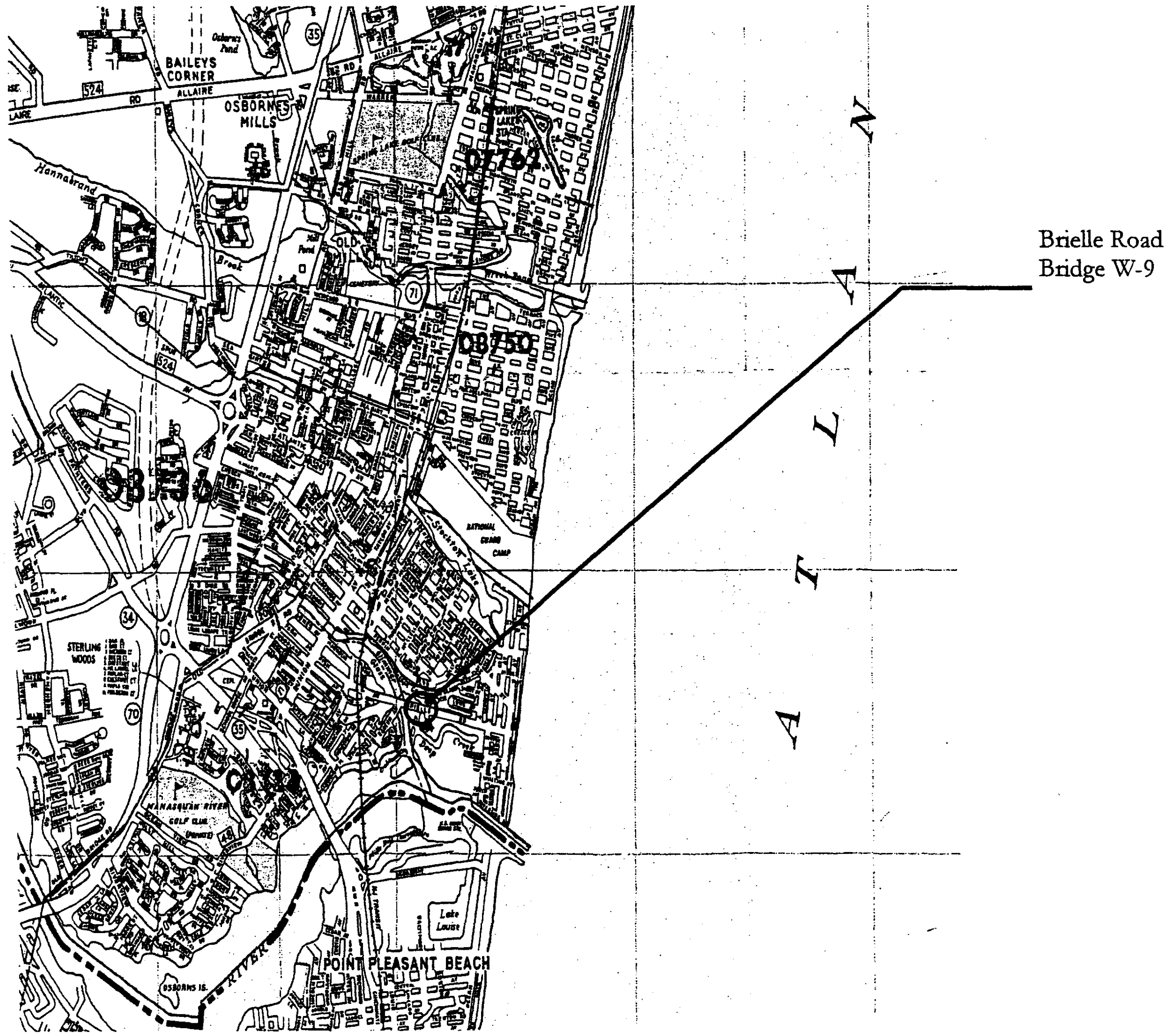
Location Map



Location Map

Location map showing the Brielle Road Bridge W-9.

