

SAWMILL RIVER CULVERT/FLUME INSPECTION Yonkers, New York



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100 Snake Hill Road
West Nyack, NY 10994

August 2006
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EXECUTIVE SUMMARY

During the summer of 2006, the McLaren Engineering Group (MEG) conducted an inspection of the Yonkers Culvert/Flume, located in the City of Yonkers, New York. The purpose of the inspection was to document the condition of the existing culvert/flume structures, prepare a condition survey report which presents the existing conditions, and makes comparisons with the findings provided in the Flume Investigation Report prepared for the City of Yonkers by Cahn Engineers, Inc in December 1978 (prior Flume Report).

The inspection included a one hundred percent visual inspection of the culvert/flume structures, beginning at the Hudson River and continuing upstream to the spillway located near Waring Row. Any areas of observed structural deficiencies or deteriorated elements and abutments and retaining wall undermining were fully documented, including photographs attached to this Report.

Close attention was paid to the areas of significant deterioration noted in the prior Flume Report. It was found that most of the areas of deficiencies noted in 1978 have not been addressed as of the summer of 2006.

Overall, the flume is generally in fair condition. This report documents areas where stone masonry footings are undermined, where most of these locations are localized to areas of the flume higher velocities or change in channel alignment. It is recommended that the undermined stone masonry elements be repaired to prevent potential damage to the various building structures upon which they are founded. Cracks, voids, and areas of missing grout in the concrete, and masonry walls should be repaired to prevent further deterioration. Deteriorated roof elements observed are primarily a result of the wet and humid environment and lack of preventive maintenance.

This Report does not include a structural analysis of the building adjacent or over the flume or the structural elements of the flume. It is recommended that each property owner have a detailed inspection and structural analysis by a Professional Engineer performed in order to determine the extent of which the deficiencies and deterioration observed have on the overall structural capacity of the individual buildings. The Flume

Study was prepared by for informational purposes only and is published in the Draft Environmental Impact Statement (DEIS) solely in response to the scoping document adopted by the City Council. No property owner is entitled to rely on the Flume Study, and each property owner is encouraged to perform their own inspection of the portion of the flume within their property to determine what repairs or maintenance, if any, is warranted by current conditions.

It is recommended that the trash rack at the upstream end of the flume at Ann Street should be reconstructed. This design should address stopping large debris from entering the flume, but not block high storm flows.

Within the open section of the River, upstream of Ann Street, many locations of deteriorated rip-rap and walls were observed. This Report assumes that this section of the River will be rehabilitated as part of the River Park Center project and these conditions will be addressed.

There are many locations where debris has collected within the flume. This ranges from large cobbles and stones to portions of trees and garbage. In order to restore full hydraulic capacity to the flume, it is recommended that debris should be removed from the flume. It is MEG's understanding that the City do not currently have any ownership interest in the portions of the Saw Mill River and the flume that are located within private properties, and will not have any such ownership interest during construction of the River Park City Project or after its completion. Therefore, the cleaning or debris within the private properties is the responsibility of the owners.

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LOCATION PLAN

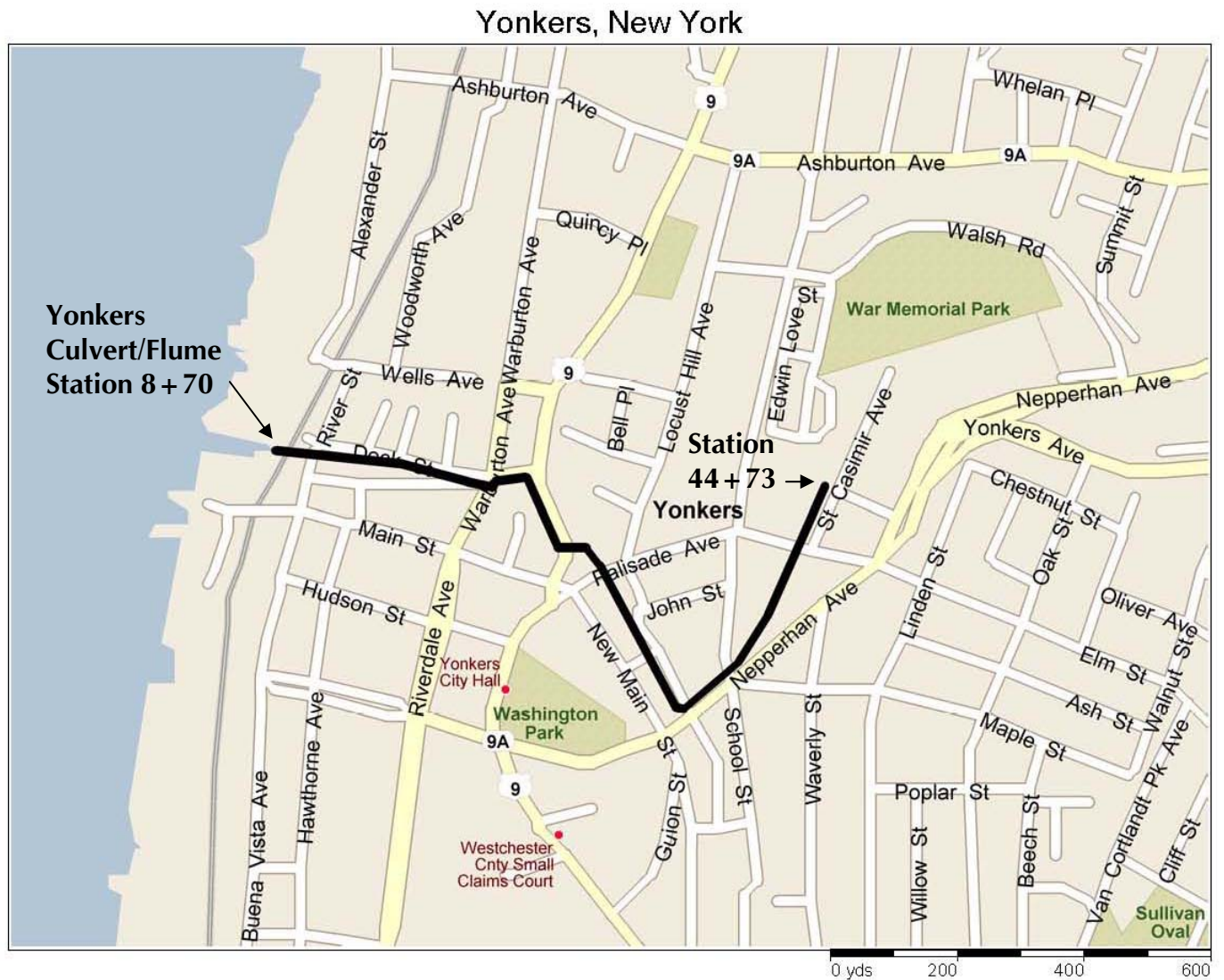


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1. INTRODUCTION

During the summer of 2006, the McLaren Engineering Group (MEG) conducted an inspection of the Yonkers Culvert/Flume, located in the City of Yonkers, New York. The purpose of the inspection was to document the condition of the existing culvert/flume structures, and prepare a condition survey report which presents the existing conditions, and makes comparisons with the findings provided in the Flume Investigation Report prepared for the City of Yonkers by Cahn Engineers, Inc in December 1978 (prior Flume Report).

The inspection included a one hundred percent visual inspection of the culvert/flume structures, beginning at the Hudson River and continuing upstream to the spillway located near Waring Row (see Location Plan, page ii). Any areas of observed structural deficiencies and deteriorated or undermined elements of abutments and retaining wall undermining were fully documented. In addition, close attention was paid to the areas of significant deterioration noted in the prior Flume Report. Representative photographs of the observed conditions were obtained during the inspection. The photographs are referenced in the following Report and are included in Appendix A. Appendix B includes a Photo Location Plan that provides the approximate referenced stationing used for the inspection and the photograph locations. . A summary table of the Observed Deficiencies is included in Appendix C.

In order to obtain accurate information regarding the extent of deterioration and undermining of the stone masonry piers and walls, it was required that the inspection be conducted during periods of low flow throughout the early summer of 2006.

This report documents the observed conditions within the portions of the Yonkers Culvert/Flume inspected. The areas of deterioration, undermining, etc noted are based on the visual inspection by MEG personnel. The scope of the Report does not include structural analysis to determine if the deficiencies noted compromise the structural integrity of the buildings over or adjacent to the flume or the components of the flume.

2. INSPECTION PROCEDURES

In accordance with OSHA confined space a requirement, the inspection team was comprised of a 4-man OSHA trained and certified crew. The team was supervised by a registered Professional Engineer/Diver. Three different locations were used as entry points into the culvert/flume from which the inspection team conducted its operations. The inspection of the lower section of the culvert/flume was staged from shore just west of the Metro North Train Station. The entry point for the inspection of the middle section of the culvert/flume is located at the foot of Mill Street. Lastly, the upper section of the culvert/flume was inspected from the upstream fascia of the Ann Street Bridge.

During the inspection of the enclosed sections of the flume/culvert, the inspectors carried self-contained air sources, breathing regulators, pick hammers, awls, tape measures, a digital camera, and a digital videotape recorder which were each encased in waterproof housings. In addition, the inspection team carried a three-gas meter which continuously monitored the air quality in the culvert/flume during the inspection.

Communications were maintained with topside safety personnel using handheld VHF radios. The topside personnel were responsible for implementing rescue operations in the event of an emergency.

3. OBSERVED CONDITIONS AND ASSESSMENTS

The Yonkers culvert/flume is located beneath various buildings, streets and parking lots in the city of Yonkers, New York. The culvert/flume conveys the Saw Mill River from the area north of School Street to the Hudson River. The culvert/flume is approximately 3600 ft long and consists of many distinct types of construction.

The general location of the culvert/flume in relationship to the streets and building along the route is presented in the Location Plan on Page ii and the Photo Location Plans in Appendix B. In order to provide a comparison with the findings in the previous report, the

culvert was continuously stationed beginning at its west end (downstream end). For the purposes of this report, reference to the “left wall/embankment” and “right wall/embankment” are based on looking upstream.

A description of the various structure types and observed conditions are noted below.

3.1 *Hudson River to mouth of Saw Mill River*

The Saw Mill River is a tributary of the Hudson River. As seen in Photos 1 and 2, the river flume discharges from beneath the Metro North Train Station into a 400' long by 100' wide tidal basin before it eventually reaches the Hudson. A concrete seawall has been constructed along the southern shoreline of the basin, and the northern shoreline is currently in the process of being developed (see Photo 3).

In addition, construction of a new roadway bridge is underway just west of the Metro North Train Station. As seen in Photo 4, a new steel sheet pile bulkhead has been installed adjacent to the north abutment of the bridge which supports the Metro North Train Station.

The mean high tide elevation of the Hudson River at the mouth of the Saw Mill River is approximately elevation 2.6. This indicates that the lower portion of the Saw Mill River in this area is subject to tidal fluctuations on a twice-daily basis. This tidal effect has an influence to approximately halfway between Bashford Street and Woodsworth Avenue.

3.2 *Bridge beneath Metro-North Railroad Tracks*

Bridge No. HU 15.25 extends under the Hudson line of the Metro-North Railroad. The bridge is approximately 29.5 feet wide by 10 feet high and is approximately 188 feet long. A general view of the west fascia of the bridge is provided in Photo 5. Overall, the bridge is in fair condition.

The bridge abutments and wingwalls typically exhibit moderate to heavy concrete scale within the tidal zone, see Photo 7. A layer of silt and fine stone covers the 12 in. by 4 in. timber cribbing/matting foundation of the north and south abutments. Overall, the construction joints exhibit areas of chamfer spalls and erosion in the tidal zone. Photo 8 provides a general view of typical construction joint located at the North Abutment. At the South Abutment, a 2' high by 1' wide by 3" deep spall is located at the construction joint at Station 9+43.

Along the North Abutment, the construction changes from concrete to masonry at Station 9+91 and continues to Station 10+41. Grout loss between the masonry is approximately 25 percent. Also, at Station 9+91, the remains of a pre-existing timber sheet wall extend, at the face, through to its terminus at Station 10+50. The construction joints typically exhibit minor edge spalling and gaps up to 1-1/2 inches wide.

The construction changes to masonry blocks between Stations 9+91 and 10+19 at the South Abutment. At Station 9+91, there is a void due to missing masonry. The void measures approximately 5 ft wide by 3 ft high and is 3 inches deep. Subsequently, the masonry block directly above this deficiency exhibits a downward displacement due to lack of support. The remains of a pre-existing timber sheet wall can be found from Station 9+91 through Station 10+50.

A general view of the underside of the bridge deck is shown in Photo 9. As depicted in Photos 10 through 11, the concrete beams typically exhibit multiple 1/8" to 1/4" wide cracks, spalls and areas of delamination along the bottom 6 inches of the concrete beams. These cracks vary in size, but are typically 6 ft in length. In addition, many of the concrete diaphragms have large spalls with exposed reinforcement (see Photo 12).

3.3 *Concrete Arch Culvert located beneath Larkin Plaza*

The 8' high by 20' wide concrete arch culvert begins at Station 10+59. As indicated in prior Flume Report, the reinforced concrete is 12" to 15" thick at the crown, and 15" thick at the base. General views of the downstream and upstream culvert headwalls are shown in Photos 13 and 14 respectively. As seen in the Photo 13, the downstream headwall exhibits areas of vertical cracks with efflorescence. In addition, there is approximately 2' of freeboard between the top of the arch and the water surface at mean high tide.

The mean high tide elevation of the Hudson River at the mouth of the Saw Mill River is approximately elevation 2.6. This indicates that the lower portion of the Saw Mill River in this area is subject to tidal fluctuations on a twice-daily basis. This tidal effect has an influence to approximately halfway between Bashford Street and Woodsworth Avenue. As seen in Photo 15, a hydraulic jump is created at the confluence of the supercritical flow from the flume and backwater due to the tidal waters of the Hudson River.

Overall the concrete arch culvert is in fair condition. The concrete arch typically exhibits localized areas of minor map cracking with efflorescence (see Photo 16). Upstream of Station 14+50, the culvert floor is lined with masonry pavers. As seen in Photo 17, many of the pavers are severely deteriorated as a result of excessive flow. The construction joints between sections of culvert typically exhibit minor chamfer spalls and loss of joint filler.

A number of underground sanitary and/or storm sewers discharge into the existing flume. The discharge pipes range in size from 6" diameter to a maximum of 36" diameter. Photo 18 provides a general view of a 36" diameter storm sewer pipe penetration. In addition, there is a 72" brick sewer along Main Street with a 24" overflow which empties into the flume near Market Street.

3.4 Warburton Avenue Bridge

The brick arch bridge located beneath Warburton Avenue is approximately 39.5' wide by 51.5' long. A general view of the transition between the upstream concrete arch culvert headwall and the brick arch bridge is shown in Photo 19. The top of the brick arch, as measured from the concrete floor, is 16.4' and 15.6' at the downstream and upstream faces, respectively. The height of the stone abutments is approximately 9.6'.

Stone masonry walls have been built along the western half of the bridge in order to divert flow into the 20' wide concrete arch culvert located downstream of the bridge (see Photo 20). The presence of these walls indicates that culvert was constructed subsequent to the brick arch bridge. Overall the arch is in fair condition with no displaced or missing bricks. Scattered areas of efflorescence were observed throughout the arch with the heaviest concentration primarily in the vicinity of the utility trunk penetrations (see Photo 20).

The stone abutments and diversion walls typically exhibit isolated areas of missing grout with no missing or displaced stones. Overall the concrete floor exhibits moderate scale and erosion throughout. No voids or areas of broken concrete were observed.

The upstream faced of the arch is approximately 3' to 4' from the adjacent building fascia. As seen in Photo 22, corrugated steel formwork supports the section of concrete sidewalk between the eastern face of the arch and the adjacent building.

3.5 Section of the Flume between Warburton Avenue Bridge and Mill Street opening

The buildings located above the Warburton Avenue Bridge are primarily founded on stone masonry piers. The piers are typically 3' wide by 4.5' long and support brick arches which support the common walls between the adjacent buildings. The buildings along the east side of Warburton Avenue exhibit an 18' span between the western and center piers. In addition, a full height masonry wall has been constructed between the

western piers.

A combination of timber and steel girders span between the piers, perpendicular to the brick arches. The girders support 3" x 12" timber members that are spaced approximately 16" on-center. A variety of sub-flooring materials are located upon the timber floor joists.

Photo 23 provides a general view of the brick building fascia and steel girders which span the river at the transition to the Warburton Ave. Bridge. As seen in Photos 24 and 25, the south end of the steel girders exhibit moderate corrosion while the north end is severely deteriorated with corrosion holes throughout the web. Photo 26 provides a general view of the severely corroded bottom flanges of the steel members.

This corroded and deteriorated condition was previously noted in the prior Flume Report. In addition, the prior Flume Report noted water infiltration through the north wall in the vicinity of the girder. No active water infiltration was observed during this inspection.

Repairs to the timber beams located directly east of the severely corroded steel girders were observed during the inspection. As seen in Photos 27 and 28, the timber joists adjacent to the north end of the steel beams have been jacked-up and supported with built-up timber members. The timber support members have been installed atop a section of severely deteriorated stone masonry pier.

Heading upstream from the Warburton Avenue Bridge, the river turns approximately 90 degrees to the left and runs parallel to Warburton Avenue for approximately 55' (see Photo 29). As seen in Photo 30, the primary flow at this location is directed between the western and center piers. Many of these piers are in poor condition due to missing stones and undermining which has resulted from high velocity conditions and change in channel direction.

Overall, the eastern piers at this location are in fair condition and typically exhibit only areas of minor deterioration. Although they were basically dry during the duration of the inspection, a build-up of scattered debris and small stones indicates that there is significant flow between the center and eastern piers during periods of flooding (see Photos 31 and 32). A general view of a constructed concrete foundation wall located at the southeast corner of the flume is shown in Photos 33 and 34.

Various repairs have been made to the buildings throughout this area of the flume. As depicted in Photos 35 and 36, a large section of timber framework has been replaced with a concrete floor supported by concrete encased steel beams. At many locations, the original timber board subflooring has been replaced with concrete or plywood (see Photos 37 and 38).

The river makes a 90 degree turn to the right approximately 38' south of Manor House Square and continues parallel to the south edge of the square in an easterly direction. General views looking downstream from this turn are shown in Photos 39 and 40. As seen in Photos 41 and 42, a concrete encasement repair has been made to the center pier located at inside corner of this turn. The pier is undermined up to 1.5' high with a 2' penetration at the northwest corner.

Photo 43 provides a general view of the area of the flume located directly beneath Manor House Square. This area is constructed of steel beams and brick arches, which are supported by stone masonry walls along the north end and stone masonry piers and brick arches at the south end. In addition, in this area the flume has a concrete floor located approximately 3' above the observed water level. Although this section of the flume does not convey normal/low flows, larger storm events have deposited large stones, scattered debris and a 2' diameter section of tree stump atop the concrete floor (see Photo 44).

Overall this section of the flume is in fair condition. No missing or displaced stones were observed in the masonry walls. Hairline and 1/16" wide vertical cracks with efflorescence were observed at two locations along the wall. The brick arches are located

approximately 12' above the concrete floor in this location, thus precluding close inspection of the bottom flange and brick arches. A visual inspection of the beams indicated minor to moderate corrosion of the exposed sections of the bottom flanges. In addition, rust staining extended down the top of the stone masonry walls. Map cracking with efflorescence was observed at the majority of the brick arches.

The main flow of the river is located beneath the first building downstream of the Mill Street opening. Similar to the properties which abut Warburton Avenue, the building is founded on stone masonry piers which support brick arches. General views of this section of the flume are shown in Photos 45 and 46. In this stretch of the flume, the only steel member used as a girder is located between the westernmost stone masonry piers. The remaining three girders are constructed of 12" by 12" timber members strengthened with ¼" thick steel plates attached to the vertical faces. As seen in Photo 48, there is 1/8" to 1/4" wide crack across the bottom face of the girder located at Station 19+50. The other timber girders and the timber 3" by 12" floor joists typically exhibit isolated areas of minor rot and water seepage.

A general view of the opening to the flume located at the foot of Mill Street is shown in Photo 49. As seen in Photo 50, there is a void at the base of the stone masonry wall located directly across from the opening.

3.6 Section of Flume between of Mill Street opening and North Broadway Bridge

The first two properties upstream of the Mill Street opening and the last two properties downstream of the Broadway Bridge are founded on stone masonry piers and walls. The remaining properties are founded on stone masonry walls which support steel beams and brick arches.

The first property upstream of the opening is in fair condition. A general view of the flume located directly upstream of the Mill Street opening is shown in Photo 51. The stone masonry piers typically exhibit areas of missing grout and minor undermining. As depicted

in Photos 53 and 54, a wide diagonal crack exists in the corner of the building located directly upstream of the Mill Street opening. The crack is approximately 8' long and up to 1" wide and translates from the north to the west face of the structure. The section of the crack along the west face has been repaired by epoxy injection.

The first floor of the building is supported by a combination of steel girders and steel floor beams. As seen in Photo 55, the bottom flanges of the floor beams have been encased in concrete and terra cotta furring tiles have been inlaid between them. In addition, the webs of steel girders have been encased in concrete. Overall, the bottom flanges of the steel girders are in fair condition and exhibit isolated areas of minor corrosion.

The second property upstream of the opening is presently abandoned. The prior Flume Report also noted that this property was not occupied and that a large portion of the basement and upper floors were missing. Downstream and upstream views of the flume and abandoned property are shown in Photos 56 and 57.

