

Bridge Type Study

Proposed Bridge No. N-11-007=W-20-001

Plummer Spring Road over Artichoke Reservoir

Project No. 28395.00

Newburyport/West Newbury, Massachusetts

June 10, 2019

Prepared by:
BSC Group
803 Summer Street
Boston, MA 02127



EXECUTIVE SUMMARY

The City of Newburyport has assigned BSC Group as the design consultant for the planned full replacement of Bridge No. N-11-007=W-20-001 (8BC), Plummer Spring Road over Artichoke Reservoir. This single span structure is to be replaced in its entirety (superstructure and substructure) due to its deteriorated condition.

The proposed bridge is to be constructed on a similar alignment as the existing bridge. The number of spans will stay as one (1). Bridge types have been analyzed considering; hydraulics, costs, construction, economy, environmental, design and aesthetics. The bridge types are:

- Alternative 1 – 45'-0" Span Spread Box beams (24'-0" roadway)
- Alternative 1A – 45'-0" Span Spread Box beams (24'-0" roadway with two 5'-6" sidewalks)
- Alternative 1B – 45'-0" Span Spread Box beams (24'-0" roadway with one 5'-6" sidewalks)
- Alternative 2 – 45'-0" Span Spread Box beams (22'-0" roadway)
- Alternative 3 – 30'-8" Span Arch (24'-0" roadway)
- Alternative 4 – 24'-8" Span Arch (24'-0" roadway)
- Alternative 5 – 22'-0" Clear Span Rigid Frame (24'-0" roadway)

Plummer Spring Road is classified as a Rural Local Road. Two different bridge rail/guardrail types have also been investigated. Bridge Construction Costs are based on most cost-efficient option of continuing Thrie-Beam guardrail across the bridge. S3-TL4 bridge railing with required concrete transitions increasing cost by approximately \$50,000 for each alternative. Alternatives with sidewalks require S3-TL4 bridge railing.

Grants: The City of Newburyport was awarded a \$500,000 MassDOT Municipal Bridge Grant towards design and construction. BSC Group will assist the Town of West Newbury with an application for a MassWorks infrastructure grant due August 2019.

PRELIMINARY BRIDGE CONSTRUCTION COST ESTIMATE

Alternative 1 – 45’-0” Span Spread Box beams (24’-0” roadway)

Design, Permitting and \$40,000 Residence Engineer Estimate =	\$358,000
Bridge Estimated Construction Cost =	\$1,340,000
Highway Estimated Construction Cost =	\$420,000
TOTAL	\$2,118,000

Alternative 1A – 45’-0” Span Spread Box beams (24’-0” roadway with two 5’-6” sidewalks*)

Design, Permitting and \$40,000 Residence Engineer Estimate**=	\$411,000
Bridge Estimated Construction Cost =	\$1,960,000
Highway Estimated Construction Cost =	\$610,000
TOTAL	\$2,981,000

* Sidewalks on bridge only

**Additional permitting & design required due to sidewalks

Alternative 1B – 45’-0” Span Spread Box beams (24’-0” roadway with one 5’-6” sidewalk*)

Design, Permitting and \$40,000 Residence Engineer Estimate**=	\$389,000
Bridge Estimated Construction Cost =	\$1,650,000
Highway Estimated Construction Cost =	\$515,000
TOTAL	\$2,554,000

* Sidewalk on bridge only

**Additional permitting & design required due to sidewalk

Alternative 2 – 45’-0” Span Spread Box beams (22’-0” roadway)

Design, Permitting and \$40,000 Residence Engineer Estimate =	\$363,000
Bridge Estimated Construction Cost =	\$1,310,000
Highway Estimated Construction Cost =	\$410,000
TOTAL	\$2,083,000

Alternative 3 – 30’-8” Span Arch (24’-0” roadway)

Design, Permitting and \$40,000 Residence Engineer Estimate =	\$304,000
Bridge Estimated Construction Cost =	\$1,580,000
Highway Estimated Construction Cost =	\$440,000
TOTAL	\$2,324,000

Alternative 4 – 24’-8” Span Arch (24’-0” roadway)

Design, Permitting and \$40,000 Residence Engineer Estimate =	\$302,000
Bridge Estimated Construction Cost =	\$1,590,000
Highway Estimated Construction Cost =	\$444,000
TOTAL	\$2,336,000

Alternative 5 – 22'-0" Clear Span Rigid Frame (24'-0" roadway)

Design, Permitting and \$40,000 Residence Engineer Estimate =	\$288,000
Bridge Estimated Construction Cost =	\$1,710,000
Highway Estimated Construction Cost =	\$430,000
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TOTAL	\$2,428,000

Note: Due to soil conditions and depth of excavation high probability of additional costs for Alternative 5 during construction.