Credit: *Map of Monmouth County* (Masbeth, NY: Hagstrom Map Company, Inc. 1996)

Photograph #1:
1. Brielle Road Bridge W-9
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking northeast from Green Avenue Bridge W-7.

Photograph #2:
1. Brielle Road Bridge W-9
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking northeast from Green Avenue Bridge W-7, showing drawspan in open position.

Photograph #3:
1. Brielle Road Bridge W-9
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Overall view of bascule drawspan looking southwest, showing relationship of drawspan with approach spans of the bridge.

Photograph #4:
1. Brielle Road Bridge W-9
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking southwest at downstream side of bridge; note relationship of bascule leaf to timber portal.

Photograph #5:
1. Brielle Road Bridge W-9
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View of bascule drawspan looking southwest while drawspan is being raised. Note position of counterweights along the curved track.

Photograph #6:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Overall view of bascule drawspan looking northeast. The first in a series of images showing operation of drawspan.

Photograph #7:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking northeast. Second in a series showing drawspan being raised.

Photograph #8:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking northeast. Third in a series showing the range of motion of bascule leaf.

Photograph #9:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking northeast. Fourth and final in series showing operation of drawspan. Bascule leaf is in full open position to permit vessels into channel.

Photograph #10:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking from Fisk Avenue (west) at bascule drawspan and approach.

Photograph #11:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking from the east on Brielle Road at bascule drawspan.

Photograph #12:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking northwest at bascule drawspan and fixed timber trestle. Note the position of the operator's house.

Photograph #13:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View looking at the timber portal, counterweights and roadway from Brielle Road looking west.

Photograph #14:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Detail view of bascule drawspan looking west with the bascule leaf in the open position. Note that the counterweights are at the bottom of the track.

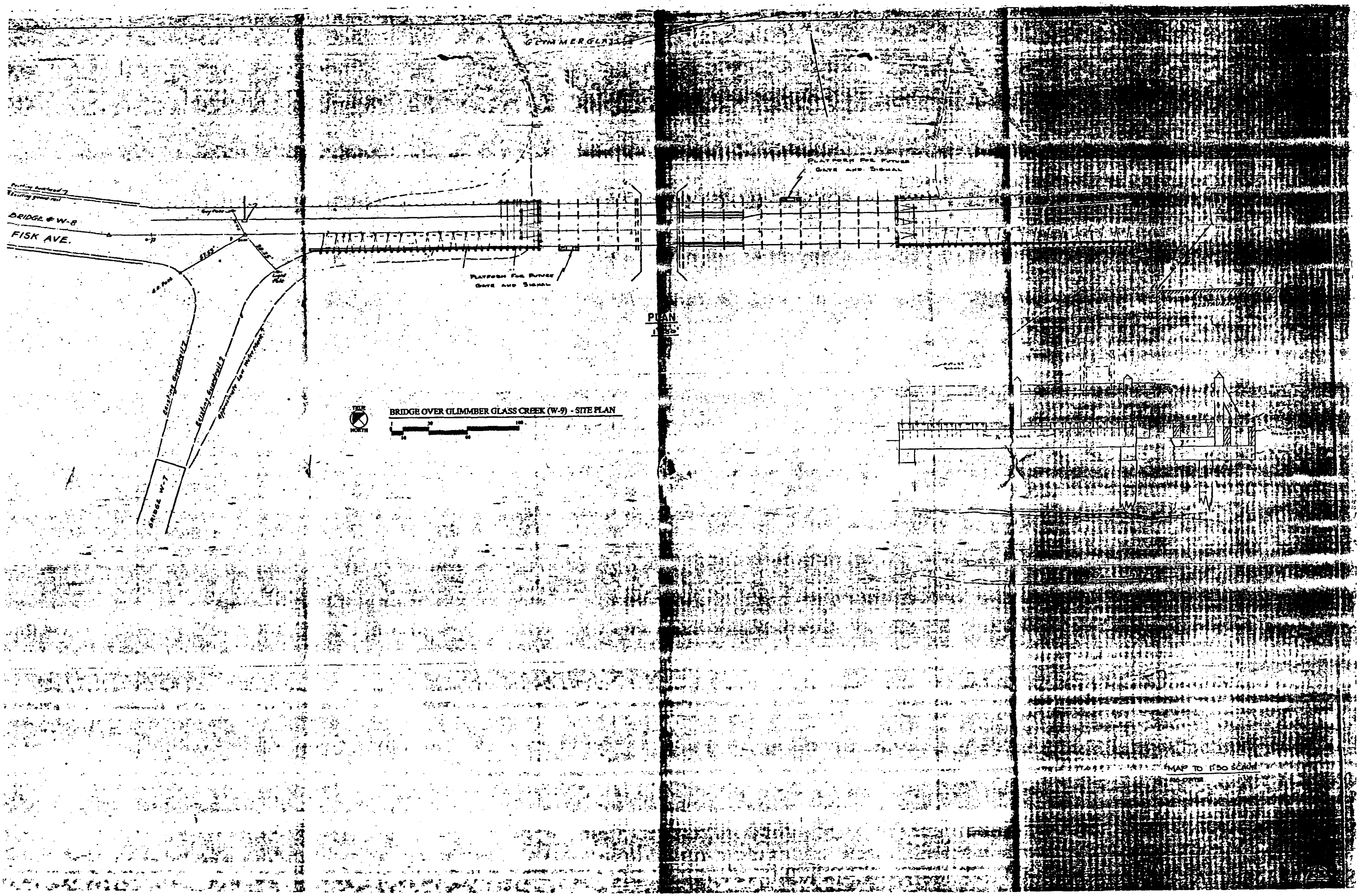
Photograph #15:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Detail view of bascule drawspan looking southeast from west side of bridge.