Much of the steel framework supporting the floors of the abandoned building are founded on brick and concrete columns, which are considerably smaller than the stone masonry piers walls that support many of the other buildings throughout the flume. The remnants of a failed brick column and its displaced concrete footing are shown in Photos 59 and 60. As seen in Photos 61 and 62, sections of the first and second floors of the structure are missing, as noted in the previous report three decades ago.

The buildings upstream of Station 20+75 are founded on stone masonry walls which support steel beams and brick arch construction. A general view of the flume looking downstream from Station 21+00 is shown in Photo 63. As seen in Photo 64, a four foot high concrete wall is located along the north half of the channel at Station 20+75. This wall appears to have been constructed in order to protect the smaller building columns located downstream from further deterioration during periods of high flows.

A total of 46 brick arches are located between Stations 20+75 and Station 23+35. General views of the brick arches and the channel in this area are shown in Photos 65 through 68. The exposed bottom flanges of many of the steel beams located between Station 22+12 and 23+35 exhibit heavy to severe corrosion. A typical steel beam with heavy corrosion is depicted in Photo 69. This area of heavy corrosion is most likely due to the infiltration of water through the top of the brick arches.

As seen in Photo 70, the timber framework in the brick arch opening exhibits severe rot and there is visible water seepage around the opening. In addition, the steel beams in the photo are severely corroded. This condition cannot solely be attributed to the moisture in the flume, as the brick arches located downstream of this property do not exhibit the same degree of deterioration. The bricks in this section of flume do not exhibit the formation of efflorescence on the as observed in the downstream brick arches, indicating that this area is subject to constant wet conditions.

Upstream of Station 23+35, the difference in construction between the north and south sides of the flume appears to be governed by a property line which cuts diagonally across the waterway. As seen in Photo 72, the left side (north) of the channel is constructed with steel beams and a concrete deck. Only the bottom flanges of the beams are exposed as the webs are encased in concrete. The flanges typically exhibit minor corrosion. Severe concrete scale and exposed reinforcement was observed at the underside of the concrete deck (see Photo 73). This condition may be the result of insufficient concrete cover between bottom of the deck and the steel reinforcement.

Corrugated steel formwork rests atop a combination of timber logs and steel beams along the right side (south) of the channel (see Photos 74 and 75). Although not typical construction, no signs of severe deterioration or structural distress were observed in this location during the inspection. The upstream limit of this section of the flume is located at Station 23+88. A view of the underside of deck downstream of the steel fascia beam, and the building fascia at Station 23+88 are shown in Photos 79 and 80, respectively. As seen

in the photos, although the fascia beam exhibits a significant loss of paint, the steel exhibits isolated areas of minor corrosion.

At Station 23+70, a stone masonry pier divides the two types of construction. As seen in the Photo 76, there is a significant build-up of debris along the face of the pier. Due to a change in direction in the flume at this location, the majority of the flow is directed to the channel along the south side of the pier. As a result, there are voids due to missing stones and undermining of the masonry wall along this section of the flume. Photos 77 and 78 show the general views of the observed undermining in this area.

3.7 North Broadway Bridge

The North Broadway Bridge is located between Stations 23+88 and 24+45. It is approximately 19' wide and there is 13' between the bottom of the concrete deck and the river bottom. Downstream and upstream views of the bridge are shown in Photos 81 and 82, respectively. As seen in the photos, the original steel beam supported deck has been reconstructed with a cast-in-place concrete slab deck. Remnants of the cut-off steel stringers can be seen at the top of the stone masonry abutments.

A 16' long by 5' high by 3' deep void is located along the left wall (looking upstream) between Stations 24+22 and 24+38. As seen in Photo 83, the original abutment is located behind the new stone masonry. Due to the slope of the wall and rubble masonry construction, it appears that the outer wall may be a previous repair or scour protection measure to prevent the abutment from undermining. A 2' high by 2' wide concrete repair has been constructed along the base of the right abutment from Station 23+88 to 24+25 (see Photo 84).

3.8 Section of Flume between North Broadway Bridge and Palisade Avenue Bridge

Upstream of the Broadway Bridge, the flume travels beneath two buildings which are supported by a combination of stone masonry and brick walls, and steel columns. A

general view of the flume looking upstream from Station 24+50 is shown in Photo 85. As depicted in the photo, steel girders run longitudinally between the steel columns and support timber floor joists. Stucco has been applied along the bottom face of the floor joists. Along the right wall, there is an area of missing stucco located in the vicinity of Station 24+60. The exposed timber beams at this location exhibit moderate to severe rot (see Photo 86). The 14' distance between the bottom of the joists and the streambed at this location precluded a hands-on inspection of this area.

The wall along right side of the flume appears to be the buildings original exterior fascia before the River was covered. As seen in Photo 87, some of the window openings in the basement of the building have been sealed closed with masonry blocks. A stone and concrete ledge has been constructed as scour protection along the base of the wall from Station 24+45 to 24+75. The downstream 11' of the ledge exhibits up to 2' high by 1' deep erosion (see Photo 88).

Heading upstream, the flume turns approximately 30 degrees to the right (southeast) at Station 25+25. A general view looking upstream from Station 24+75 is shown in Photo 89. As a result of the change in stream channel alignment, an 8' long by 3' high by 4' deep void is located in the left wall at Station 25+10 (see Photo 90). Upstream and downstream views of the flume from Stations 25+50 and 25+60 are shown in Photos 91 and 92, respectively. As seen in Photo 92, a significant amount of debris has accumulated at the base of the steel column located at Station 25+25. This is typical of all the steel columns in this section.

3.9 *Palisade Avenue Bridge*

The Palisade Avenue Bridge is located between Stations 26+16 and 26+64. A general view of the downstream bridge fascia is shown in Photo 93. The bridge is approximately 32' wide and ranges in height between 7' and 9.5' at the upstream and downstream fascias, respectively.

Overall the stone masonry arch is in fair condition with no missing or displaced stones. Photo 94 provides a general view of the underside side of the arch. Approximately 15 percent of the joints exhibit 1" to 3" deep areas of missing grout. In addition, efflorescence was observed at more than half the joints. The concrete floor of the bridge is generally in fair condition and exhibits localized areas of severe concrete scale. At the downstream fascia of the bridge, there is a concrete floor bench approximately 1' higher than the downstream channel bottom.

3.10 Section of Flume between Palisade Avenue Bridge and Ann Street Bridge

Upstream of the Palisade Avenue Bridge, a series of stone masonry piers divide the waterway into two channels. General views of the left and right channels looking upstream from Station 26+64 are shown in Photos 95 and 96, respectively. As depicted in the Photo 95, a 10' wide stone wall located along the left side of the channel limits the width of the waterway to approximately 9'. As a result, the majority of the flow in this section of the flume is directed towards the 27' wide channel located to the right side of the pier. At the nose of the 46' long pier (Station 27+00), a 3' high accumulation of debris has created a small dam which stretches across the right channel.

A general view of the flume looking downstream along the right side of the channel from Station 27+42 is shown in Photo 98. A second 18' long by 4' wide pier stone masonry pier is located between Stations 27+27 and 27+45 (see Photo 99). The stone masonry walls or piers in this section of the flume typically exhibit minor grout loss. No significant voids or undermining was observed at this section of the flume.

Overall, the steel beams and girders which support the buildings above this section of the flume are in fair condition and exhibit minor to moderate corrosion. The application of stucco has precluded the inspection of the timber floor joists in this area.

As seen in Photo 100, a steel beam delineates the transition in construction located at Station 27+66. The beam has approximately 25 percent loss of coating and areas of

minor corrosion. Upstream of Station 27+66, the flume is supported of 16" wide by 2' high concrete beams which are spaced approximately 6.5' on-center. Overall the beams are in fair condition and exhibit isolated areas of minor spalls with exposed reinforcement. In this section of the flume, 6' and 9' wide by 3' to 4' high stone walls have been constructed along the left and right flume walls, respectively (see Photo 100). The flume channel in this area is approximately 20' wide.

A transition in construction occurs at Station 28+30 (see Photo 101). As seen in the photo, rigid foam insulation has been applied to the concrete beams in this section of the flume. Minor areas of missing insulation were observed throughout this section of the flume (see Photo 103). The exposed concrete beams at these locations were typically in good condition with isolated areas of minor deterioration. The upstream limit of the foam insulation occurs at Station 28+94.

The next section of the flume supports a parking lot located just north of the Ann Street Bridge. This section of the flume is supported by 30" high concrete beams and a concrete deck. Approximately 10 percent of the bottom of the beams exhibit large spalls with exposed reinforcement. Photo 104 provides a general view of the floor looking upstream from Station 28+94.

The stone wall along the right side of the culvert continues upstream to Station 29+75. At Station 28+94 the construction of the wall along the left side of the flume changes from rubble stone to brick. This wall continues upstream until Station 29+35. At Station 30+60, there is a 6' return in the left wall and the overall width of the flume is reduced from 36' to 30' between the left and right walls.

3.12 Ann Street Bridge

The Ann Street Bridge is approximately 75' long by 30' wide. The bridge is constructed of reinforced concrete abutments which support cast-in-place reinforced concrete beams and a concrete slab. The concrete beams are 18" wide by 18" deep and

are spaced approximately 4' on-center. A general view of the underside of the concrete beams and the upstream entrance to the flume is shown in Photo 105. As seen in the photo, the steel support beams are the only remnants of a trash rack that was located at the entrance to the flume.

Overall the bridge is in fair condition. The concrete beams typically exhibit minor longitudinal cracks with efflorescence and isolated concrete spalls with exposed reinforcement. Hairline to 1/16" wide vertical cracks were observed at a few locations along the left and right abutments. A concrete floor has been poured beneath the limits of the bridge. Although the majority of the floor is covered by small stones, silt, debris, the exposed sections of concrete were in fair condition with moderate scale.

3.13 Open channel between Ann Street Bridge and Henry Herz Street Bridge

The riverbanks along the 216' open reach between the Ann Street and Henry Herz Street bridges is comprised of a combination of stone masonry walls, concrete block walls, and an earthen bench. As depicted in Photo 106, at the interface of the Ann Street Bridge's southeast wingwall, there is a 10' long by 5' high by 3' deep void at the base of the upstream stone masonry wall.

Upstream along the left (east) embankment, there is a change in construction from stone masonry wall to concrete block wall at Station 31+40 (see Photo 107). As seen in the foreground of the photo, a heavily vegetated earthen bench is located between the 6' high block wall and the river's edge. The bench extends from Station 31+10 to 32+50 and is approximately 15' to 20' wide and sloped 4ft to 6ft high above the river bottom at the interface of the concrete block retaining wall. A general view of the river looking upstream from Station 31+15 is shown in Photo 108.

From Station 32+30 to 33+16 (downstream fascia of Henry Herz Street Bridge), the concrete block wall has been constructed atop a section of stone masonry wall. Photo 109 provides a general view of the river looking upstream from Station 32+50.

Overall the stone masonry wall is in poor condition. It exhibits up to 2.5' high by 2' deep areas of missing stones/undermining from Station 32+50 to 33+16 (see Photo 110). In addition, up to 1" wide full height vertical cracks are located at Stations 32+30 and 32+60. The wall exhibits some degree of overturning as it has rotated out of plumb and leaning towards the river channel.

Upstream of the Ann Street Bridge, along the right (west) embankment, a concrete repair has been installed at the base of the stone masonry wall. A general view of the concrete repair and the upstream fascia of the Ann Street Bridge are shown in Photo 111. The concrete repair is located between Stations 31+07 and 32+10. As seen in Photo 112, the concrete repair is undermined up to 1' high by 2' deep between Stations 31+03 and 32+10.

The masonry wall extends along the right embankment from Station 31+08 to 32+00, and again from Station 32+40 to 32+75. A general view of the embankment between the above-noted sections of masonry wall is shown in Photo 113. As depicted in Photo 115, a 5' high by 6' deep void in the stone wall is located between Stations 32+23 and 32+48. Overall, the stone masonry wall is in poor condition. Many sections of the wall indicate previous failures and have areas of missing mortar and chink stones and intrusion of vegetation. All these conditions contribute to its deteriorated condition noted (see Photo 114).

From the upstream limit of the masonry wall (Station 32+75) to the downstream fascia of the Henry Herz Street Bridge (Station 33+16), the riverbank is comprised of destabilized riprap, earth, and thick vegetation. Photo 116 provides a general view of the river looking downstream from the Henry Herz Street Bridge.

3.14 Henry Herz Street Bridge

The Henry Herz Street Bridge is approximately 49' long by 30' wide. The bridge is constructed of reinforced concrete abutments which support cast-in-place reinforced

concrete beams and a concrete slab. A general view of the underside of the concrete beams and the waterway beneath the bridge is shown in Photo 117.

Overall the concrete abutments and beams are in fair condition and exhibit isolated areas of minor deterioration. The river bottom at the bridge consists of small stone with scattered debris. At Station 33+30, there is 8.4' and 9.2' between the mudline and the bottom of the beams at the left and right abutments, respectively.

3.15 Parking Lot between Henry Herz Street Bridge and School Street Bridge

Located between the Henry Herz Street Bridge and the School Street Bridge, the River runs beneath the municipal parking lot. A general view of the south abutment at the transition between the Henry Herz Street Bridge and the parking lot structure is shown in Photo 118. Beneath the parking lot, the flume is founded on concrete walls which support 16" wide by 20" deep reinforced concrete beams and a reinforced concrete deck.

Concrete spalls with exposed reinforcement were observed along the bottom corners of several of the beams. The exposed sections of steel reinforcement typically exhibited moderate corrosion. As seen in Photo 119, a significant amount of debris has accumulated in the channel beneath the parking lot.

As a result of the debris accumulation and general aggradation along the north wall, the majority of the flow beneath the parking lot is directed along the southern half of the waterway. At Station 35+00, there is 6.2' and 8.2' height between the mudline and the bottom of the beams at the north and south walls, respectively. A general view of the upstream transition between the parking lot and the School Street Bridge is shown in Photo 120.

3.16 School Street Bridge

The School Street Bridge is located between Stations 36+06 and 36+76. A general view of the inside of the concrete arch and the downstream transition to the

aforementioned parking lot structure is shown in Photo 121. The bridge is approximately 36' wide and there is 15' between the top of the arch and the mudline.

Overall, the concrete arch is in fair to satisfactory condition. The formed concrete exhibits areas of minor to moderate cracks with rust staining and efflorescence.

3.17 Open channel between School Street Bridge and John Street Alley Bridge

The right (east) embankment from Station 36+46 to 37+40 is mostly comprised of destabilized riprap, loose earth and vegetation (see Photo 122). A stone masonry wall is located between Stations 37+40 to 37+90. Overall the wall is in poor condition and exhibits areas of missing and displaced stones. A general view of the upstream end of the wall is shown in Photo 123. As seen in this photo, between Stations 37+60 and 38+50, a building is located approximately 10' from the top of the embankment.

Along the left (west) embankment, from Station 36+76 to Station 39+33 the sloped embankment is primarily comprised of loose earth, destabilized riprap, and vegetation. In addition, there is a deteriorated stone wall located between Stations 37+00 and 37+50 (see Photo 124). Photo 125 provides a general view looking upstream from Station 38+65. As seen in the photo, a fallen tree extends across the channel approximately 2' above the water surface at Station 38+65.

3.18 John Street Alley Bridge

The John Street Alley Bridge is located between Stations 39+33 and 39+50. Overall the bridge is in poor condition. At the east stone masonry abutment, there is a 10' long by 5' high by 3' deep void located at Station 39+36 (see Photo 126). In addition, the entire length of the west abutment is undermined approximately 1' high by 1' deep. As shown in Photo 127, a section of the northwest wingwall has been displaced to the north and has rotated out of plumb.

The timber members of the bridge deck exhibit moderate to severe deterioration

due to rot. A steel barrier has been constructed along the downstream face of the bridge deck to restrict vehicular traffic over the deteriorated timber fascia beam (see Photo 128). In addition, steel plates have been installed atop the timber deck as a temporary repair for severely deteriorated sections of deck boards.

3.19 *Open channel between John Street Alley Bridge and Elm Street Bridge*

Along the right (east) embankment of the channel, a stone masonry wall extends from Station 39+50 to 40+05. Overall, the wall is in fair to poor condition with up to 20 percent deterioration. A general view of the wall is shown in Photo 129. The wall exhibits intermittent undermining up to 1' high by 1' deep with 1/2" wide cracks throughout (see Photo 130). Upstream of the stone masonry wall is a natural earthen bank with vegetation that extends to the Elm Street Bridge (see Photo 134). A general view of the river looking upstream from Station 39+90 is shown in Photo 131.

A combination of scrap metal, stone, concrete, and timber has been used to construct a retaining wall along the left (west) embankment between Stations 39+50 and 40+40 (see Photos 132 and 133). As seen in Photo 133, a masonry building foundation is located along the riverbank from Station 40+40 to 40+67. Erosion of the foundation wall has created intermittent undermining of the structure up to 1' high by 1.5' deep. Located between Station 40+85 and the downstream fascia of the Elm Street Bridge, there is a 3' to 5' high stone masonry wall which is in a state of disrepair (see Photo 134).

3.20 *Elm Street Bridge*

The Elm Street Bridge is located between Stations 41+71 and 42+30. The bridge is approximately 36' wide, and the west and east abutments are exposed for a height of 4.8' and 6.4', respectively. A general view of the downstream fascia of the bridge is shown in Photo 135.

Overall the stone masonry arch is in fair condition with no missing or displaced

stones. Photo 136 provides a general view of the underside side of the arch. Approximately 25 percent of the joints exhibit 2" to 4" deep areas of missing grout. In addition, efflorescence was observed at more than half the joints. As depicted in Photo 137, the northeast wingwall exhibits minor areas of missing chink stones.

3.21 *Open channel between Elm Street Bridge and Waring Row*

Upstream of the Elm Street Bridge, a brick wall has been constructed along the first ten feet of the left (west) embankment (see Photo 138). This wall has most likely been constructed as a repair for a failed section of the original stone masonry wall which continues upstream to Station 42+80. As seen in the photo, a concrete curb for a parking area has been poured atop both sections of wall. In front of the wall, there is a sloped earthen bank with destabilized riprap and scattered debris.

From Station 42+80 to the upstream limit of the inspection (Station 44+73), the left riverbank consists of a sloped earth embankment with scattered stone, debris, and heavy vegetation. General views looking upstream from Stations 42+30 and 43+50 are shown in Photos 139 and 140, respectively.

The right (east) embankment is comprised of destabilized riprap, loose earth, vegetation, and scattered debris from Station 42+30 to 43+80. As seen in Photo 141, a 1.5' to 3' high concrete retaining wall has been constructed between Stations 43+80 and 44+73. The wall retains fill for a parking lot which has been built adjacent to the riverbank.

A general view looking upstream from Station 44+25 is shown in Photo 142. Located at Station 44+73, the upstream limit of inspection, there is a 1.5' high by 37' long concrete spillway. General views of the east and west sides of the spillway are shown in Photos 143 and 144, respectively. As seen in Photo 144, the westernmost 9.6' of the spillway exhibits one hundred percent deterioration.

4. COMPARISON WITH PREVIOUS REPORT

The previous Flume Investigation Report prepared by Cahn Engineers was conducted during the fall of 1978. Overall, the prior report recommended that the flume be rehabilitated from the Hudson River to School Street, in lieu of a major relocation of the Saw Mill River. This recommendation was based upon a review of the existing conditions within the flume, consideration of the cost of alternatives, and a cursory hydraulic analysis. The prior Flume Study recommended that this approach would effectively eliminate the occurrence of any new structural problems due to deterioration of the masonry stone walls and piers.

Details of the recommended rehabilitation included encasement of the undermined stone masonry walls and piers in concrete, detailed surface and subsurface surveys of the flume and associated building structures, excavation of test pits, and the performance of a detailed hydraulic analysis. Upon completion of these items, a program of improvements was recommended which included the removal of debris and rubble from the channel floor, and the construction of a new reinforced concrete floor and walls over the entire length of the flume between Stations 18+22 and 30+45.

With the exception of the removal of many large stones and debris from the channel, the investigation by MEG observed that most of the previously recommended repairs have not been implemented. In some instances there may be continued deterioration of the structural elements.

Comparisons of detailed recommendations included in the prior Flume Report and the current investigation by MEG are provided below.

1. The removal of boulders and debris was recommended at the following five separate locations:
 - It was recommended to dredge the outlet channel from the Hudson River to the start of the flume in order to remove the build-up of boulders and debris. In addition, it

was recommended that the entire area be “dressed-up” to reduce maintenance and make the area available for recreation or other use.

MEG observation: The land along the north shore of the outlet to the Hudson is presently under development, and the south shore has been previously developed with an esplanade which follows the rivers edge. In addition, a roadway bridge which parallels the Metro-North railroad is under construction just west of the flume outfall. Although minor debris was noted in the vicinity of the flume outfall, no significant build-up was observed.

- The removal of boulders and debris from concrete arch culvert located between Stations 10+50 and 18+22.

MEG observation: No signs of any boulders or debris were observed in the area during this inspection.

- The removal of boulders and debris located between Warburton Avenue and flume opening at the foot of Mill Street.

MEG observation: A comparison of the photos presented in the prior Flume Report, and those obtained during the MEG inspection indicate a substantial decrease in the amount of large boulders located in the center of the channel. An accumulation of debris is still present at many of the stone masonry piers in this area. Additional recommendations to encase the stone masonry piers and walls in this area have not been performed.

- The fourth and fifth areas were located from Station 21+00 to 30+45 and Station 30+45 to School Street.

MEG observation: Various sized stones and boulders are still located throughout the channel in these locations. In addition, debris has accumulated at many of the piers and support columns which are located throughout the center of the channel.

2. A number of channel improvements were also recommended in the prior Flume

Report.