Thrie Beam – Guardrail Across Bridge

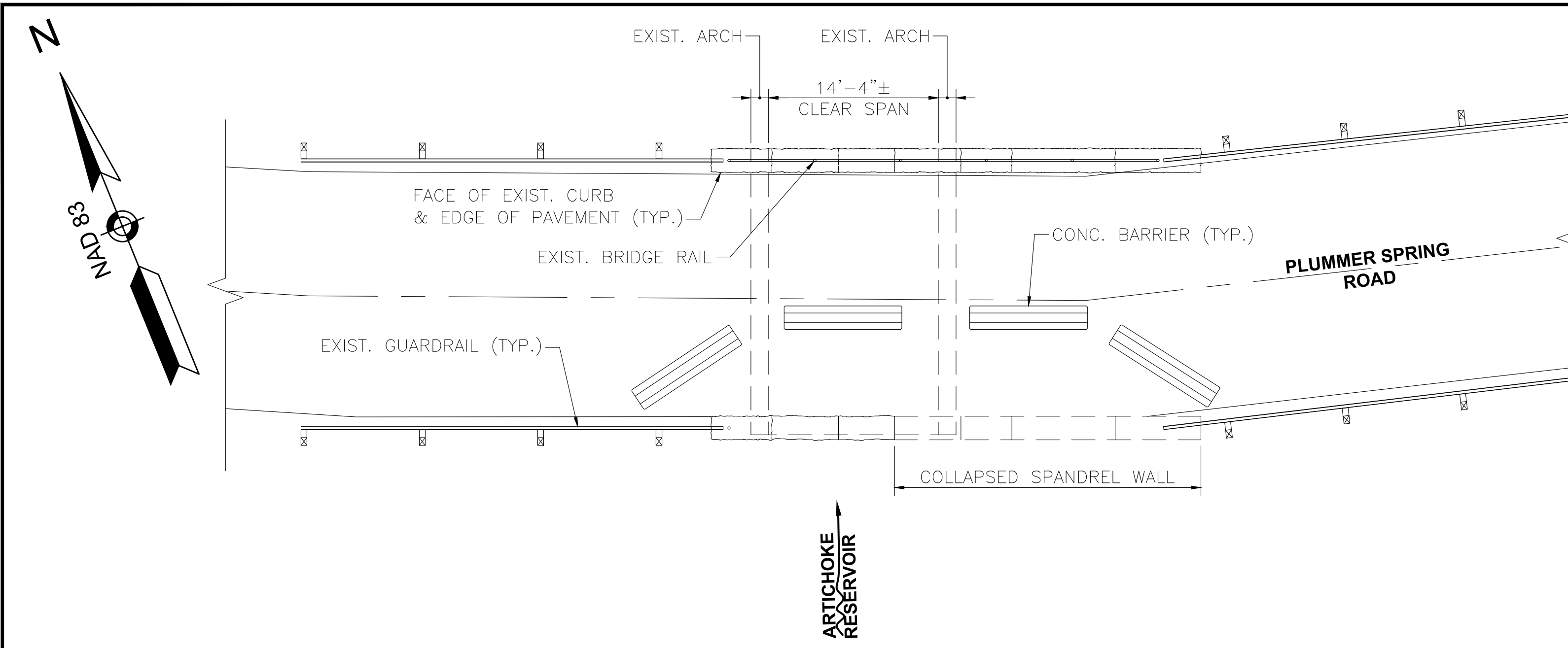


S3-TL4 – Bridge Rail & Concrete Transitions at Safety Curb



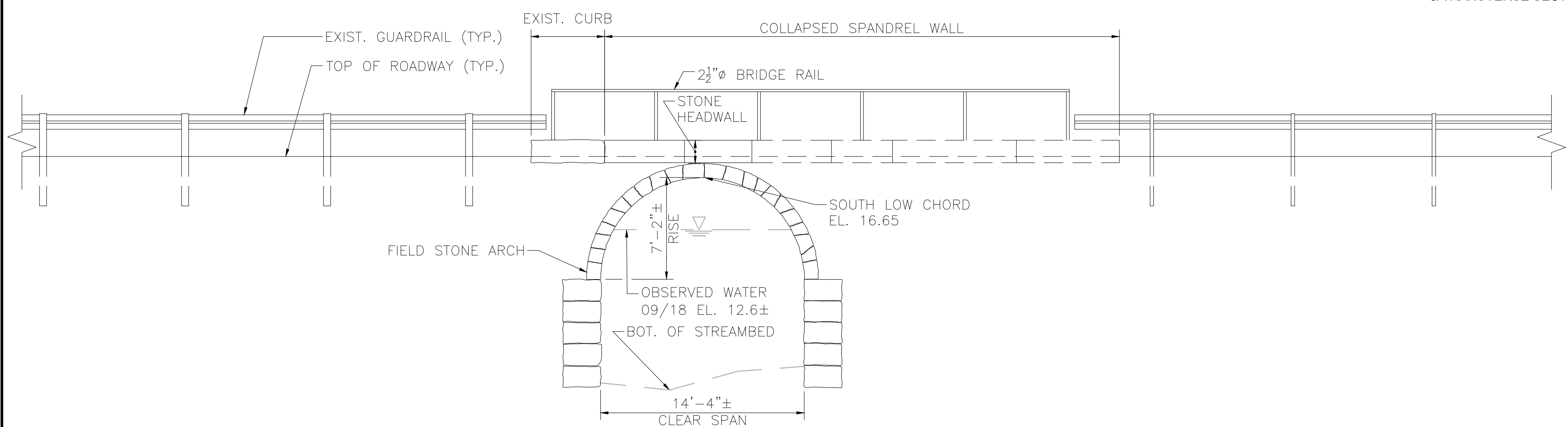