Photograph #16:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Detail view of counterweights showing cable position over sheaves and location of electric motor.

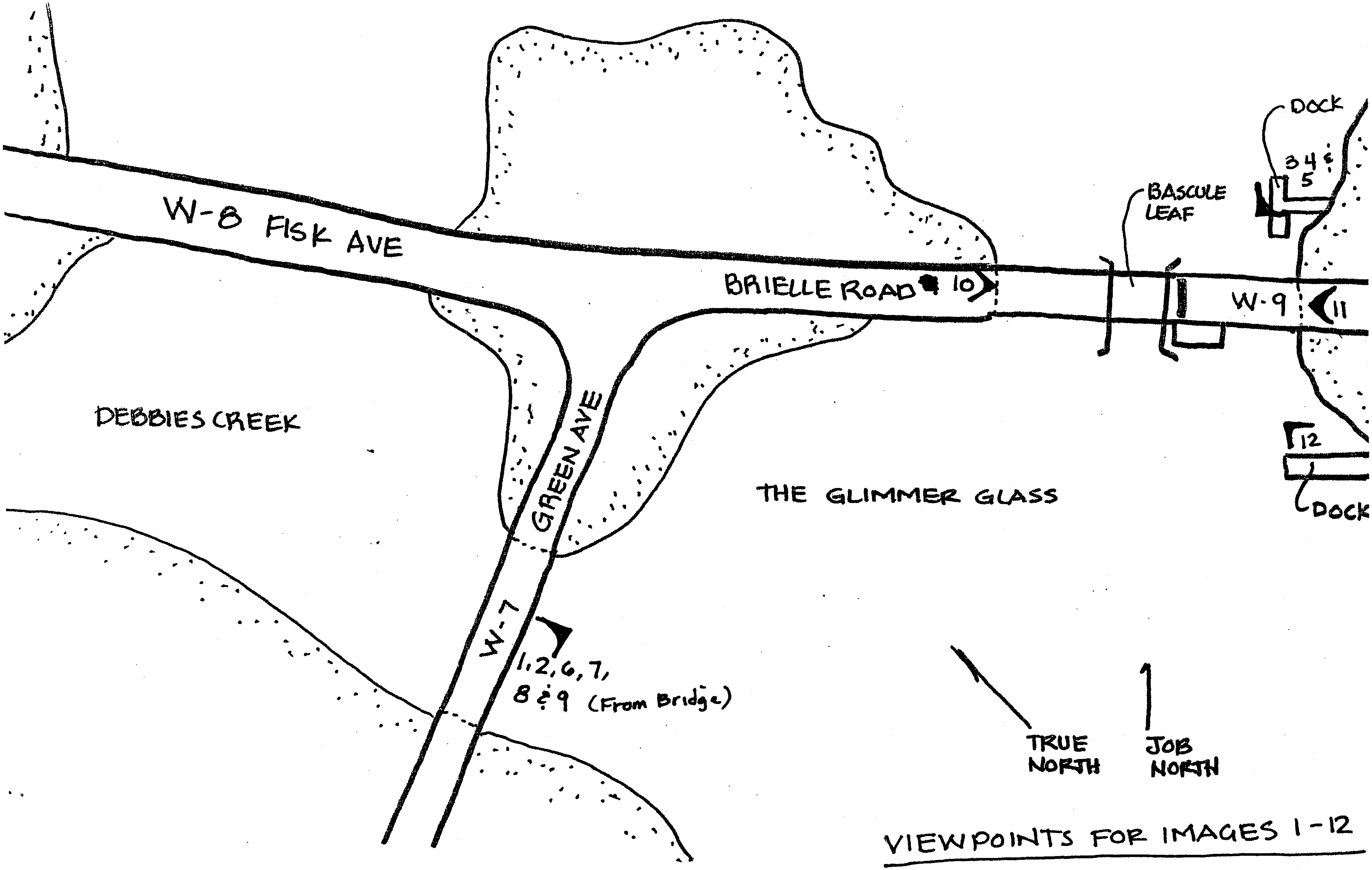
Photograph #17:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Overall view of curved track, counterweights and portal.