- In the section of the concrete arch culvert located between Stations 10+50 and 18+22, repair of the joint and culvert floor at Station 15+00 and revising the profile of the existing 24" drain pipe at this location were recommended.

MEG observation: These repairs have not been addressed.

- The remainder of the channel improvement repairs involved encasing of various sections of the flume in concrete.

MEG observation: As previously noted, these repairs have not been completed.

3. Various structural improvements were recommended in the prior Flume Report at many of the buildings which are located throughout the flume. Generally, these recommendations have not been implemented.

MEG observation: Repairs to the severely corroded steel girder which supports buildings along the east side of Warburton Avenue have not been completed: however, there was no sign of the previously reported water infiltration through the north wall in the vicinity of the girder. Repairs to the severely deteriorated utility supports which cut through the Warburton Avenue Bridge have not been completed.

4. The undermined stone masonry piers located upstream of the Warburton Avenue Bridge should be encased in concrete.

MEG observation: Additional undermining was observed at the one pier which was encased in concrete prior to the previous inspection.

5. Repair the wide crack in the foundation of the building located just upstream of the Mill Street opening has been partially completed.

MEG observation: The repair of the 1" wide crack in the foundation of the building has been partially completed. The crack along the west face of the building has been repaired with an injected epoxy, but no repair has been completed along the north face

of the foundation.

6. Rehabilitation or repairs at the abandoned building located between Stations 20 + 35 and 20 + 75.

MEG observation: No rehabilitation or repairs have been completed at the abandoned building.

7. Repairs to the steel brick arch beams located between Stations 22 + 00 and 23 + 75.

MEG observation: Repairs have not been implemented. The bottom flanges of the beams exhibit severe corrosion and water infiltration through the brick arches.

8. Repairs to the area located at Station 23 + 75.

MEG observation: Although no apparent repairs have been made to this area, corrugated steel formwork is located above much of the area where the timber logs are located. The prior Flume Report does not mention the presence of any formwork nor can it be observed in any of the photos

9. Undermining located at Stations 23 + 75 and 24 + 50.

MEG observation: These conditions remain similar in the current observation.

10. Repairs to the deteriorated concrete beams located at Stations 29 + 10 and 29 + 70.

MEG observation: No repairs have been implemented.

5. RECOMMENDATIONS

Overall, the flume is generally in fair condition, without any visually observable unstable structural elements. It is important to note that this Report does not include a structural analysis of the building adjacent or over the flume or the structural elements of the flume. It is recommended that each property owner have a detailed inspection and structural analysis by a Professional Engineer performed in order to determine the extent of

which the deficiencies and deterioration observed have on the overall structural capacity of the individual buildings. The Flume Study was prepared by for informational purposes only and is published in this DEIS solely in response to the scoping document adopted by the City Council. No property owner is entitled to rely on the Flume Study, and each property owner is encouraged to perform their own inspection of the portion of the flume within their property to determine what repairs or maintenance, if any, is warranted by current conditions.

A summary of the observed deficiencies is included in Appendix C. MEG recommends that the City of Yonkers should advise the individual property owners of the observed conditions.

This Report documents many areas where stone masonry footings are undermined, where most of these locations are localized to areas of the flume subject to higher velocities or change in channel alignment. It is recommended that the undermined stone masonry elements be repaired to prevent potential damage to the various building structures upon which they are founded. Cracks, voids, and areas of missing grout in the concrete, and masonry walls should be repaired to prevent further deterioration.

The roof of the flume varies in construction type. Deteriorated roof elements observed are primarily a result of the wet and humid environment and lack of preventive maintenance.

MEG recommends the re-construction of a trash rack at the upstream end of the flume at Ann Street. This design should address stopping large debris from entering the flume, but not block high storm flows.

Within the open section of the River, upstream of Ann Street, many locations of deteriorated rip-rap and walls were observed. This Report assumes that this section of the River will be rehabilitated as part of the River Park Center project and these conditions will be addressed.

There are many locations where debris has collected within the flume. This ranges

from large cobbles and stones to portions of trees and garbage. In order to restore full hydraulic capacity to the flume, it is recommended that debris should be removed from the flume. It is MEG's understanding that the City do not currently have any ownership interest in the portions of the Saw Mill River and the flume that are located within private properties, and will not have any such ownership interest during construction of the River Park City Project or after its completion. Therefore, the cleaning or debris within the private properties is the responsibility of the owners.

Inspection Personnel:

Team Leader: Brian C. Moody, PE

Chief of Field Operations: .. Carl Sundvik

Inspector: Steve Molison

Inspector: Brian Fischer

Quality Control Engineer: Eric Bodnar, PE

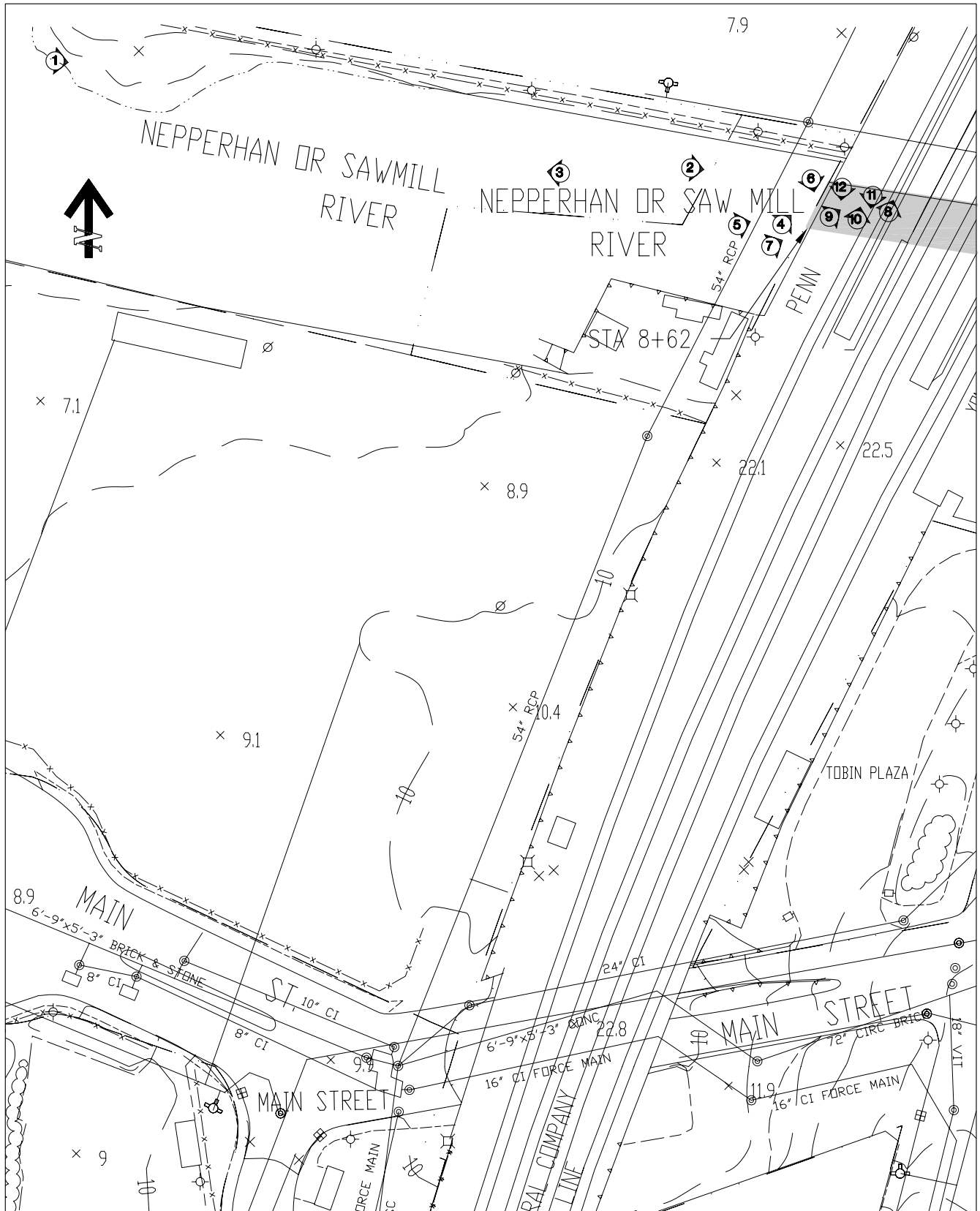
**SAWMILL RIVER
CULVERT/FLUME INSPECTION
Yonkers, New York**

APPENDIX A

PHOTOS



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SHEET TITLE

PHOTO LOCATION PLAN

PROJECT

NEPPERHAN/SAWMILL RIVER
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

1" = 60'

DATE

AUG. 29, 2006

DRAWN BY

JPM

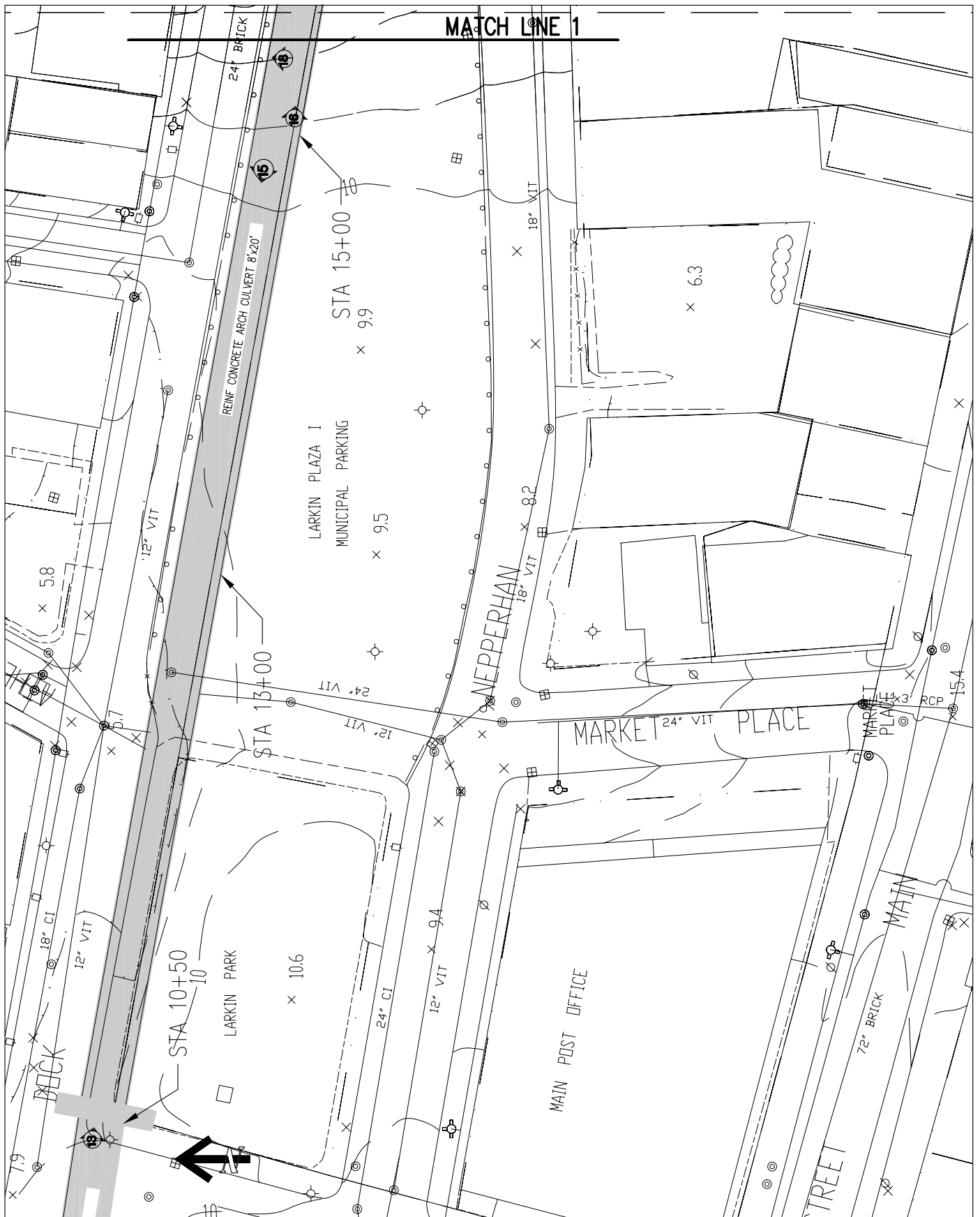
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JPM

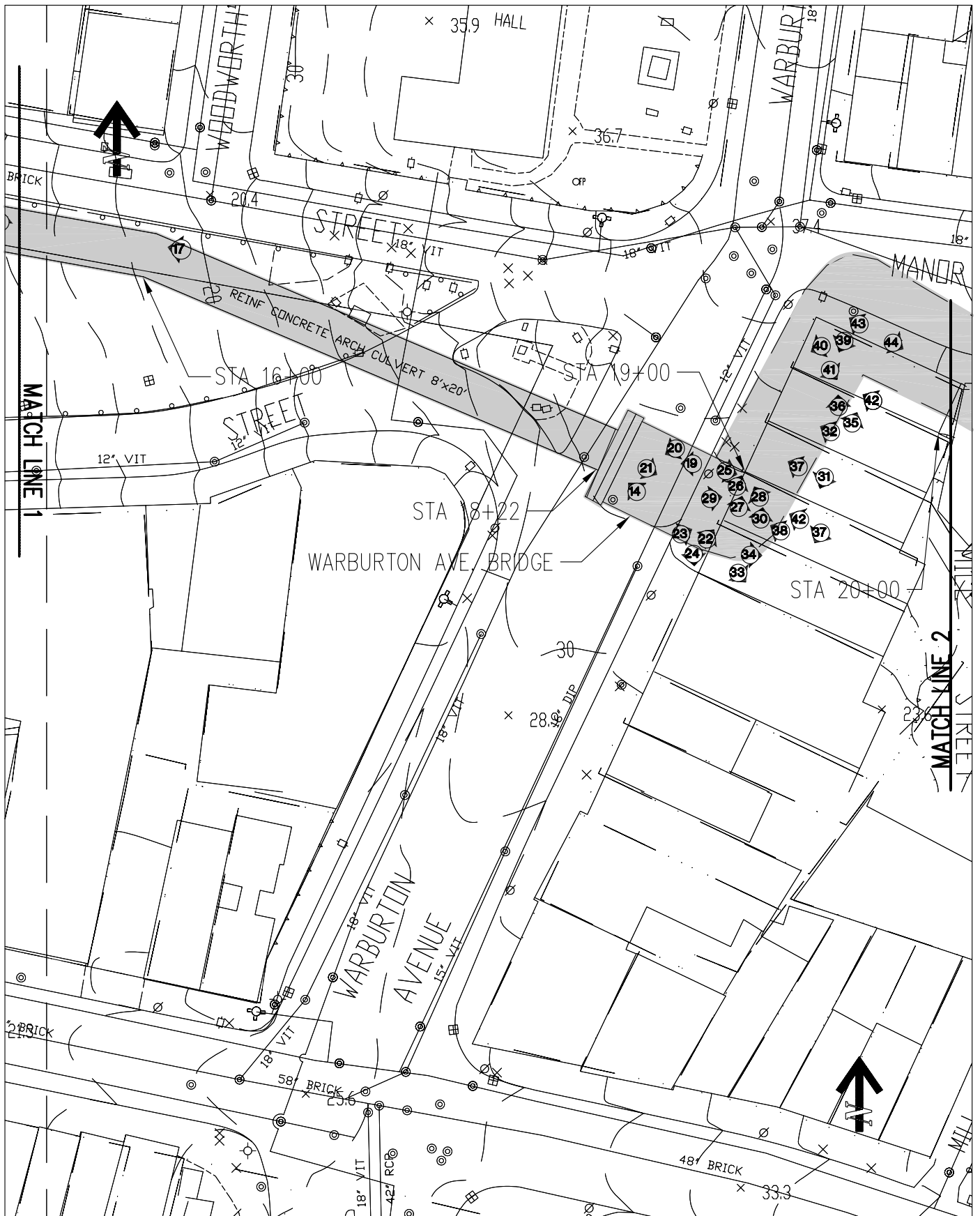
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SHEET TITLE

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SCALE

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DATE

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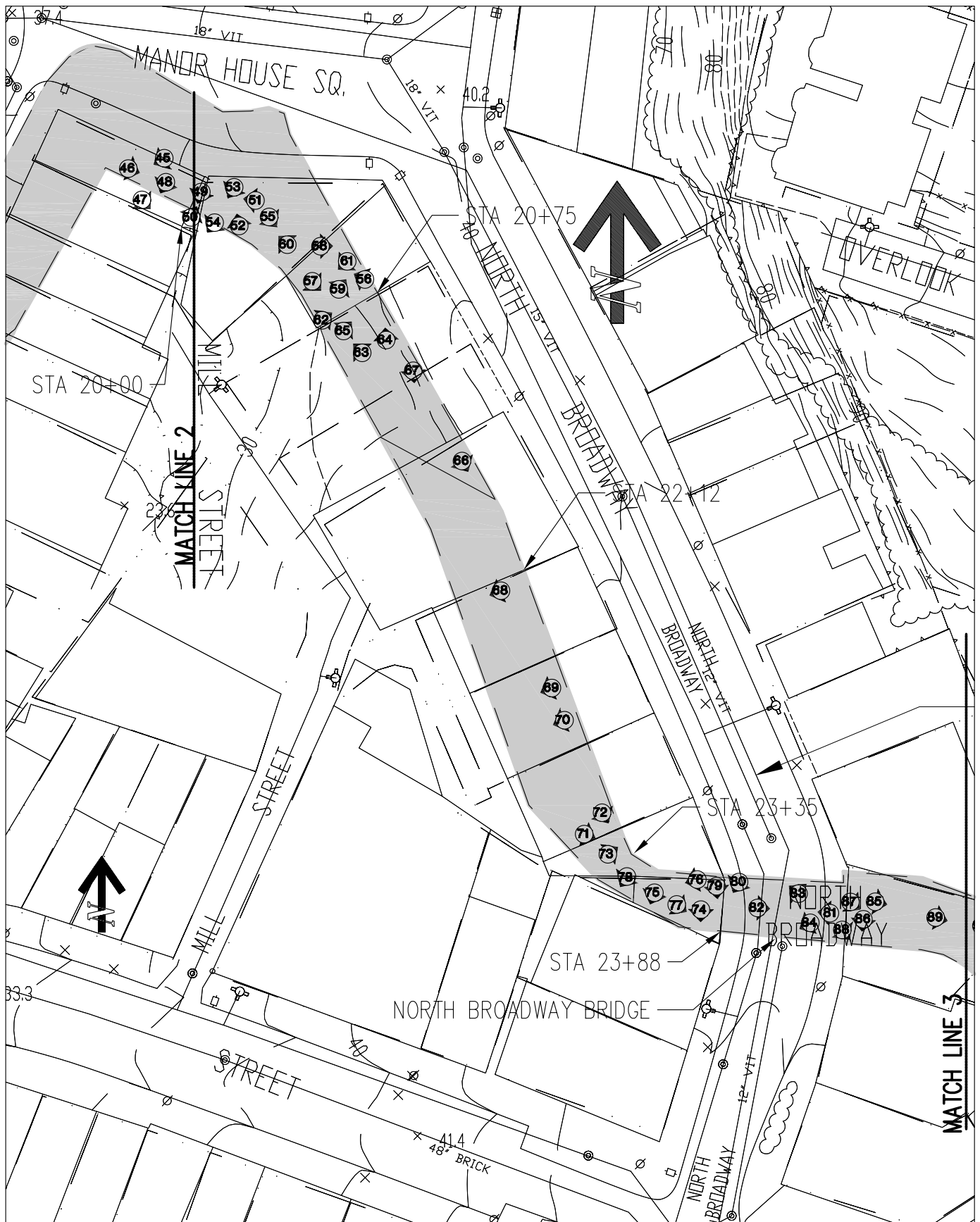
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PHOTO LOCATION PLAN

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YONKERS, NEW YORK

PROJ. NO.