S3-TL4 – Bridge Rail & Concrete Transitions at Sidewalk

DRAWINGS

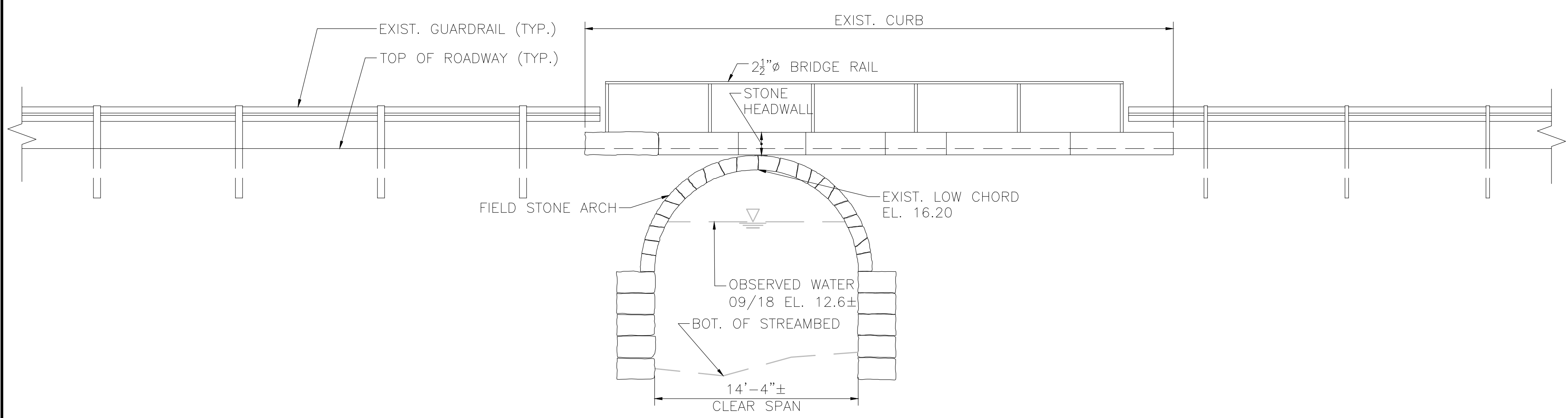


EXISTING PLAN
SCALE: 1/8" = 1'-0"