Photograph #18:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. Detail view of counterweights.

Photograph #19:
1. Brielle Road Bridge over the Glimmer Glass Creek (W-9)
2. Monmouth County, New Jersey
3. Margaret Hickey
4. July 2006
5. HJGA Consulting Architecture and Preservation, 36 Park Street, Montclair, NJ
6. View of wood blocks set at end of track as bumper for counterweights.



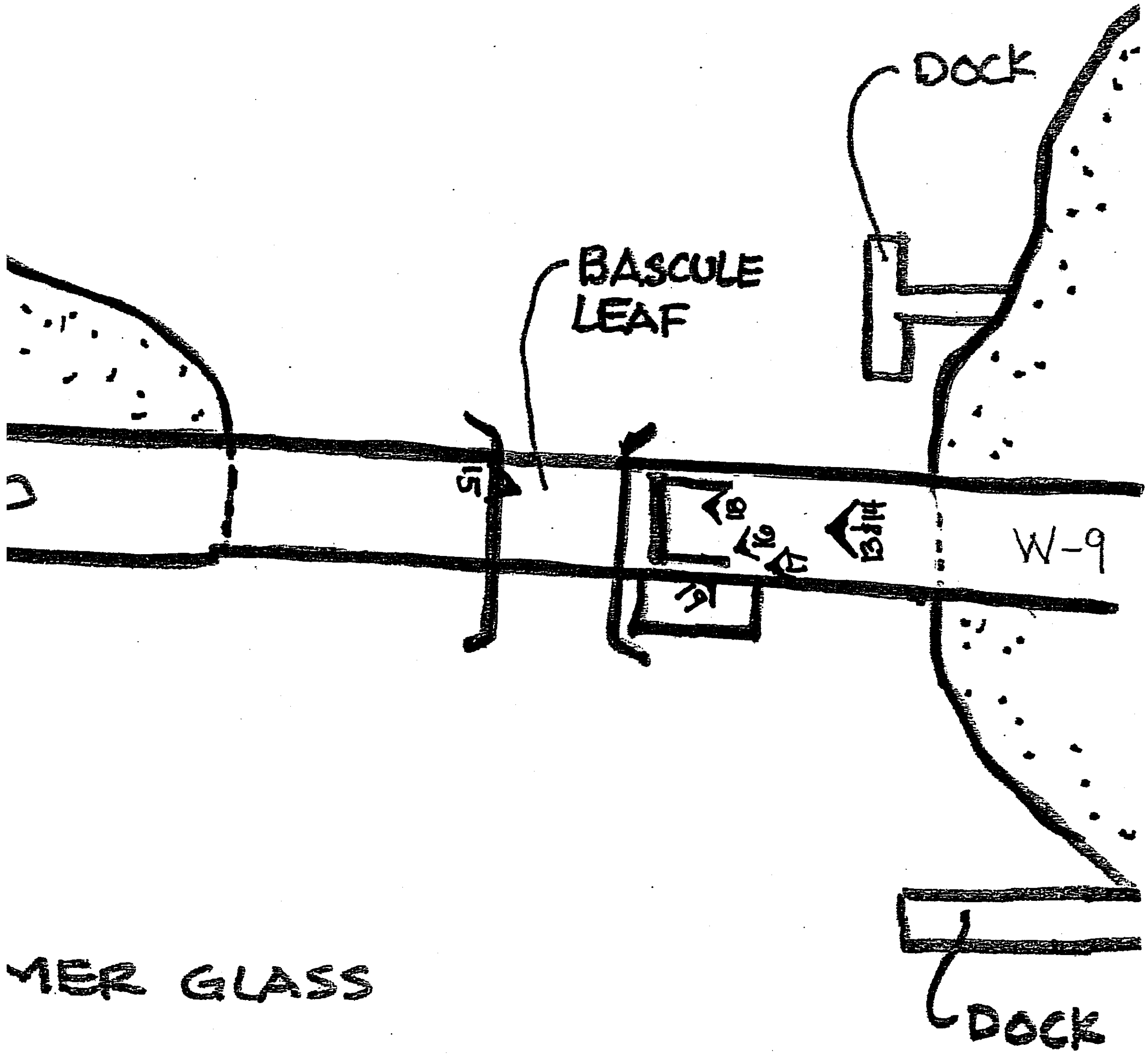
GLIMMERGLASS
PLATFORM FOR FUTURE GATE AND SIGNAL
BRIDGE # W-8
FISK AVE.
PLATFORM FOR FUTURE GATE AND SIGNAL
PLAN
Existing Guardrail
Existing Guardrail
BRIDGE W-7
TRUE NORTH
BRIDGE OVER GLIMMBER GLASS CREEK (W-9) - SITE PLAN