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SCALE

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DATE

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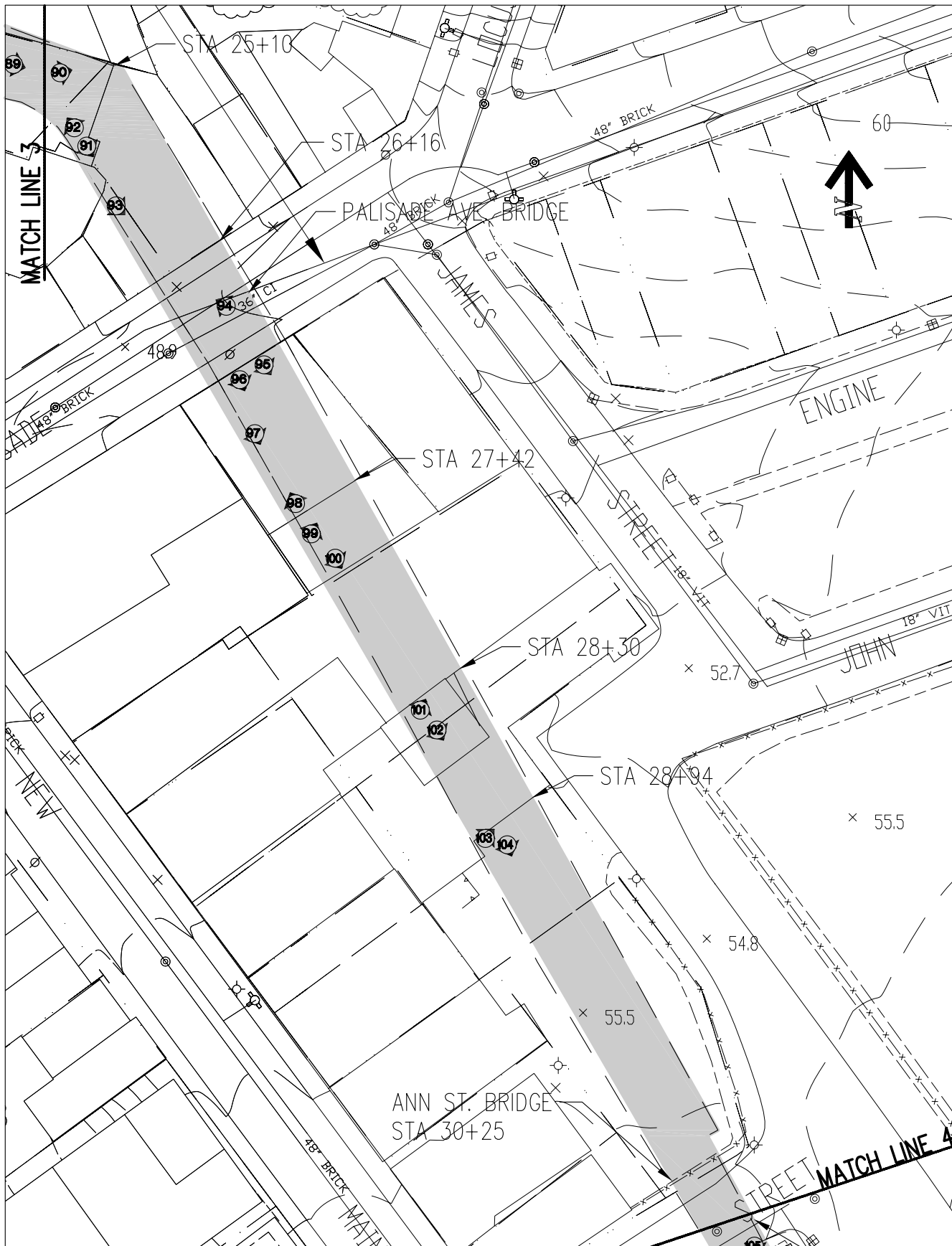
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SHEET TITLE

PHOTO LOCATION PLAN

PROJECT

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CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO. 106100.01

SCALE 1" = 60'

DATE AUG. 29, 2006

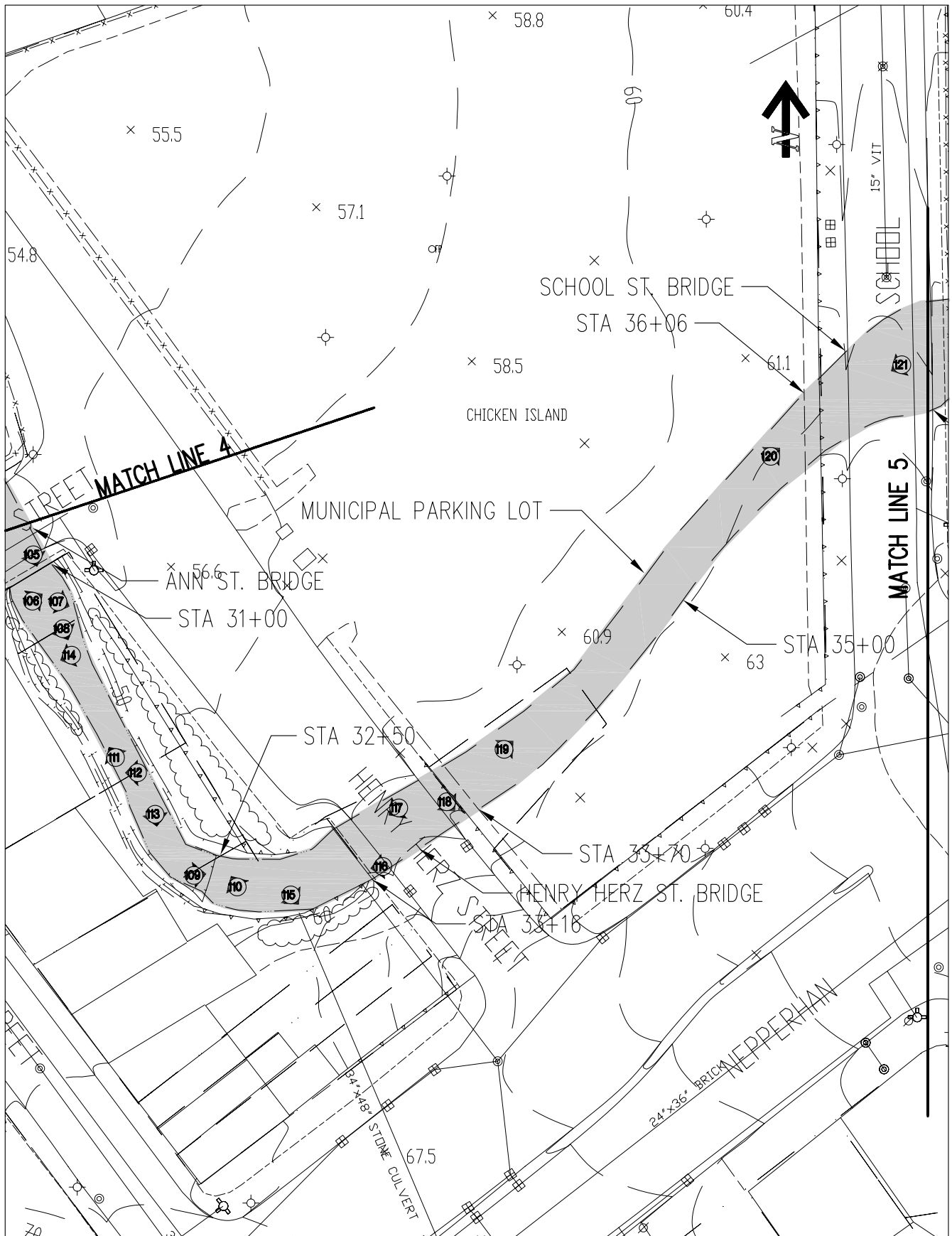
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PHOTO LOCATION PLAN

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YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

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DATE

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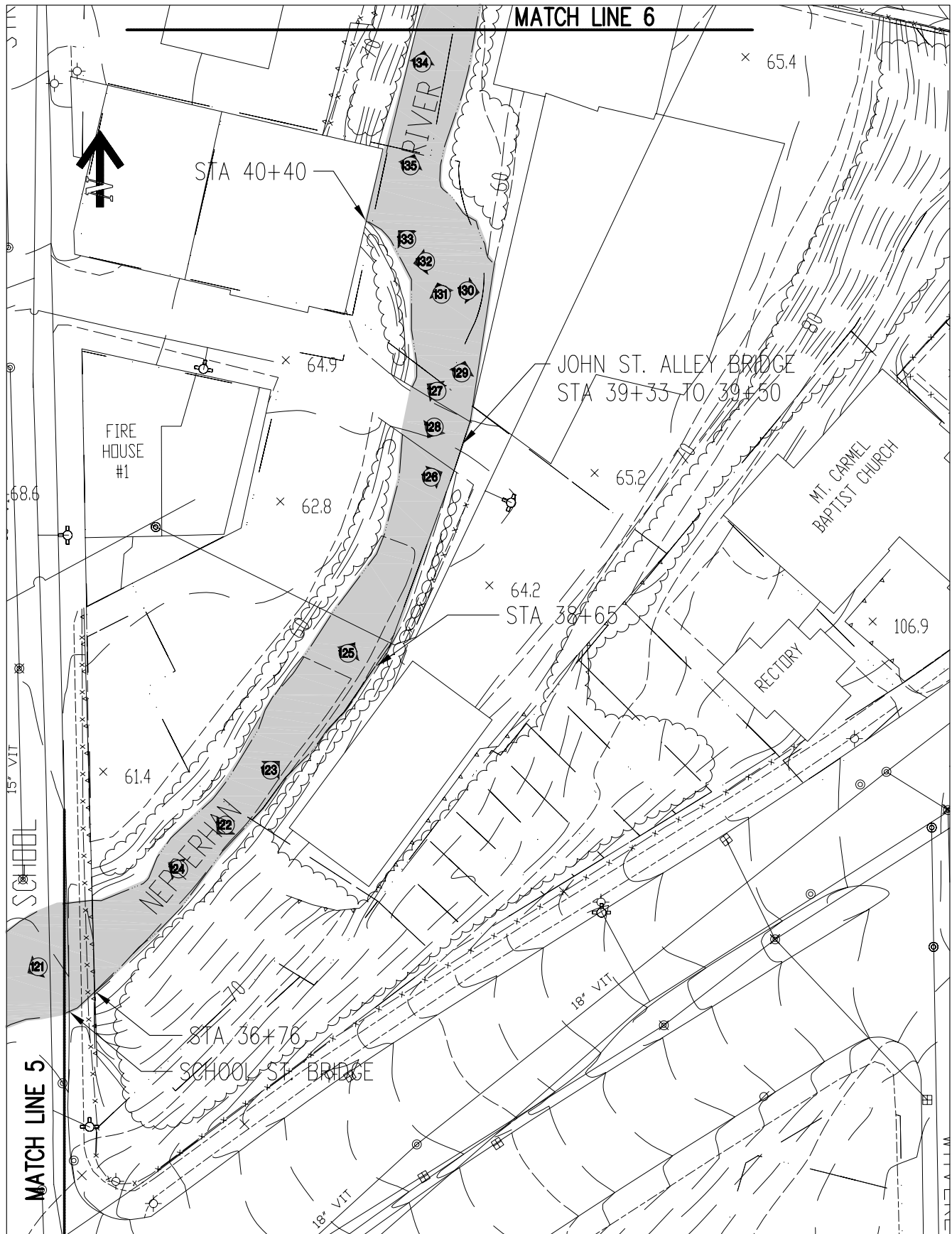
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106100.01

SCALE

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DATE

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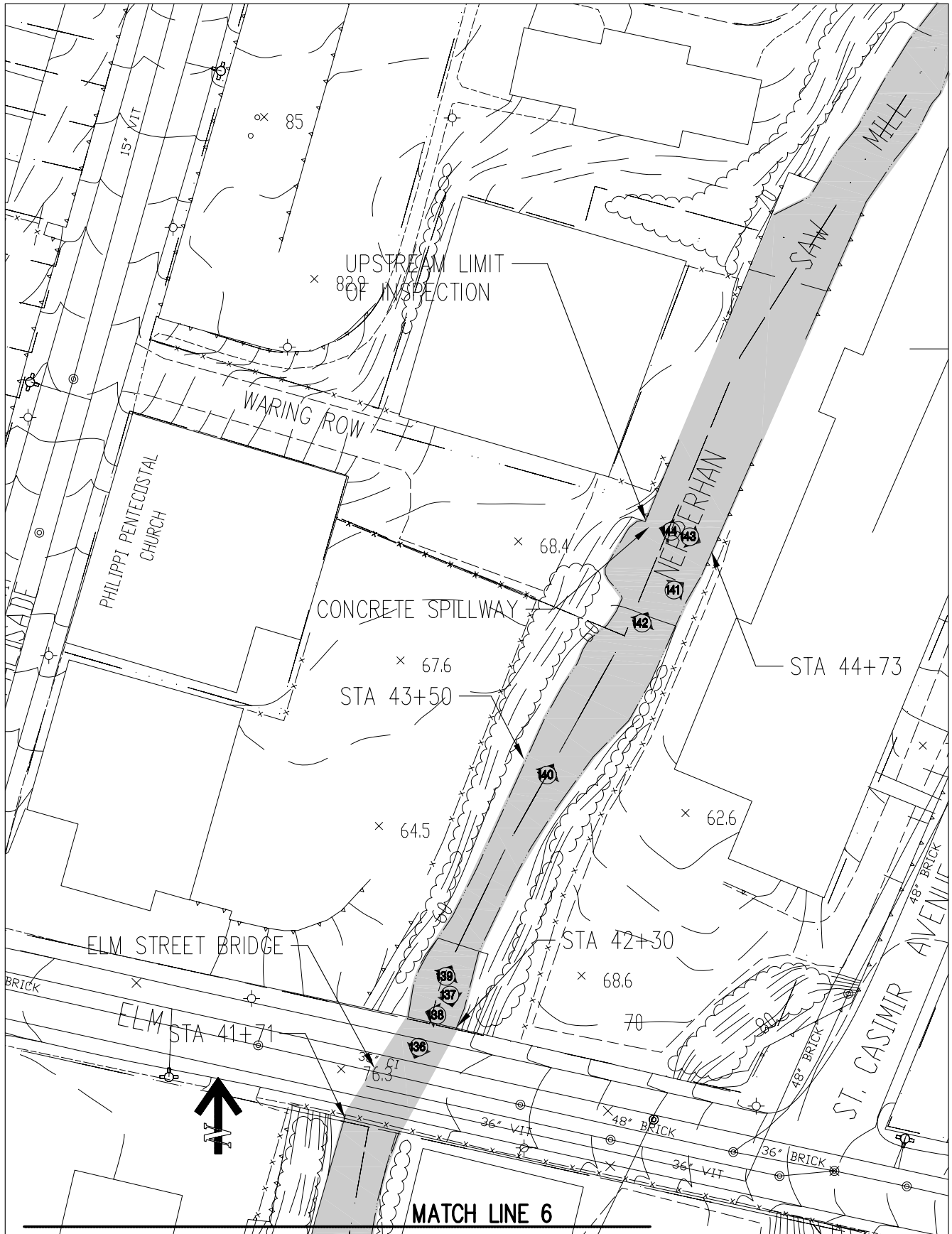
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Photo 1 General view of Yonkers Metro North Train Station from Hudson River. Note construction of new bridge pier in front of station.



Photo 2 West elevation of Yonkers Metro North Train Station at Saw Mill River outfall.



PHOTO 3 General view of western terminus of Saw Mill River. Note Hudson River in background.



PHOTO 4 New steel sheet pile bulkhead located adjacent to western end of north bridge abutment.



Photo 5 West fascia of 29.5' wide bridge which carries the Hudson Line of the Metro North Railroad.



Photo 6 General view of western end of south bridge abutment and southwest wingwall.



Photo 7 Up to 1" deep concrete scale with exposed aggregate in tidal zone at southwest wingwall.



Photo 8 General view of north bridge abutment. Note spall in construction joint below mean high water.



Photo 9 General view of underside of bridge deck.



Photo 10 Wide cracks, delamination, and rust staining in bottom of concrete beam.



Photo 11 Typical longitudinal cracks and delamination at bottom corner of concrete beam.



Photo 12 Spalled concrete diaphragm with exposed corroded steel reinforcement.



Photo 13 Western end of concrete arch culvert (Sta 10+50) at mean high tide. Note cracks with efflorescence in concrete headwall.



Photo 14 General view of concrete arch culvert upstream headwall (Sta 18+22).



Photo 15 General view of concrete arch culvert interior. Note hydraulic jump in channel flow.



Photo 16 Minor map cracking with efflorescence in concrete arch.



Photo 17 Deteriorated and missing masonry pavers at center of culvert floor.



Photo 18 General view of 36" diameter storm sewer pipe penetration.



Photo 19 General view of transition between upstream concrete arch headwall and brick arch bridge located beneath Warburton Avenue.



Photo 20 Stone masonry wall built at southwest corner of bridge in order to divert flow into concrete arch culvert. Note efflorescence on bricks in vicinity of western utility trunk penetration.



Photo 21 Eastern end of brick arch bridge located beneath Warburton Avenue.



Photo 22 Corrugated steel formwork supporting section of sidewalk between eastern face of brick arch bridge and adjacent buildings.



Photo 23 General view of brick building fascias and steel beams which span the Saw Mill River channel at the eastern edge of Warburton Avenue (Sta 18+75).



Photo 24 Moderate corrosion at the south end of above-noted steel beams.



Photo 25 North end of steel beam located at Station 18+75 exhibits one hundred percent deterioration of web due to corrosion.



Photo 26 Severe corrosion of bottom flanges of above-noted steel beams.



Photo 27 Repair to support timber beams directly east of severely corroded steel beam noted in Photos 25 and 26.



Photo 28 Above timber beam repair installed atop severely deteriorated stone masonry pier.



Photo 29 General view beneath buildings located directly east of Warburton Ave Bridge. At this location, the river flow turns from a southerly to westerly direction.



Photo 30 Looking north beneath buildings along east side of Warburton Ave.



Photo 31 Accumulation of scattered debris along the eastern half of the channel looking south.



Photo 32 Large timber debris adjacent to the north face of a center stone masonry pier.



Photo 33 Southeast corner of recently constructed concrete foundation wall located along eastern edge of building.



Photo 34 Northeast corner of recently constructed concrete foundation wall. Note large stones which appear to mark the eastern limits of the Saw Mill River channel.



Photo 35 General view looking north beneath buildings. Note concrete encased steel beams located above repaired stone masonry pier.



Photo 36 Original timber floor joists replaced with a concrete floor supported by a concrete encased steel beam.



Photo 37 Concrete floor poured over severely deteriorated timber floor boards.



Photo 38 Timber plywood placed atop deteriorated timber floor boards.



Photo 39 Looking south beneath buildings along east side of Warburton Ave. At this location, the river flow turns from a westerly to a southerly direction.



Photo 40 General view of masonry piers and wall along west face of channel.



Photo 41 Severely deteriorated north and west faces of masonry pier which has been encased in concrete as a repair.



Photo 42 Accumulation of debris along eastern face of pier.



Photo 43 General view of curved stone masonry wall beneath western end of Manor House Square.



Photo 44 Brick jack-arch construction looking east beneath Manor House Square. Note general efflorescence in concrete arches and rust stains on masonry walls.



Photo 45 General view of Saw Mill River looking west from approximately Station 19+60.



Photo 46 Looking upstream (east) from Station 19+40.



Photo 47 General view of stone masonry and brick foundation walls.



Photo 48 Crack in underside of timber 12" x 12" beam located at Station 19+50.



Photo 49 General view of Saw Mill River daylighting located at the foot of Mill Street.



Photo 50 Void at base of stone masonry wall located directly north of the Mill Street opening.



Photo 51 General view beneath the building located directly upstream of the Mill Street opening.



Photo 52 Stone masonry pier along north face of river channel.



Photo 53 Stone masonry foundation along south face of river channel. Note diagonal crack in corner of building foundation.



Photo 54 Close-up view of wide crack depicted in Photo 53. Note crack along west face of foundation has been repaired with an injected epoxy.



Photo 55 General view looking upstream from Station 20+25.



Photo 56 General view looking downstream from Station 20+60.



Photo 57 General view looking upstream from Station 20+50



Photo 58 General view inside abandoned building located between Stations 20+35 and 20+75.



Photo 59 Brick and concrete remnants from missing support column.



Photo 60 Concrete footing for missing column noted in above photo washed downstream by heavy river flow.



Photo 61 Second and third floors of abandoned building.



Photo 62 General view of abandoned building interior. The steel beams and brick wall at right adjoin the upstream property.



Photo 63 General view of Saw Mill River looking downstream from Station 21+00.



Photo 64 Four foot high concrete wall which has been constructed along the north half of the channel at Station 20+75.



Photo 65 General view of the jack-arch construction located upstream of Station 20+75.



Photo 66 General view of the left side of the channel looking upstream from Station 22+00.



Photo 67 General view of the right side of the channel looking upstream from Station 21 + 50.



Photo 68 Transition in jack-arch construction (Station 22 + 12).



Photo 69 Heavy corrosion of bottom flange of steel beam.



Photo 70 Rotted timber framework in jack-arch opening, and corrosion of steel beam is due to water infiltration from above (Station 22 + 80).



Photo 71 Upstream limit of jack-arch construction (Station 23 + 35).



Photo 72 General view of steel beam of concrete deck construction located along left half of channel north of Station 23 + 35.



Photo 73 Concrete scale with exposed reinforcement in underside of deck at Station 23 + 50.



Photo 74 Timber logs supporting corrugated steel formwork at Station 23 + 75.



Photo 75 Steel beams installed to replace deteriorated/missing timber logs. Note corrugated steel formwork above.



Photo 76 Build-up of debris at stone masonry pier (Station 23+70).



Photo 77 Void/undermining of stone masonry wall located from Station 23+88 to 23+63.



Photo 78 Void/undermining of stone masonry wall located at Station 23+50.



Photo 79 Underside of deck just downstream of Station 23+88 building transition.



Photo 80 Building fascia located at Station 23+88. North Broadway bridge is located upstream of this station.



Photo 81 North Broadway bridge viewing downstream. Note replacement of original steel beams with a concrete deck.



Photo 82 North Broadway bridge viewing upstream.



Photo 83 Void in left abutment of North Broadway bridge. Note original stone abutment located behind.



Photo 84 North Broadway bridge abutment, right side.



Photo 85 General view looking upstream of Station 24 + 50.



Photo 86 Building fascia located along right side of channel upstream of Station 24 + 50.



Photo 87 Area of missing stucco exposing timber beams with moderate to severe rot and biodeterioration.



Photo 88 Undermining of stone ledge constructed as a scour countermeasure for the building foundation.



Photo 89 General view looking upstream from Station 24+75. Note river turns approximately 30 degrees to southeast at Station 25+25.



Photo 90 Void/undermining of left wall at Station 25+10.



Photo 91 General view looking upstream from Station 25+50. Note downstream fascia of Palisade Ave. bridge in background.



Photo 92 General view looking downstream from Station 25+60. Note build-up of debris in center of channel.



Photo 93 Downstream fascia of Palisade Ave bridge located at Sta 26+16.



Photo 94 General view beneath the Palisade Ave masonry arch bridge. Note efflorescence located in joints between stones.



Photo 95 Viewing upstream from Station 26 + 64, left channel.



Photo 96 Viewing upstream from Sta 26 + 64, right channel.



Photo 97 Viewing upstream from Sta 27+00 along right side of the pier. Build-up of debris has created a 3' high dam.



Photo 98 Viewing downstream from Sta 27+42.



Photo 99 Construction transition at Sta 27 + 42.



Photo 100 Viewing upstream from Sta 27 + 66.



Photo 101 Construction transition at Sta 28+30. Note foam insulation applied to underside of deck and beams in right side of photo.



Photo 102 Viewing upstream from Sta 28+94.



Photo 103 Construction transition at Sta 28+94. Note sections of missing insulation exposing concrete beam.



Photo 104 Viewing upstream from Sta 28+94 beneath the parking lot to Ann St. bridge.



Photo 105 Underside of concrete beams and abutment at Ann Street Bridge. Note steel support beam remnants from original trash racks at entrance to flume (Sta 31+00).



Photo 106 Station 31+03 to 31+13, 5' high by 3' deep void at base of stone masonry wall at interface with southeast wingwall for Ann St. Bridge.



Photo 107 Station 31+40, change in construction from stone masonry wall to concrete block wall.



Photo 108 General view looking upstream from Sta 31+15.

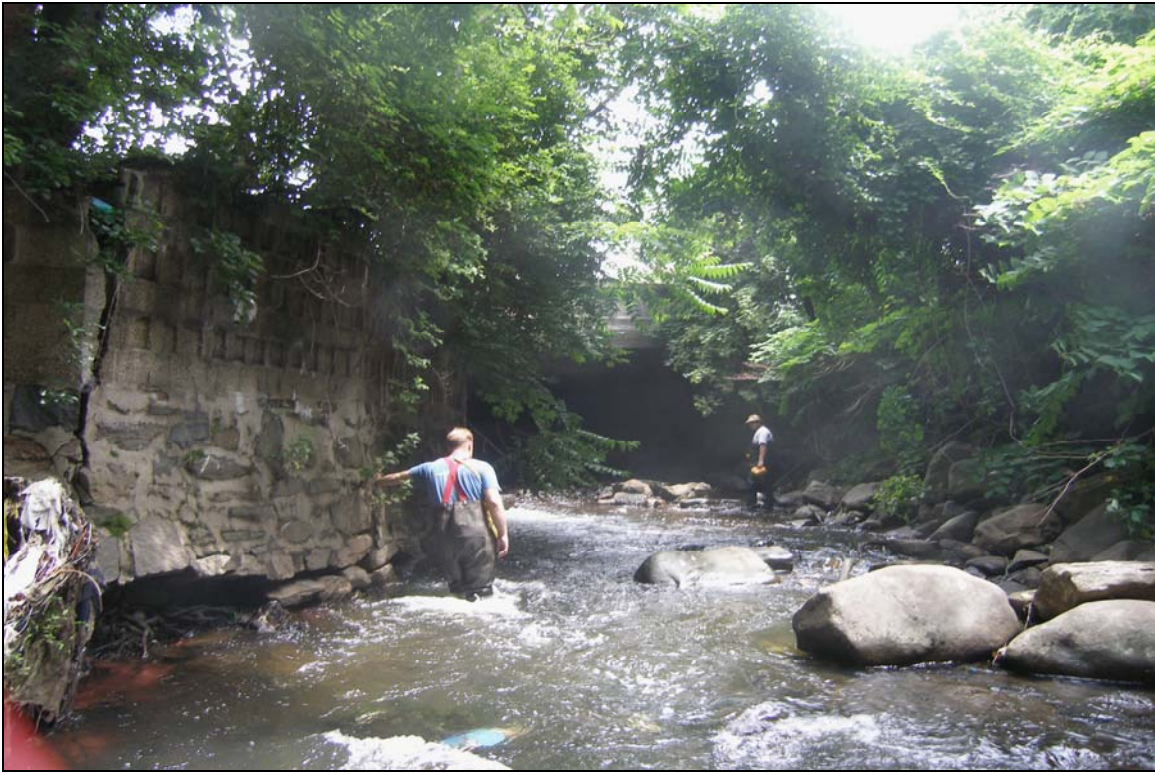


Photo 109 General view looking upstream from Sta 32+50 to the Henry Herz Street Bridge.



Photo 110 Left embankment, Station 32+00 to 32+15. 2.5' high by 2.0' deep undermining and 1" wide vertical cracks in stone masonry wall.



Photo 111 General view looking downstream at the Ann Street Bridge. Note the concrete repair at the base of the stone masonry retaining wall.



Photo 112 Right embankment, upstream of Ann Street bridge. Concrete repair is undermined up to 1' high by 2' deep from Station 31+03 to 32+10.



Photo 113 General view of right embankment between Stations 32+00 to 32+40.



Photo 114 Right retaining wall, upstream of the Ann St. Bridge. Typical condition whereby vegetation and missing chink stones are compromising the integrity of the retaining wall.



Photo 115 Right embankment, Station 32+23 to 32+48. 5' high by 6' deep void in stone masonry wall.



Photo 116 General view looking downstream from Henry Herz Street Bridge.



Photo 117 General view of the underside of the concrete beams and the waterway beneath the Henry Herz Street Bridge.



Photo 118 Viewing the south abutment at the construction transition from the Henry Herz Street Bridge to the parking lot structure.



Photo 119 General view of concrete underdeck and abutments beneath parking lot between Stations 33+70 and 36+06. Note accumulation of debris in channel.



Photo 120 General view looking upstream from the transition between the parking lot structure and the School Street Bridge.



Photo 121 General view of the School Street Concrete Arch Bridge, and the transition to the downstream parking lot structure.



Photo 122 General view looking downstream from Station 37+00 at the upstream fascia of the School Street Bridge.



Photo 123 Right embankment. Upstream end of stone masonry wall at Station 37+90. Note building in right side of picture is located approx. 10' from top of embankment.



Photo 124 Left embankment. Deteriorated stone masonry wall located between Stations 37+00 and 37+50. Note accumulation of debris along edge of river.



Photo 125 General view looking upstream from Station 38+65. Note fallen tree at Station 38+65, and John Street Alley Bridge in background.



Photo 126 John Street Alley Bridge, East Abutment. 10' long by 5' high by 3' deep void in stone masonry abutment at Station 39+36. Note severely deteriorated timber fascia beam.



Photo 127 John Street Alley Bridge, West Abutment. Section of the northwest wingwall has been displaced to the north and rotated out of plumb. Note the retaining structure upstream of the bridge.



Photo 128 John Street Alley Bridge, top of deck looking downstream. Steel barrier used to restrict vehicular traffic over the deteriorated timber fascia beam. Note steel plates above deteriorated deck boards.



Photo 129 General view of stone masonry wall located along right embankment upstream of the John Street Alley Bridge from Sta 39+50 to Sta 40+05.



Photo 130 Typical undermining and cracks in stone masonry wall. Wall exhibits intermittent undermining up to 1' high by 1' deep.



Photo 131 General view looking upstream from Sta 39 + 90.



Photo 132 Left embankment, upstream of John Street Alley Bridge. General view of retaining wall constructed of scrap metal, stone, concrete, and timber.



Photo 133 Left embankment, upstream of John Street Alley Bridge. Scrap metal and concrete retaining wall from Station 39+50 to 40+40. Masonry building foundation from Sta 40+40 to Sta 40+67 exhibits intermittent 1' high by 1.5' deep areas of undermining.



Photo 134 Left embankment. Deteriorated stone masonry wall located downstream of Elm Street Bridge between Stations 40+85 and 41+71.



Photo 135 General view looking upstream from Sta 40+65. Note downstream fascia of Elm Street Bridge in background.



Photo 136 Underside of Elm Street Bridge stone masonry arch (looking downstream). Note areas of missing grout and overall efflorescence in joints.



Photo 137 Missing chink stones at the northeast wingwall of the Elm Street Bridge, Station 42 + 30.



Photo 138 Left embankment, upstream fascia of Elm Street Bridge. Brick and stone masonry walls located upstream of bridge. Note concrete cap for upland parking lot poured atop both walls.



Photo 139 General view looking upstream from Station 42 + 30. Note the fallen timber across the river at Station 43 + 50.



Photo 140 General view looking upstream from Station 43 + 50.



Photo 141 Right embankment, Station 43+80 to 44+73 (upstream limit of inspection). 1.5' to 3' high concrete wall retains fill for parking lot built adjacent to riverbank.



Photo 142 General view looking upstream from Station 44+25. Note the 1.5' high spillway located at Station 44+73 (upstream limit of inspection).



Photo 143 East embankment, Station 44+73. General view of east half of 1.5' high concrete spillway.



Photo 144 West embankment, Station 44+73. General view of west half of 1.5' high concrete spillway. Note westernmost 9.6' of spillway is missing.

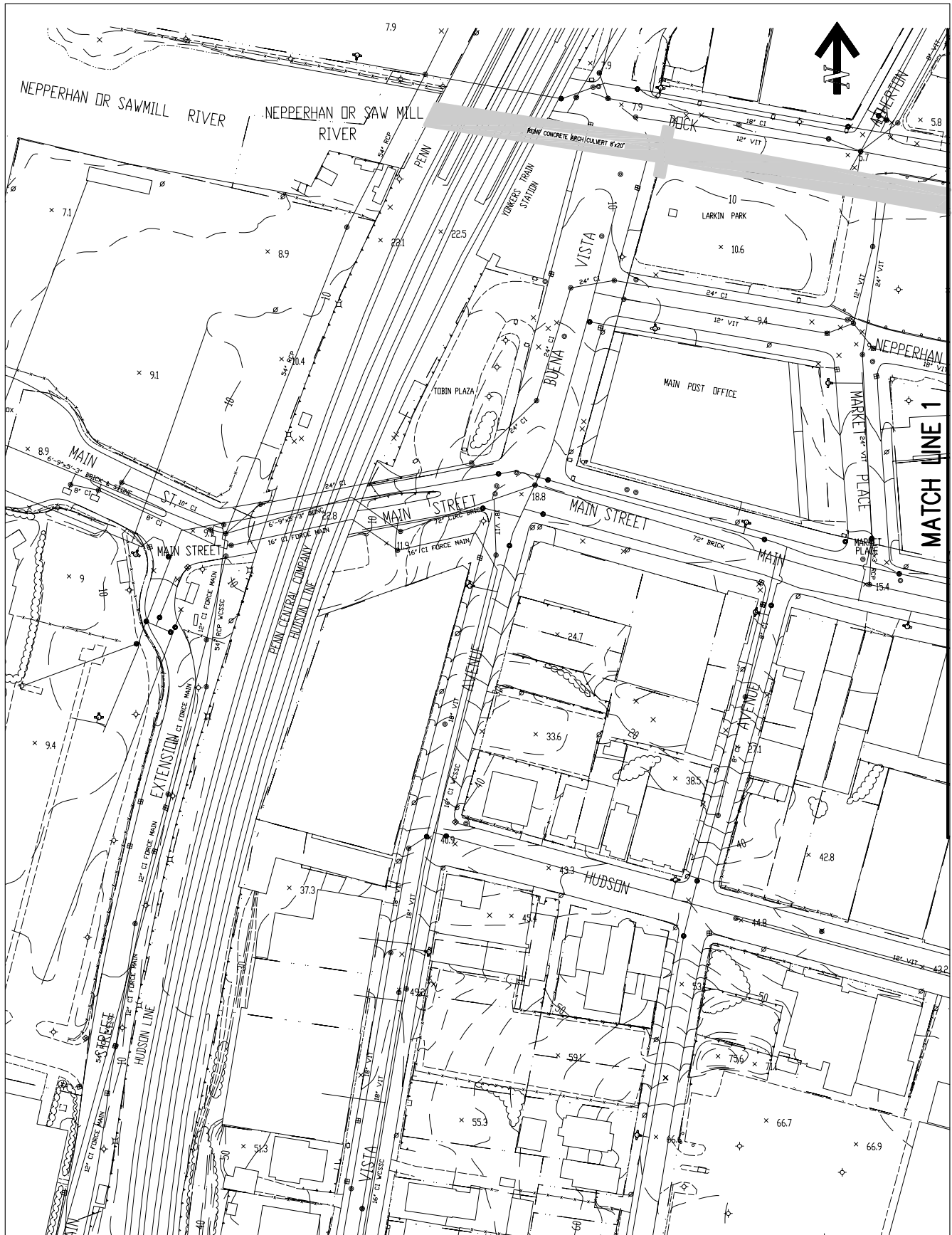
**SAWMILL RIVER
CULVERT/FLUME INSPECTION
Yonkers, New York**

APPENDIX B

FIGURES



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SHEET TITLE

SITE PLAN - PART 1

PROJECT

CHICKEN ISLAND-YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

1" = 120'

DATE

AUG. 29, 2006

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B-1



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SHEET TITLE

SITE PLAN - PART 2

PROJECT

CHICKEN ISLAND- YONKERS CULVERT/FLUME INSPECTION YONKERS, NEW YORK

PROJ. NO.	106100.01
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SCALE	1"=120'
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DATE	AUG. 29, 2006
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CHECKED BY	CGS
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B-2

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SHEET TITLE

SITE PLAN - PART 3

PROJECT

CHICKEN ISLAND-YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

1" = 120'

DATE

AUG. 29, 2006

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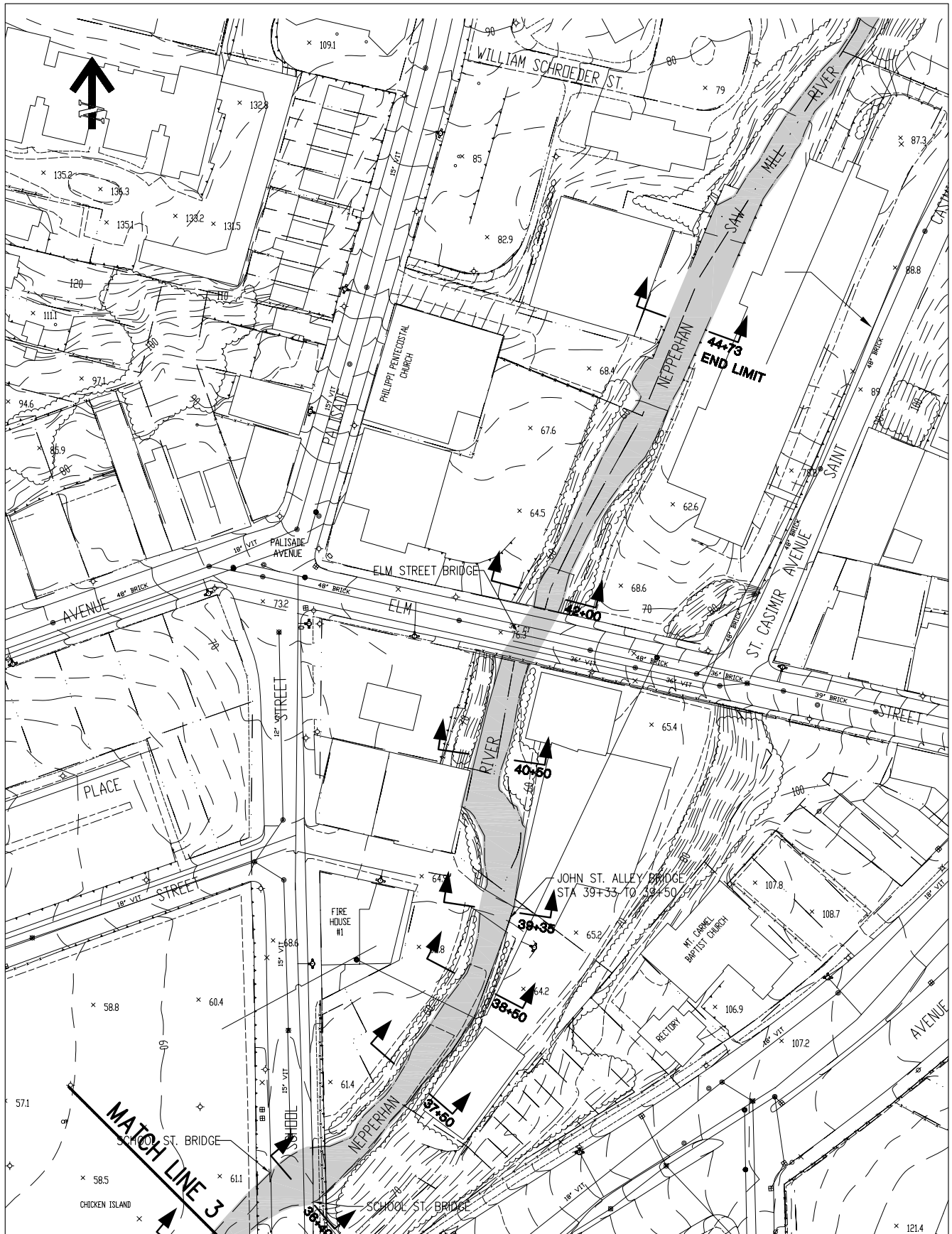
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SHEET TITLE

SITE PLAN - PART 4

PROJECT

CHICKEN ISLAND-YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

1" = 120'

DATE

AUG. 29, 2006

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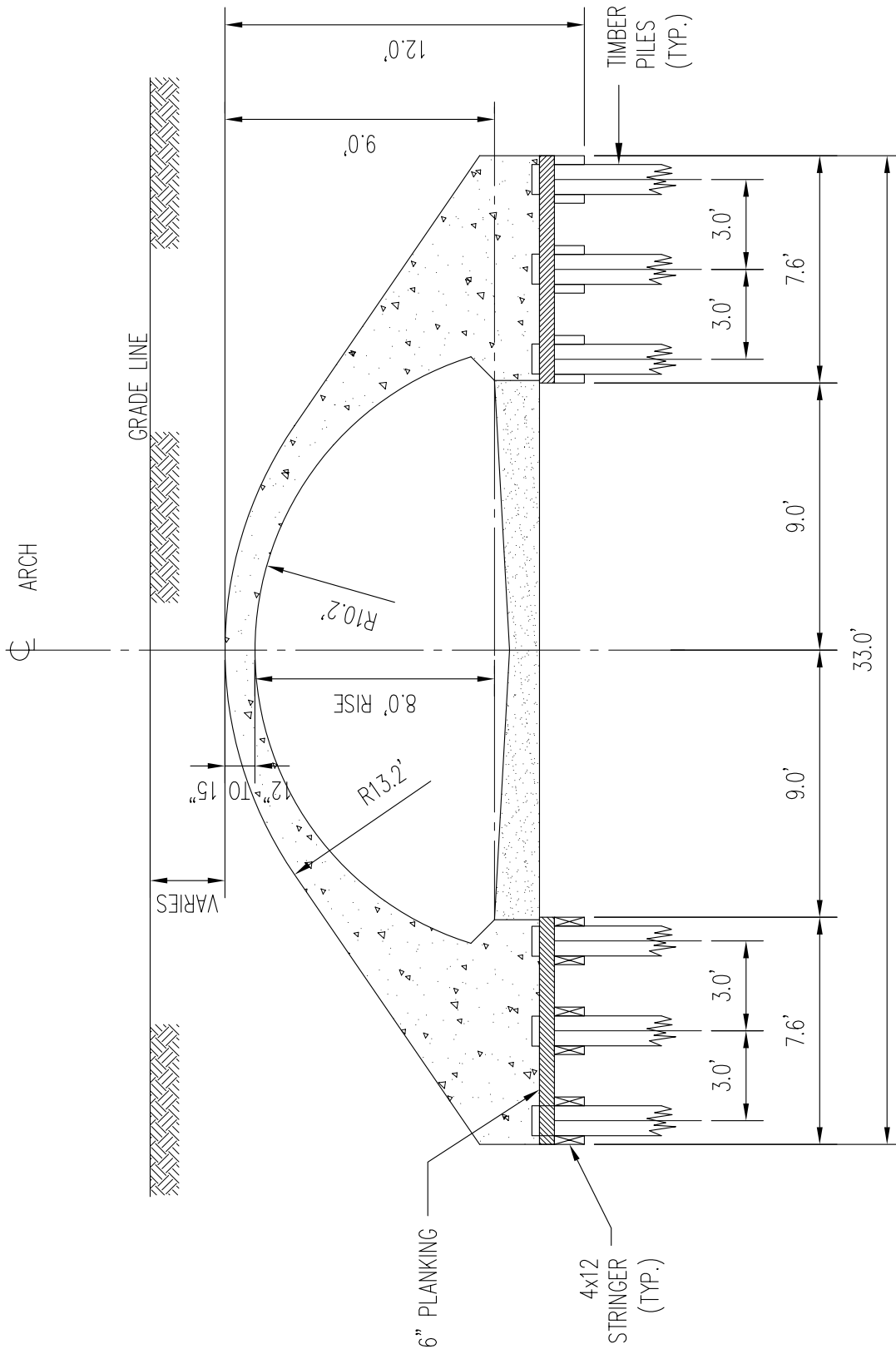
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SECTION @ STA. 14+00



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SHEET TITLE

SECTIONS

PROJECT

CHICKEN ISLAND- YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO. 106100.01

SCALE 3/16" = 1'-0"