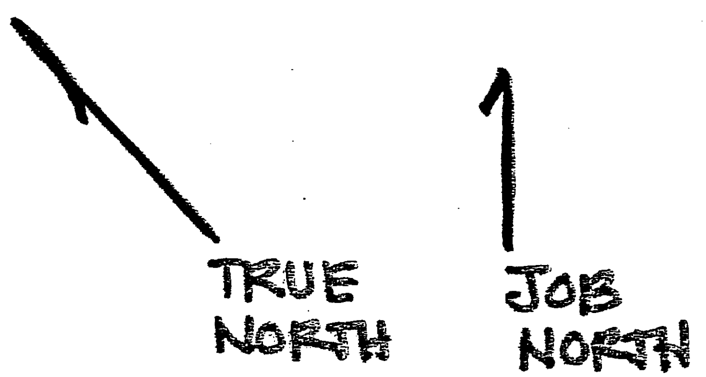


DIAGRAMMATIC PLAN @ BRIELLE ROAD BRIDGE W-9

NOT TO SCALE

Brielle Road Bridge over the Glimmer Glass Creek (W-9)
Monmouth County, NJ



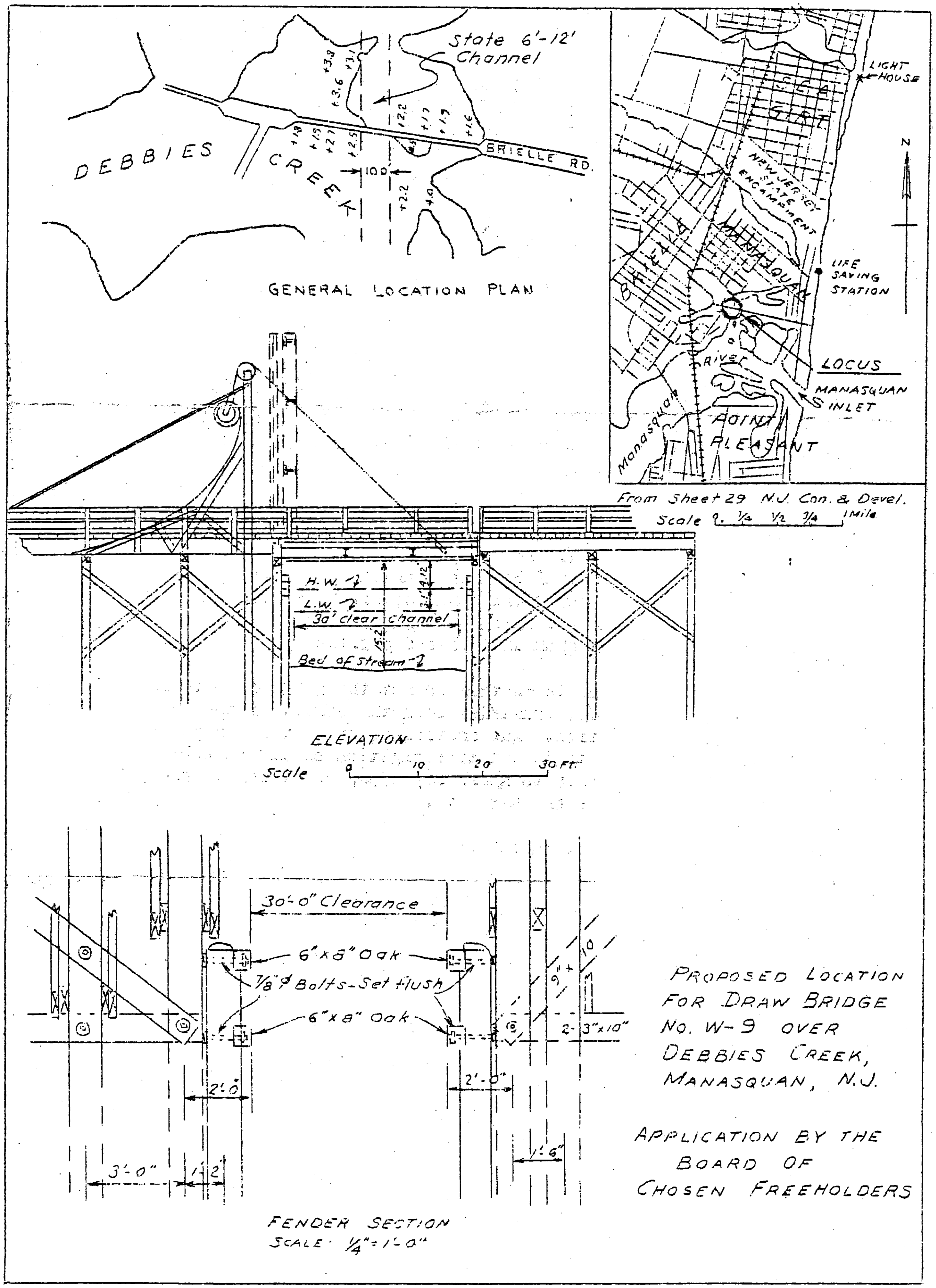


VIEWPOINTS FOR IMAGES 13 - 19

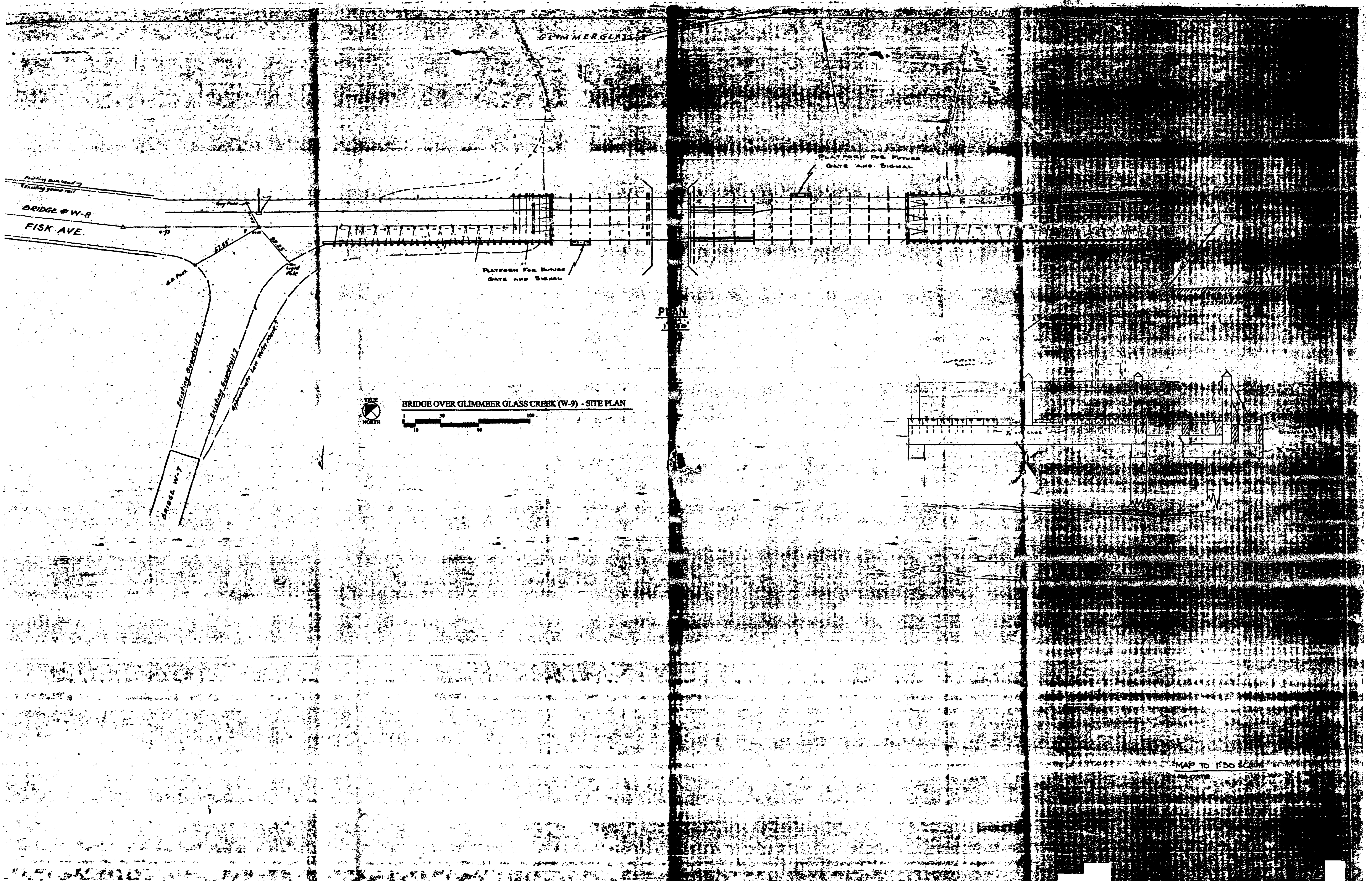
NOT TO SCALE

Brielle Road Bridge over the Glimmer Glass Creek (W-9)
Monmouth County, NJ

FIGURE 8-F



(c. 1938)



GLIMMERGLASS
BRIDGE # W-8
FISK AVE.
Existing guard rail
Existing Guardrail
Approximate Low Water Front
BRIDGE W-7
PLATFORM FOR FUTURE GATE AND SIGNAL
PLATFORM FOR FUTURE GATE AND SIGNAL
PLAN
TRUE NORTH
BRIDGE OVER GLIMMBER GLASS CREEK (W-9) - SITE PLAN
MAP TO 1"=50 SCALE