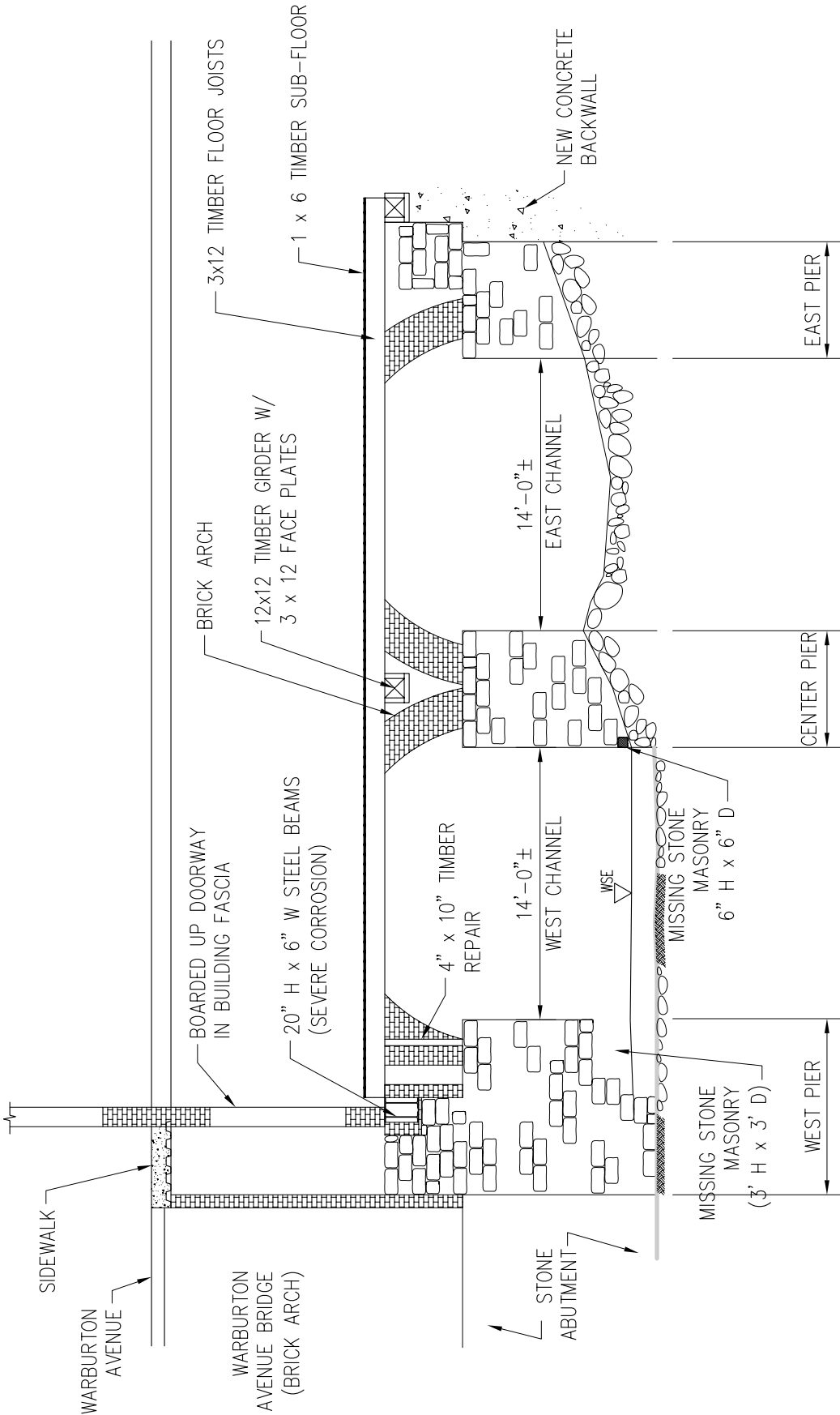
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B-5



SECTION @ STA 19+00

LOOKING UPSTREAM



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SECTIONS

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YONKERS, NEW YORK

PROJ. NO. 106100.01

SCALE 3/16" = 1'-0"

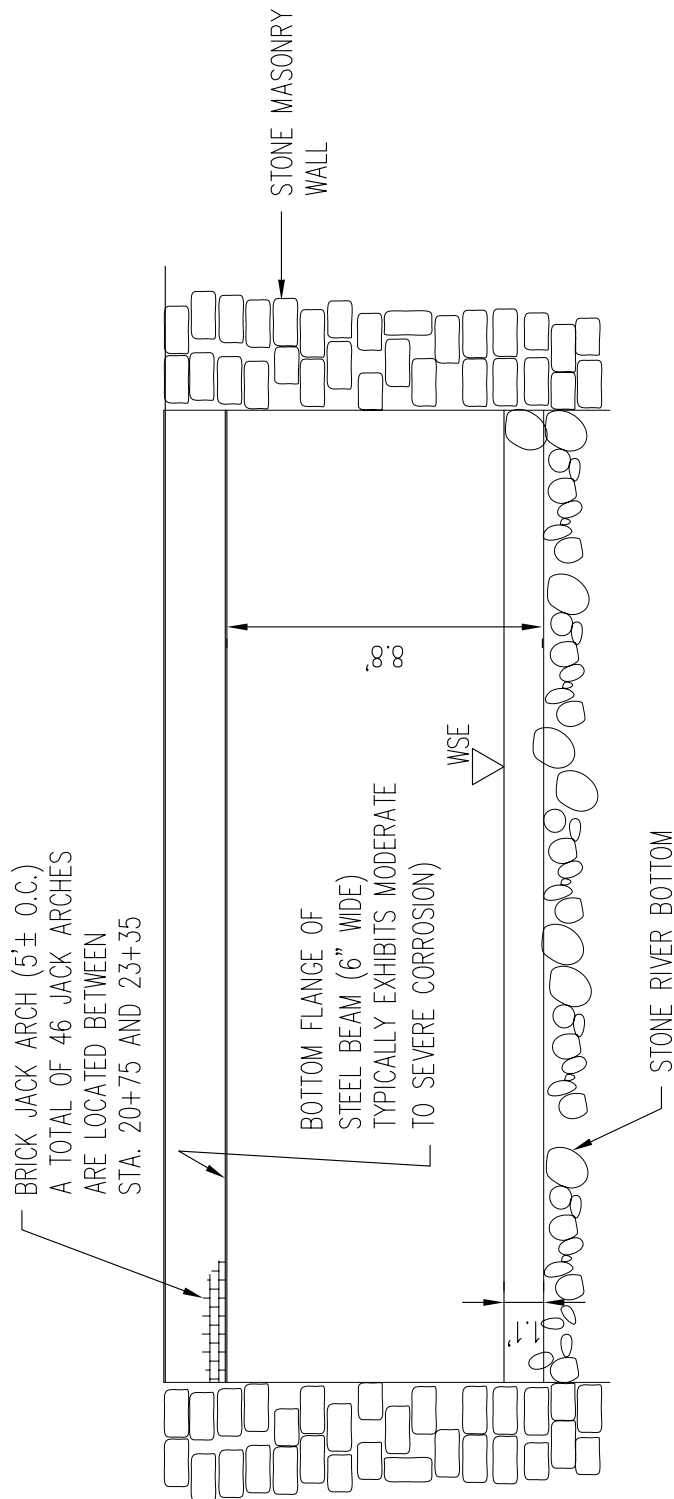
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SECTION @ STA. 21+40



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PROJ. NO. 106100.01

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DATE AUG. 29, 2006

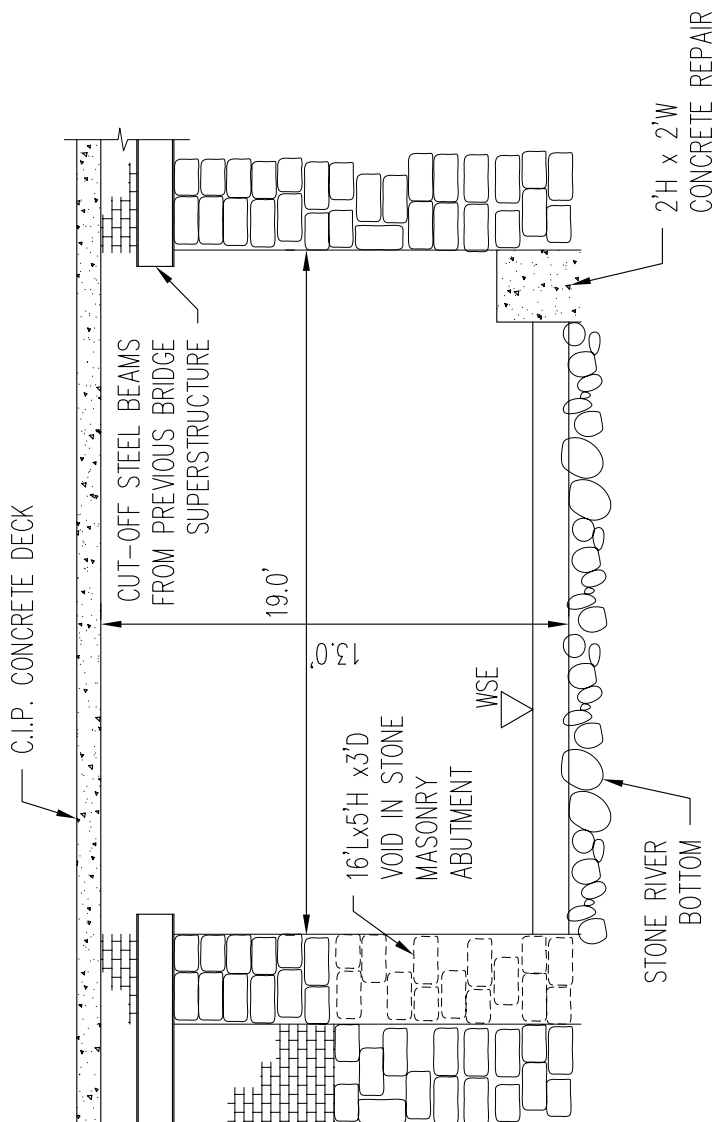
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B-7

NORTH BROADWAY BRIDGE



SECTION @ STA. 24+25 (LOOKING UPSTREAM)

SHEET TITLE

SECTIONS

PROJECT

CHICKEN ISLAND- YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

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SCALE 3/16" = 1'-0"

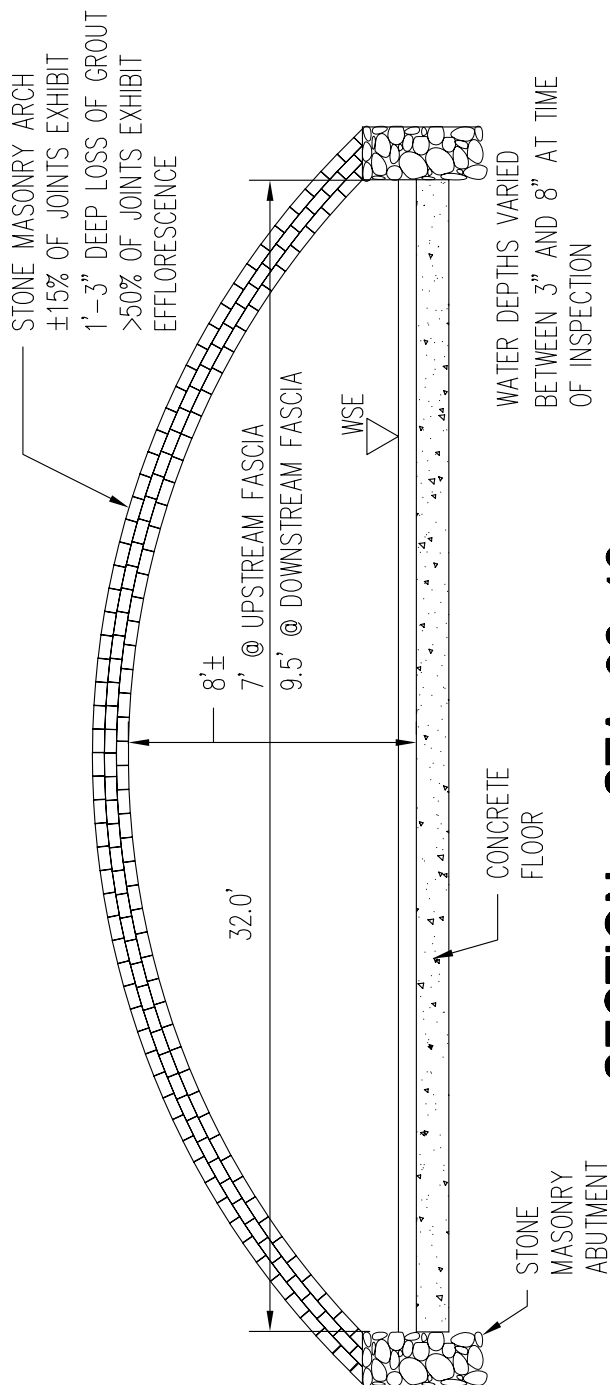
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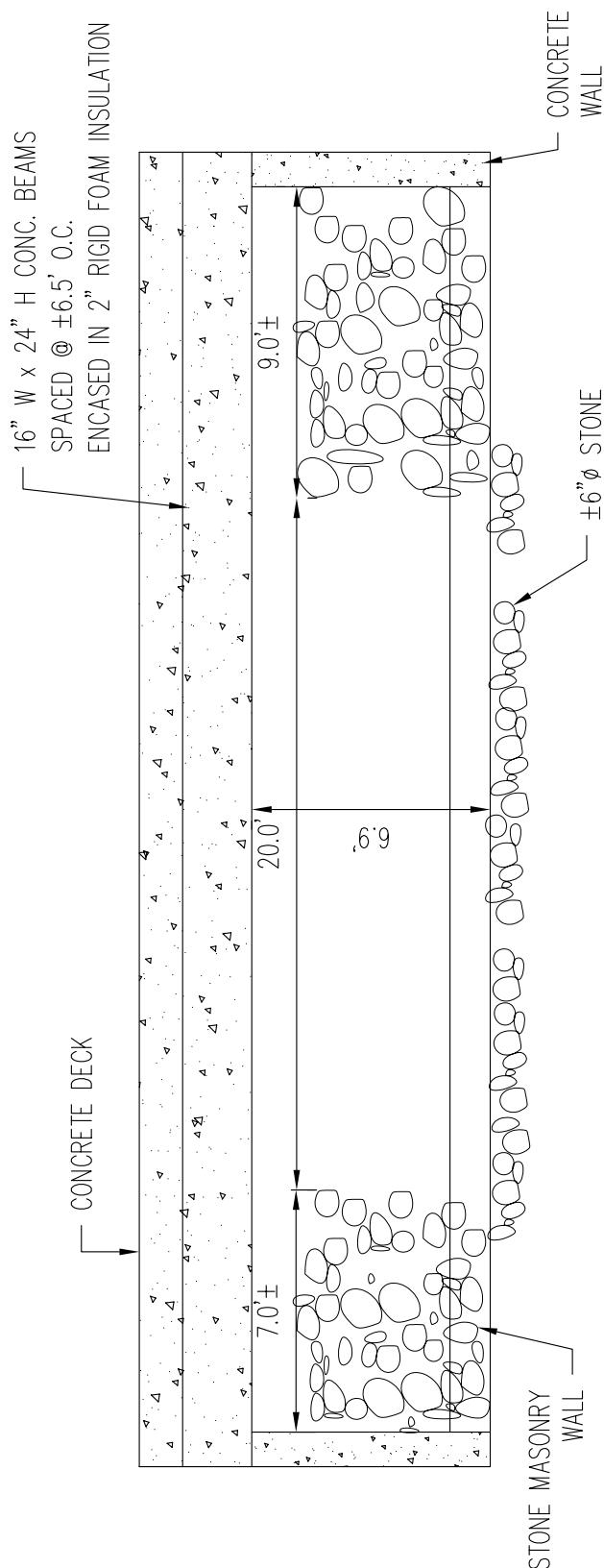
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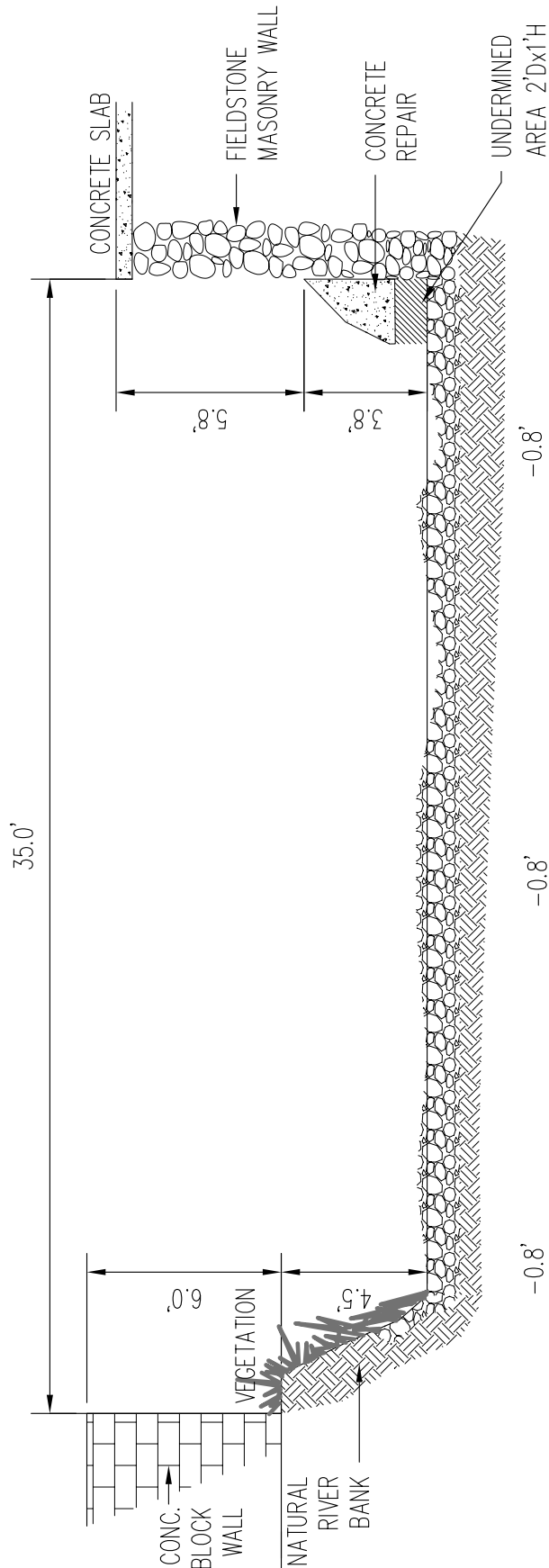
B-8



SECTION @ STA. 26+40



SECTION @ STA. 28+90



SECTION @ STA. 31+75



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SHEET TITLE

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PROJECT

CHICKEN ISLAND- YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

$\frac{3}{16}'' = 1'-0''$

DATE

AUG. 29, 2006

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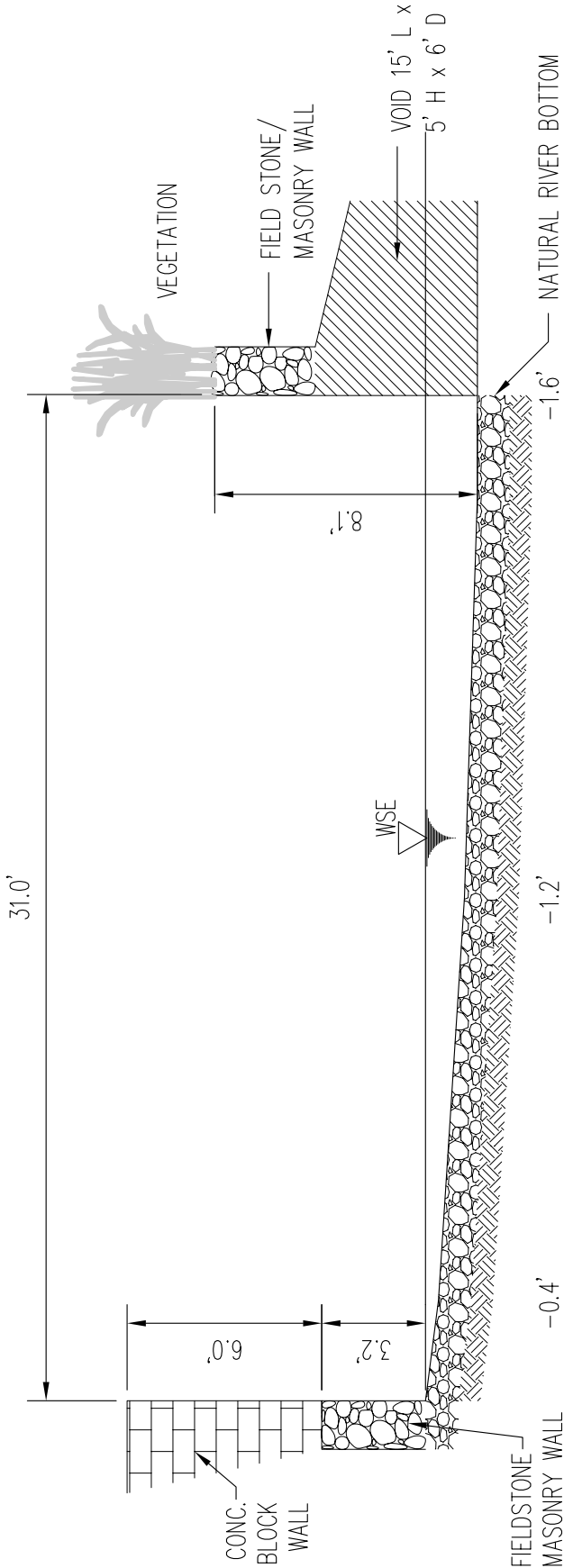
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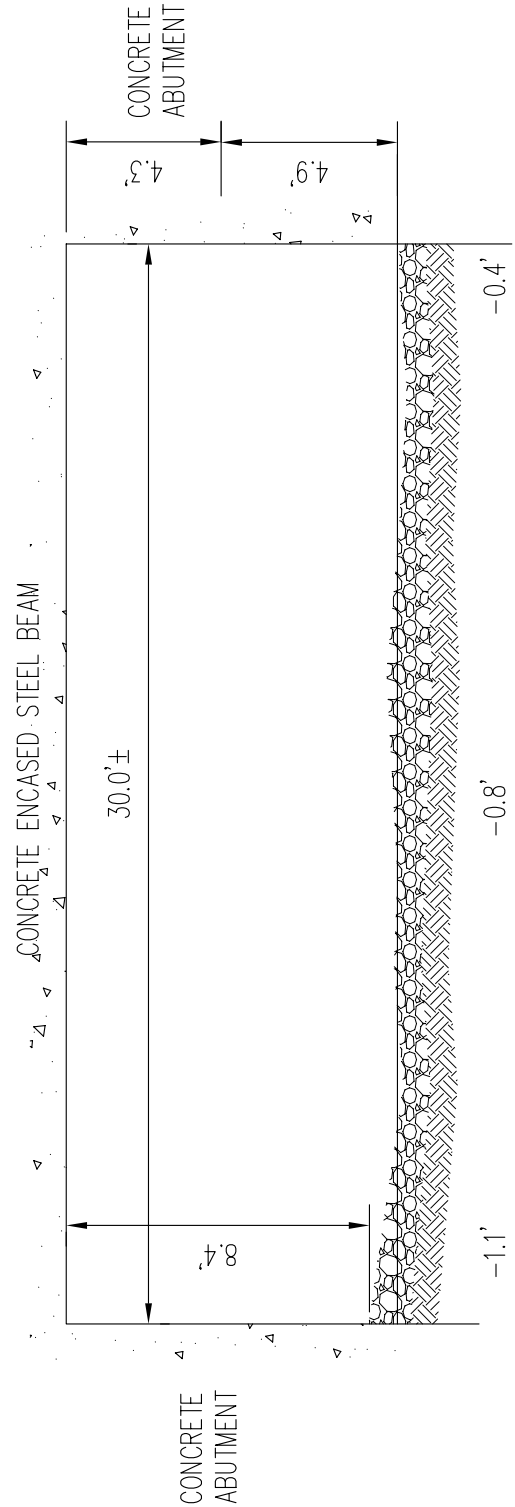
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B-10



SECTION @ STA. 32+50



SECTION @ STA. 33+30



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YONKERS, NEW YORK

PROJ. NO.

106100.01

SCALE

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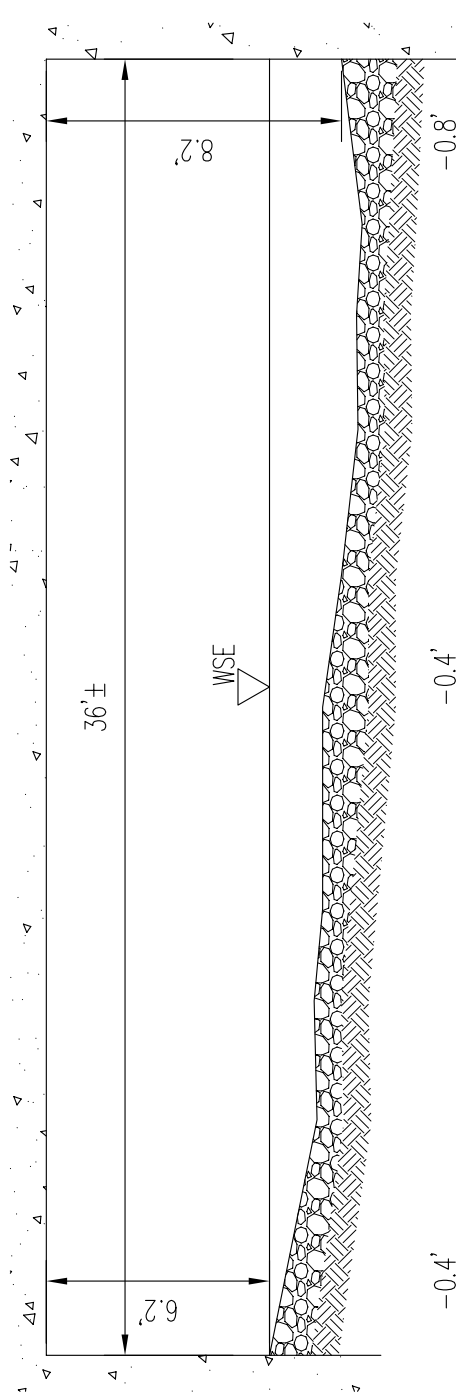
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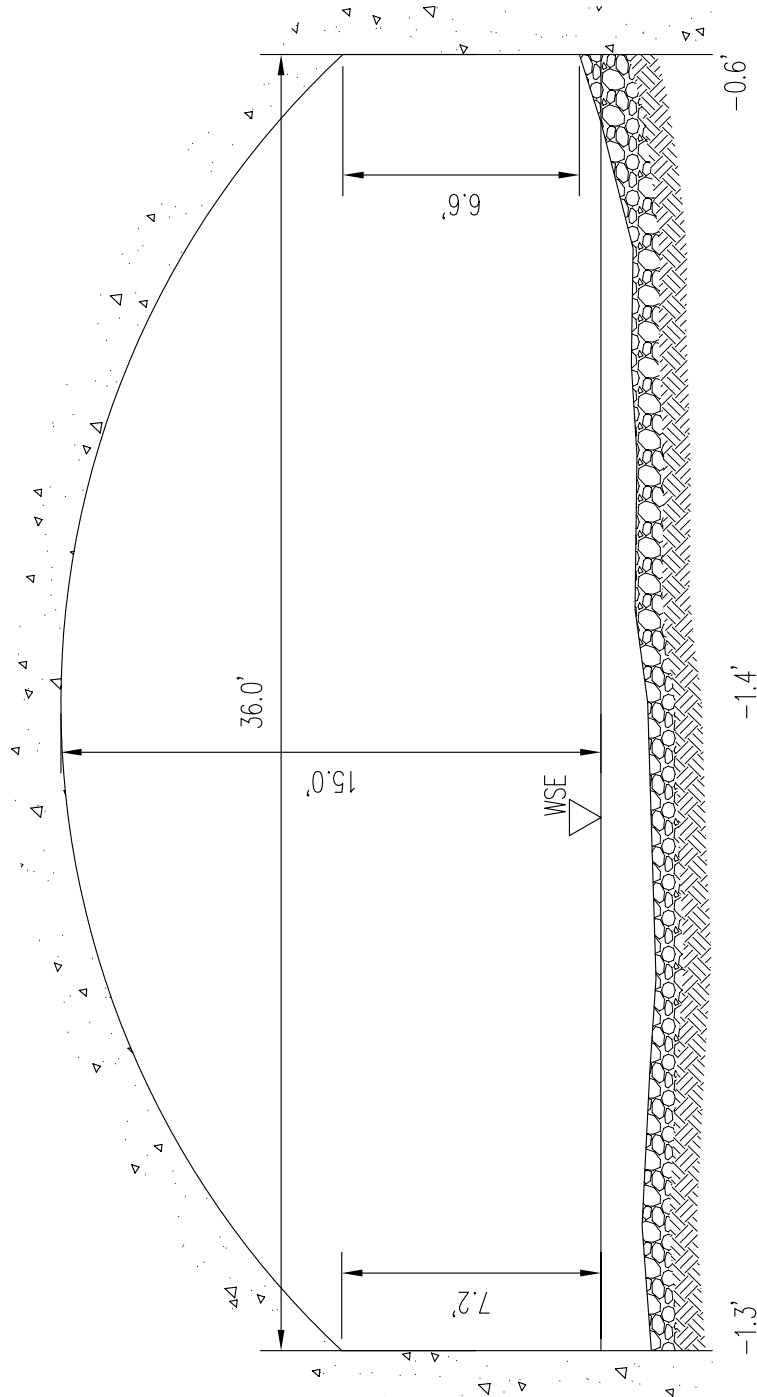
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B-11



SECTION @ STA 35+00



SECTION @ STA 36+40



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YONKERS, NEW YORK

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SCALE

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DATE

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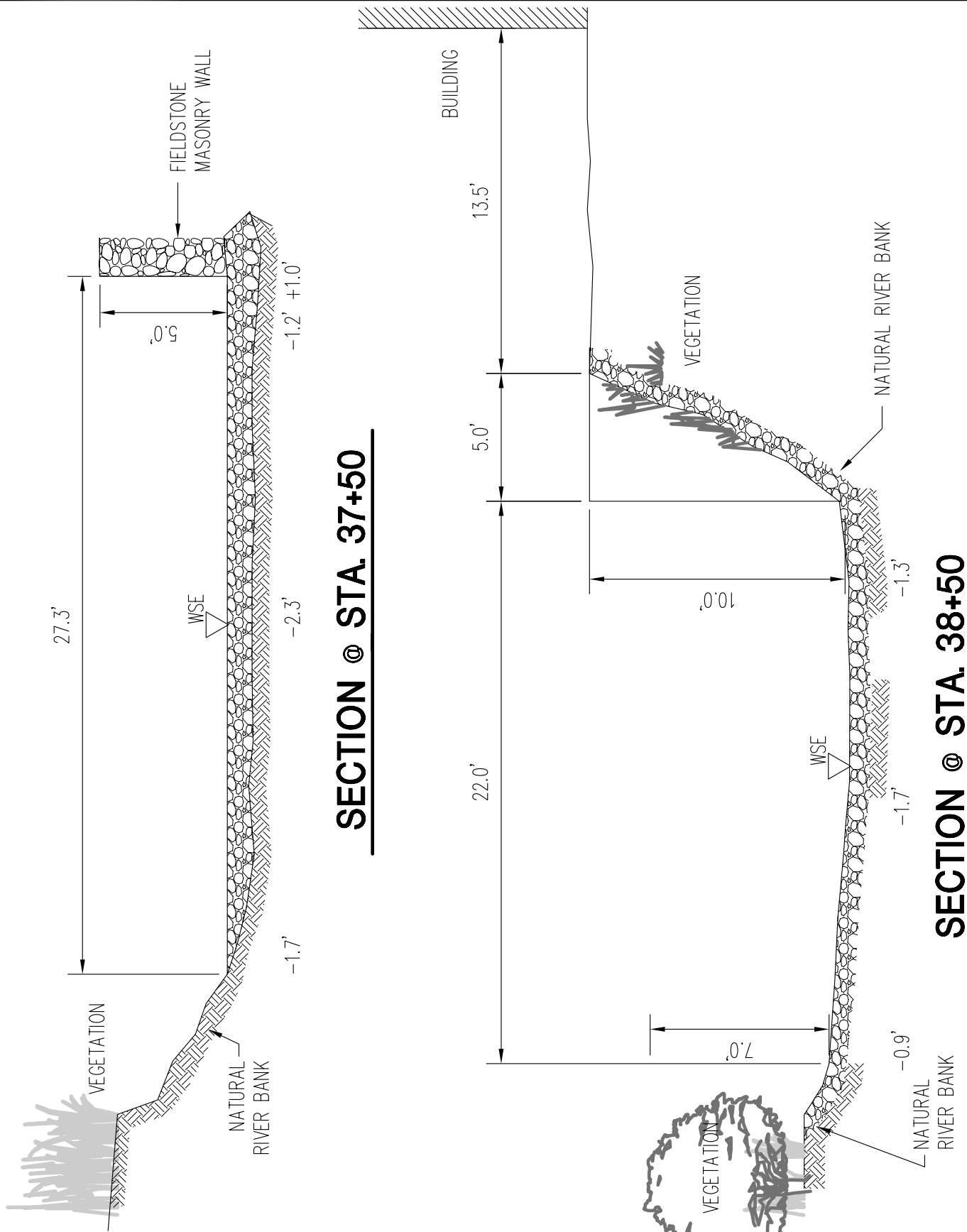
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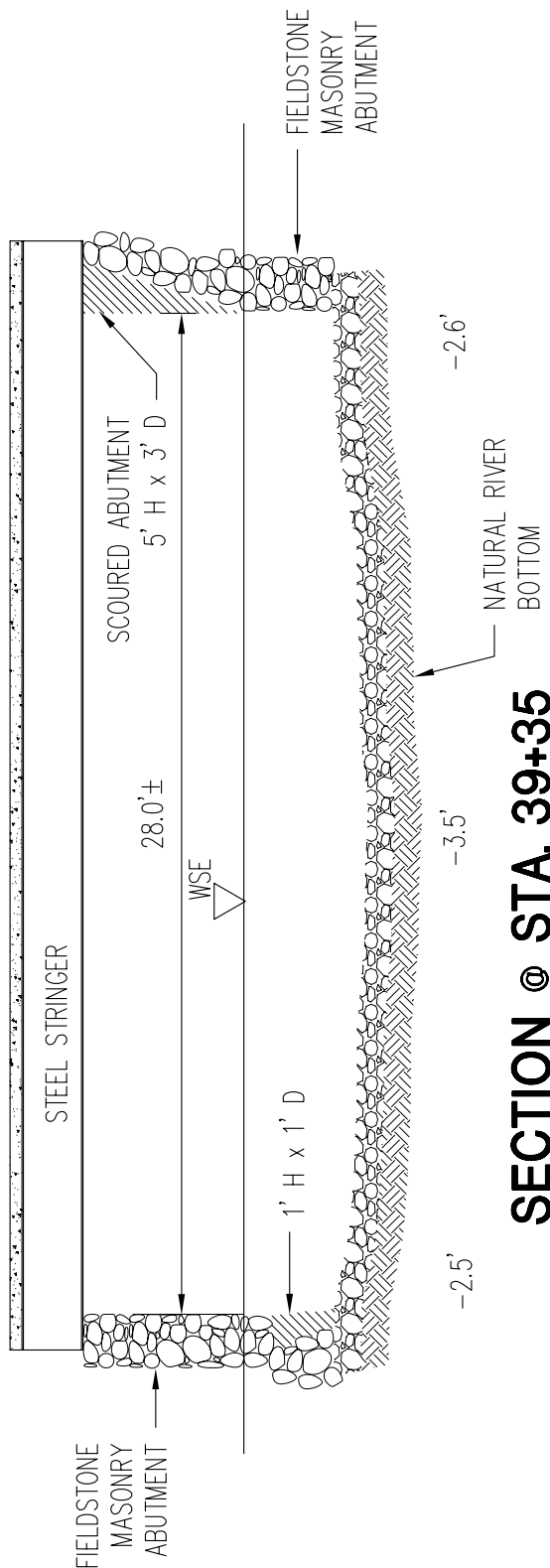
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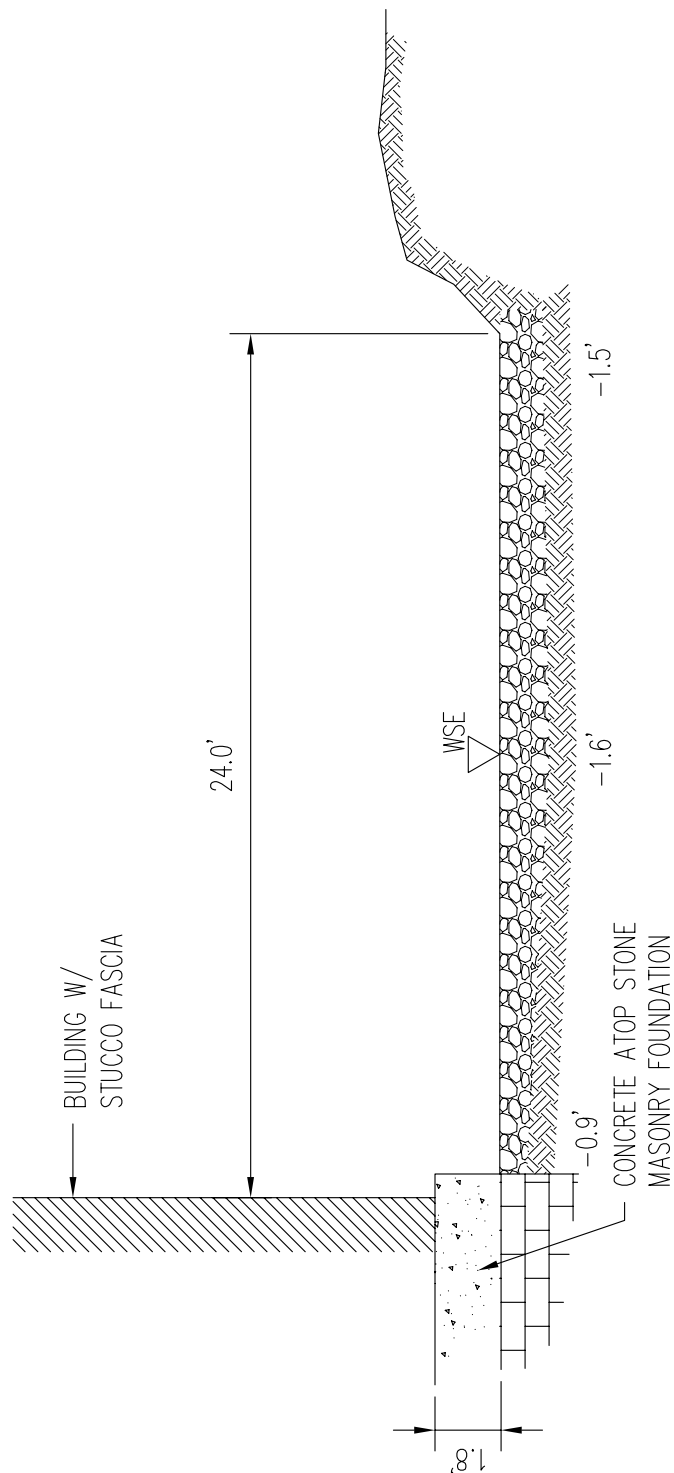
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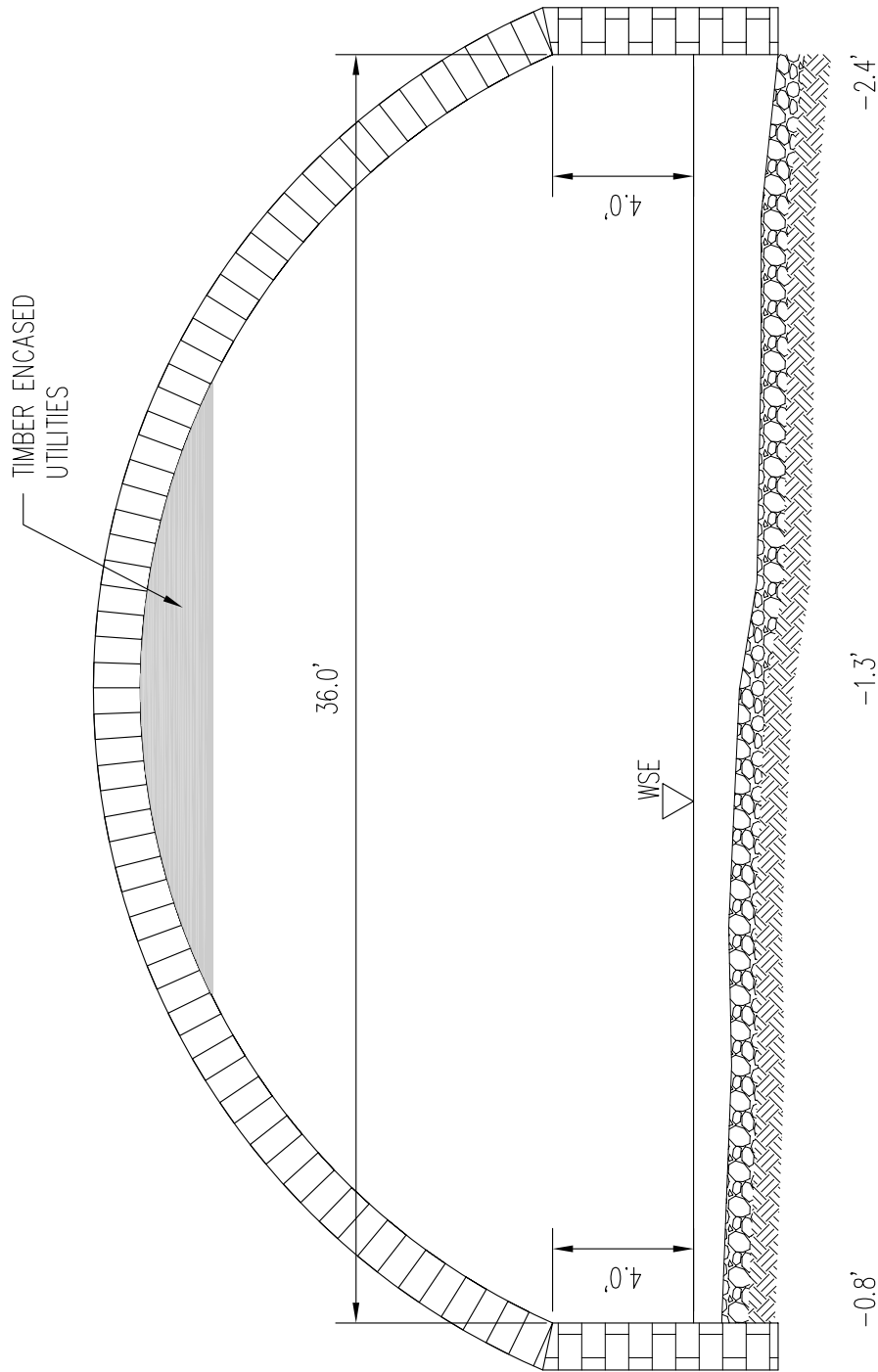


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SECTION @ STA 40+50

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SECTION @ STA. 42+00



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SHEET TITLE

SECTIONS

PROJECT

CHICKEN ISLAND- YONKERS
CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

PROJ. NO. 106100.01

SCALE 3/16" = 1'-0"

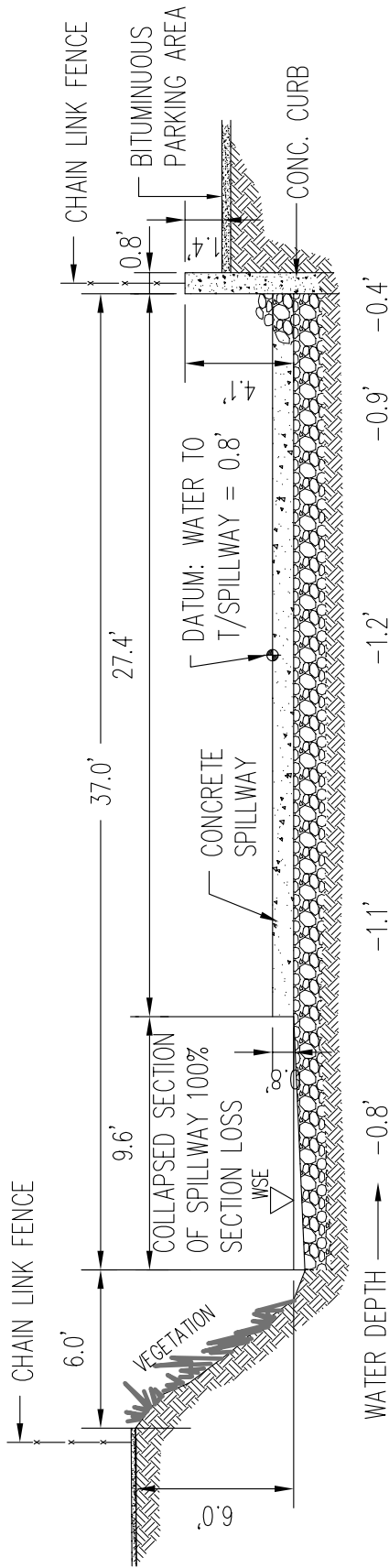
DATE AUG. 29, 2006

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B-15



NOTE: MUDLINE ELEVATIONS TAKEN ON
DOWNSTREAM SIDE OF CONCRETE
SPILLWAY (1.7' x 2' H ON
DOWNSTREAM SIDE).

SECTION @ STA. 44+73



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CULVERT/FLUME INSPECTION
YONKERS, NEW YORK

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B-16

**SAWMILL RIVER
CULVERT/FLUME INSPECTION
Yonkers, New York**

APPENDIX C

OBSERVED DEFICIENCIES



APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
18+05	Manhole	Bottom of manhole to culvert floor = 20.0'	
18+22		Upstream headwall of culvert. 8.4' from top of arch to culvert floor. Headwall exhibits intermittent hairline cracks and honeycombing. Chamfer spalls at radius of arch are 1'-2' long and 5" - 6" diameter.	
Warburton Avenue Bridge			
18+22 - 18+75	Geometry	39.5' wide by 51.5' long brick arch. Top of arch to concrete floor is 16.4' at downstream end, and 15.6' at upstream end.	
18+22 - 18+75	Brick Arch	No areas of missing bricks observed. Typically exhibits minor cracks with efflorescence.	
18+40	Utility Penetration	Approx. 6'W by 20'L utility penetration extends 2' down from top of arch. Area in vicinity of penetration exhibits heavy efflorescence.	X
18+52.5	Utility Penetration	Approx. 6'W by 20'L utility penetration extends 2' down from top of arch. Area in vicinity of penetration exhibits heavy efflorescence.	X
North Abutment	Left	Stone masonry abutment exhibits approx. 60% loss of grout up to 8" deep. No displaced or missing stones.	
South Abutment	Right	Good condition. No loss of grout.	
East face of Brick Arch	Brick Arch	Underside of SIP corrugated steel formwork can be viewed from culvert floor. Formwork has been installed to support sidewalk along east side of Warburton Ave.	
Section of Flume between Warburton Avenue Bridge and Mill Street Opening			
(Stone Masonry Piers are labeled West, Center, and East going upstream, south to north)			
18+75	Steel Girder	As the river enters beneath the Warburton Avenue Bridge, a steel girder, comprised of twin 20" high x 6" wide steel beams, supports the western fascias of two of the buildings located along the east side of Warburton Avenue. The north end of the girder exhibits severe deterioration with corrosion holes in the web. The south end exhibits moderate corrosion.	X
West 1		No undermining. Bottom 3' exhibits approximately 25% loss of mortar, up to 3" deep.	
Center 1		No undermining. Minor areas of missing mortar.	
West 2		Bottom 3' of stone pier has washed away. Area of missing stones is approximately 3.5' deep along north face and 2.5' along south face.	X
Center 2		West face, undermining/void, 6" high x 6" deep. West face, up to 6" deep loss of mortar at bottom 3' of pier. Other faces of pier are in good condition.	
East 2		No undermining. Minor areas of missing mortar.	
West 3		NE corner - area of missing stones, 10" high x 2' long x 16" deep. SE corner - area of missing stones, 10" high x 1' long x 16" deep. Bottom 2.5' - 3' of pier exhibits missing mortar and chink stones up to 8" deep.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
Hudson River to mouth of Saw Mill River			
	General	The Saw Mill River discharges into a 400' long by 100' wide tidal basin. A new steel sheet pile bulkhead has been constructed along the north shoreline of the basin adjacent to the flume outfall. The bulkhead was constructed to retain upland fill for a roadway bridge which is being constructed just west of the Metro North Train Station. Overall, the basin exhibits scattered areas of minor debris.	
Bridge beneath Metro North Railroad Tracks			
8+62 to 10+50	Geometry	The bridge is approximately 29.5' wide by 10' high and is approximately 188' long.	
8+62 to 10+50	Underdeck	The concrete beams and diaphragms typically exhibit multiple 1/8" to 1/4" wide cracks, spalls, and areas of delamination along	
8+62 to 9+91	Concrete Abutments	The reinforced concrete abutments typically exhibit moderate to heavy scale within the tidal zone.	
8+62 to 9+91	Concrete Abutments	The construction joints typically exhibit areas of chamfer spalls and moderate to heavy erosion in the tidal zone.	
8+62	SE Concrete Wingwall	The reinforced concrete wingwall typically exhibits moderate to heavy scale within the tidal zone.	
8+62 to 10+50	Underdeck	Approximately 25% of the bottom of the concrete beams are spalled with areas of exposed reinforcement.	
9+91 - 10+41	Left	Construction of the north abutment changes from concrete to stone masonry. The abutment typically exhibits up to 25% grout loss.	
9+91	Right	A 5' wide by 3' high by 3" deep void is located in the south abutment.	
9+91 - 10+19	Right	Construction of the south abutment changes from concrete to stone masonry. The abutment typically exhibits up to 25% grout loss.	
Concrete arch culvert located beneath Larkin Plaza			
10+50 - 18+22	General	Approx. 20' wide by 8' high concrete arch. The arch typically exhibits localized areas of minor map cracking with efflorescence. The construction joints exhibit minor chamfer spalls and loss of joint filler.	
11+20	Right	Drainage pipe penetration through culvert wall.	
11+32	Manhole	Bottom of manhole to culvert floor = 9.1' Water Depth = 1.9'	
12+03.5	Right	Drainage pipe penetration through culvert wall.	
14+30	Manhole	Bottom of manhole to culvert floor = 11.35'	
14+50	Floor	Masonry paver floor begins. Pavers are typically missing 3' to 6' wide at center of culvert throughout. Exposed areas of concrete floor exhibits heavy scale.	X
14+60	Floor	Transition from level floor to sloped floor.	
16+18	Manhole	Bottom of manhole to culvert floor = 12.9'	
17+79	Left	Drainage pipe penetration through culvert wall.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
Center 3		West face - area of missing stones, 2' high x 3' long x 20" deep. South face, bottom 4' - 5' of pier exhibits missing mortar 4" to 6" deep.	
East 3		No undermining. Minor areas of missing mortar.	
West 4		NE corner - area of missing stones, 10" high x 2' long x 18" deep. SE corner - area of missing stones, 1' high x 1' long x 16" deep. Bottom 6' of pier exhibits missing mortar and chink stones.	
Center 4		Stone masonry pier has been repaired with a concrete encasement. Timber log debris is located atop north face of pier, and a 3' high accumulation of debris is located at the upstream face of the pier.. Concrete repair/pier is undermined 1' high x 1' deep at North face, 1.5' high by 2' deep at NW Corner, 1' high x 2' deep at West face, 6" high by 6" deep at the south and east faces. In addition, an 8" high by 6" deep void is located around the exposed stones at the SW corner. A large stone located next to the SE corner of the pier prohibits any undermining at this location.	X
East 4		NW corner - area of missing stones, 8" high x 3' long x 18" deep. Bottom 2' of pier exhibits approx. 50% missing mortar with up to 4" penetration.	
19+50	Timber 12" x 12"	1/8" - 1/4" wide in underside to timber girder.	
18+75 - 19+00	Left	Bottom 5' of stone masonry wall exhibits areas of missing chink stones and mortar with up to 16" penetrations.	
19+00 - 19+25	Left	Bottom 5' of stone masonry wall exhibits areas of missing chink stones and mortar with up to 10" penetrations.	
19+80 - 20+00	Right	Bottom 1.5' of stone masonry wall exhibits approx. 50% missing mortar with up to 4" penetration.	
20+00	Left	No undermining observed at stone masonry pier. South face of pier exhibits approx. 50% missing mortar with up to 10" penetration and areas of missing chink stones.	
Manor House Square	Left	Stone masonry walls exhibit areas of rust staining and hairline to 1/16" wide cracks with efflorescence at isolated locations.	
Manor House Square	Concrete Jack-Arches	Minor to moderate corrosion of exposed bottom flanges of steel beams. The concrete arches typically exhibit map cracking with efflorescence.	
20+05	Left	Void at base of stone masonry wall, 3' long x 2' high x 3' deep.	
Section of Flume between Mill Street Opening and North Broadway Bridge			
20+12	Right	1" wide x 8' long diagonal crack in corner of building foundation. Crack extends through corner of foundation from north to west face. Section of crack at west face has been repaired with an injected epoxy.	X
20+12	Left	Bottom 1' of stone masonry pier exhibits 50% loss of mortar with up to 4" penetrations. Up to 3' high accumulation of debris at upstream face of pier.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
20 + 22	Right	Missing stone at base of masonry wall, 1' diam. x 1' deep.	
20 + 24	Right	Missing stone at base of masonry wall, 1' diam. x 1' deep.	
20 + 27	Right	Undermining/void, 8" high by 3.5' long by 1' deep.	
20 + 35 - 20 + 75	Left	Intermittent missing chink stones at bottom of 2' of wall. Approx. 50% of bottom 2' of wall exhibits up to 6" deep areas of missing mortar.	
20 + 35	Center Pier	Up to 3' high accumulation of debris located at upstream and east face of pier.	
20 + 34	Right	Missing stone at base of masonry wall, 8" diam. x 1' deep.	
20 + 36	Right	Missing stone at base of masonry wall, 8" diam. x 1' deep.	
20 + 65	Center Pier	Missing brick column and concrete footing at abandoned building.	
22 + 12 - 23 + 35	Brick Jack-Arches	Visible water infiltration through brick arches and at steel beams. Bottom flanges of steel beams exhibit heavy to severe corrosion.	X
20 + 75 - 23 + 35	Left/Right	Stone masonry walls typically exhibit isolated areas of missing grout.	
23 + 35	Right	An 8' long x 2.5' high x 2'-2.5' deep void/area of undermining is located at the base of the wall.	
23 + 50	Right	An 10' long x 2' high x 2.5' deep void/area of undermining is located at the base of the wall.	
23 + 63 - 23 + 73	Right	A 10' long x 2'-3' high x 7' deep void/area of undermining is located at the base of the wall.	X
23 + 73 - 23 + 88	Right	An 15' long x 3' high x 2.5' deep void/area of undermining is located at the base of the wall.	X
23 + 65 - 23 + 88	Left	Steel beam and concrete construction located along left half of channel. Underside of concrete deck exhibits severe scale with exposed reinforcement. Exposed bottom flanges of steel beams exhibit minor corrosion.	X
23 + 65 - 23 + 88	Right	Timber log and steel beam construction located along right half of channel. Corrugated steel formwork rests atop much of the timber logs and steel beams. Although it appears that many of the logs are missing, no signs of severe deterioration or structural distress was observed in this location.	X
23 + 70	Center Pier	Up to 2' high accumulation of debris located at upstream and east face of pier.	
North Broadway Bridge			
23 + 88 - 24 + 45	Left	Stone masonry wall typically exhibits minor cracks and separation of repointed mortar joints.	
24 + 15	Left	7' long by 4' high by 3' deep void in stone masonry abutment.	
24 + 22 - 24 + 38	Left	16' long by 5' high by 3' deep void in stone masonry abutment. Original stone masonry abutment is located behind void in new abutment.	
24 + 30	Left	1/2" wide by 3' high vertical crack in original stone masonry abutment behind void in new abutment.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
24 + 25 - 24 + 36	Right	2' high by 2' wide concrete repair is severely eroded up to 1' deep.	
23 + 88 - 24 + 25	Right	2' high by 2' wide concrete repair is located at the base of stone masonry abutment.	
24 + 23	Right	Void at base of abutment, 30" long x 7" high x 24" deep.	
24 + 26	Right	Void at base of abutment, 24" long x 2.5' high x 1' deep.	
Section of Flume between North Broadway Bridge and Palisade Avenue Bridge			
24 + 50	Right	1/4" - 3/8" wide diagonal crack in building foundation fascia at transition to North Broadway Bridge.	X
24 + 60	Underdeck	Exposed timber floor joists at area of missing stucco exhibit moderate to severe rot.	
24 + 45	Left	Up to 4' high by 5' wide accumulation of debris is located at base of steel column.	
24 + 45 - 24 + 75	Right	Stone and concrete ledge is located at base of foundation wall.	
24 + 45 - 24 + 56	Right	Stone and concrete ledge exhibits 2' high by 1' deep erosion.	
25 + 68	Right	Base of wall is undermined 2' long x 20" high x 1' deep.	
24 + 70	Left	Area of missing stones/void in masonry wall, 4' long by 2' high by 2' deep.	
25 + 10	Left	Area of missing stones/void in masonry wall, 8' long by 3' high by up to 4' deep (1' avg). No cracks or addition deterioration was observed above void.	
25 + 33	Center Column	Up to 4' high by 12' wide accumulation of debris is located at base of steel column.	
25 + 63 - 25 + 75	Left	Area of missing stones/void in masonry wall, 12' long by 8" high by 2' deep.	
Palisade Avenue Bridge			
26 + 16 - 26 + 64	Geometry	32' wide by 48' long stone masonry arch. Top of arch to concrete floor is 9.5' at downstream end, and 7' at upstream end.	
26 + 16 - 26 + 64	Stone Arch	No areas of missing stones observed. Approximately 15% of the joints exhibit 1" to 3" deep areas of missing grout.	
26 + 16 - 26 + 64	Concrete Floor	Exhibits localized areas of severe concrete scale.	
26 + 16	Concrete Floor	Top of arch to concrete floor is 9.5'. Top of arch to bottom of flume is approximately 10.5'.	
Section of Flume between Palisade Avenue Bridge and Ann Street Bridge			
27 + 00	Right Channel	A 3' high accumulation of debris has created a small dam which stretches across the right channel.	
26 + 64 - 26 + 85	Right	Stone masonry wall typically exhibits 5% missing grout and areas of missing chink stones.	
26 + 95 - 26 + 85	Right	Area of missing stones/void in masonry wall, 10' long by 2' high by 3' deep.	
26 + 64 - 27 + 00	Center Pier	No undermining. Minor areas of missing mortar.	
27 + 27 - 27 + 45	Center Pier	No undermining. Minor areas of missing mortar.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
28 + 30 - 28 + 94	Underdeck	Rigid foam insulation has been applied to the concrete beams. The beams typically exhibit minor areas of missing insulation.	
29 + 50 - 29 + 75	Underdeck	Approximately 5% of the bottom of the concrete beams are spalled with areas of exposed reinforcement.	
29 + 75 - 29 + 90	Left	Concrete wall exhibits intermittent undermining, 2" high by 2" deep.	
29 + 75 - 30 + 25	Underdeck	Approximately 10% of the bottom of the concrete beams are spalled with areas of exposed reinforcement.	
30 + 00	Construction Joint	Daylight coming through 1/2" - 3/4" gap in deck construction joint.	
30 + 25 - 30 + 75	Underdeck	Approximately 25% of the bottom of the concrete beams are spalled with areas of exposed reinforcement.	
Ann Street Bridge			
30 + 25 to 31 + 00	Geometry	The bridge is approximately 30' wide by 75' long. Reinforced concrete abutments support reinforced concrete beams and a concrete slab.	
30 + 25 to 31 + 00	Underdeck	The concrete beams are 18" wide by 18" deep and spaced approximately 4' on-center. The beams typically exhibit minor longitudinal cracks with efflorescence.	
30 + 25 to 31 + 00	Concrete Abutments	The reinforced concrete abutments typically exhibit isolated vertical cracks with efflorescence.	
30 + 25 - 30 + 50	Underdeck	Approximately 25% of the bottom of the concrete beams are spalled with areas of exposed reinforcement.	
30 + 50 - 30 + 75	Underdeck	Approximately 20% of the bottom of the concrete beams are spalled with areas of exposed reinforcement.	
31 + 00		Vertical steel support beams are the only remnants from original trash rack.	X
Open Channel between Ann Street Bridge and Henry Herz Street Bridge			
31 + 03 - 31 + 12	Left	Area of missing stones/void in masonry wall, 10' long by 5' high by 3' deep.	
31 + 03 - 32 + 10	Right	Concrete repair is undermined 1' high by 2' deep.	
32 + 23 - 32 + 38	Right	Void in stone masonry wall, 5' high by 6' deep.	
32 + 00 - 32 + 15	Left	Stone masonry wall undermined 2.5' high by 2.0' deep.	
32 + 30 - 32 + 60	Left	Multiple vertical cracks in masonry wall, up to 1" wide.	
Henry Herz Street Bridge			
33 + 16 to 33 + 65	Geometry	The bridge is approximately 30' wide by 49' long. Reinforced concrete abutments support reinforced concrete beams and a	
33 + 16 to 33 + 65	Underdeck	The concrete beams are 18" wide by 18" deep and spaced approximately 4' on-center. The beams typically exhibit minor	
33 + 16 to 33 + 65	Concrete Abutments	The reinforced concrete abutments typically exhibit areas of hairline vertical cracks with efflorescence.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
Parking Lot between Henry Herz Street Bridge and School Street Bridge			
33 + 70 - 36 + 06	Geometry	The flume beneath the parking lot is approximately 36' wide by 236' long. Reinforced concrete abutments support reinforced	
33 + 70 - 36 + 06	Underdeck	The concrete beams are 16" wide by 20" deep and typically exhibit minor longitudinal cracks with efflorescence. The bottom coners of several of the beams are spalled with exposed reinforcement.	
33 + 70 - 36 + 06	Concrete Abutments	The reinforced concrete abutments typically exhibit areas of hairline vertical cracks with efflorescence.	
School Street Bridge			
36 + 06 - 36 + 76	Geometry	The bridge is approximately 36' wide by 70' long. Reinforced concrete abutments support reinforced concrete arch. There is approximately 15' between the top of the arch and the mudline.	
33 + 70 - 36 + 06	Concrete Arch	The concrete arch exhibits areas of minor to moderate cracks with rust staining and efflorescence.	
Open Channel between School Street Bridge and John Street Alley Bridge			
37 + 40 - 37 + 90	Right	Stone masonry wall in poor condition with missing or displaced stones.	
39 + 15 - 39 + 33	Right	Stone masonry wall in poor condition. Wall exhibits 100% grout loss below high water mark.	
38 + 65	Center	A fallen tree, approximately 2' above the water surface, extends across the entire width of the river channel.	
John Street Alley Bridge			
39 + 33 - 39 + 50	Left	West masonry abutment is undermined up to 1' high by 1' deep.	
39 + 36	Right	Area of missing stones/void in east masonry abutment, 10' long by 5' high by 3' deep.	
39 + 33 - 39 + 50	Underdeck	Timber members supporting bridge deck exhibit moderate to severe deterioration due to rot.	
39 + 50	Left	A section of the northwest wingwall has rotated out of plumb and is displaced to the north.	
39 + 33 - 39 + 50	Top of deck	Steel plates have been placed atop the deck as a repair for severely deteriorated timber deck boards.	
Open Channel between John Street Alley Bridge and Elm Street Bridge			
39 + 50 - 39 + 60	Right	Concrete faced stone masonry wall undermined 1' high by 1' deep.	
39 + 60 - 40 + 05	Right	Stone wall in poor condition with intermittent voids.	
40 + 40 - 40 + 67	Left	Intermittent undermining of building foundation, up to 1' high by 1' deep.	
40 + 85 - 41 + 71	Left	3' to 5' high stone masonry wall in poor condition with intermittent voids.	

APPENDIX C - OBSERVED DEFICIENCIES

Nepperhan/Saw Mill River Culvert/Flume Inspection

Station/Location	Left/Right Side (looking upstream)	Comment	Noted in Previous Report
Elm Street Bridge			
41 + 71 - 42 + 30	Geometry	32' wide by 59' long stone masonry arch. The west abutment is 4.8' high and the east abutment is 6.4' high.	
26 + 16 - 26 + 64	Stone Arch	No areas of missing stones observed. Approximately 25% of the joints exhibit 2" to 4" deep areas of missing grout.	
26 + 64	Right	The northeast wingwall exhibits minor areas of missing chink stones.	
Open Channel between Elm Street Bridge and Waring Row			
44 + 73	Left	Westernmost 9.6' of concrete spillway exhibits 100% deterioration.	