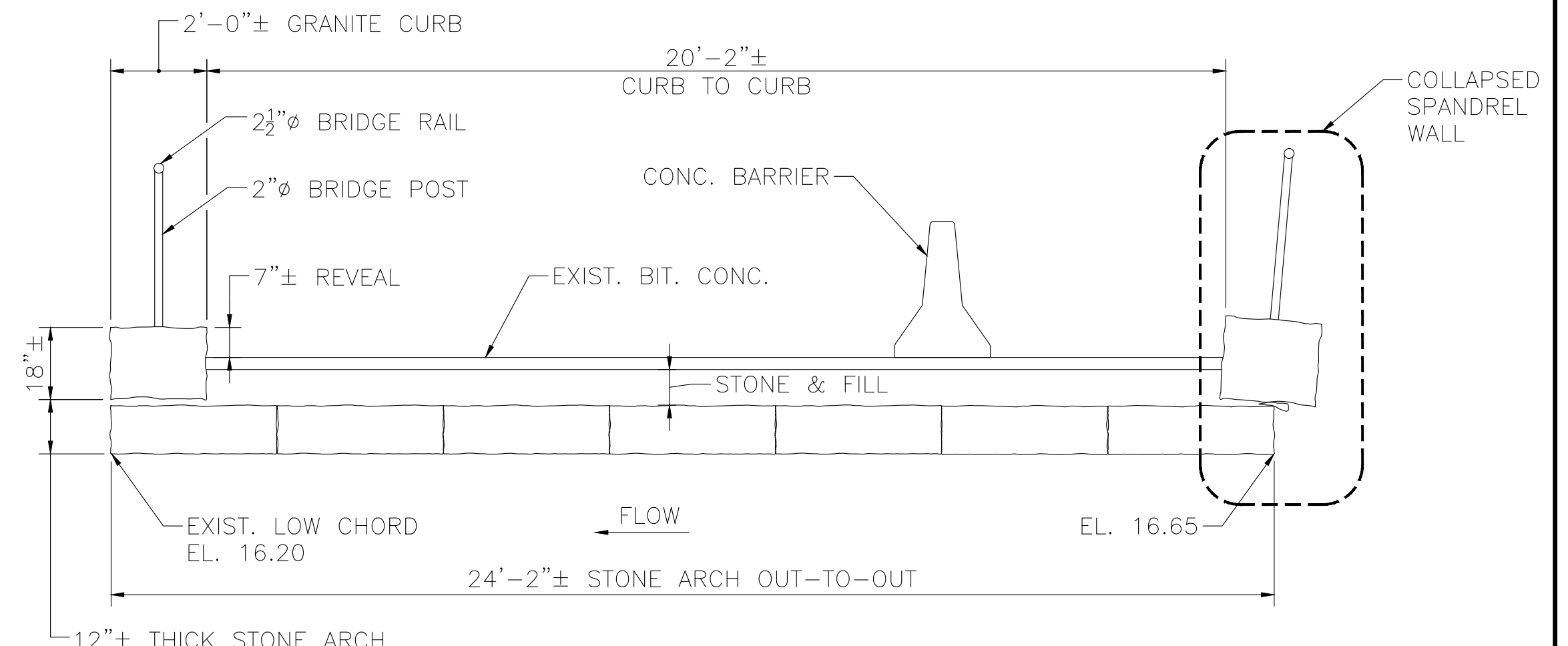
SHEET NO.	DESCRIPTION
1 OF 11	EXISTING CONDITIONS & LOCUS
2 OF 11	ALTERNATIVE 1 - 45'-0" SPAN, 24'-0" ROADWAY SPREAD BOX BEAM KEY PLAN & PROFILES
3 OF 11	ALTERNATIVE 1 - 45'-0" SPAN, 24'-0" ROADWAY SPREAD BOX BEAM PLAN, ELEVATION & TRANSVERSE SECTION
4 OF 11	ALTERNATIVE 1A - 45'-0" SPAN, SPREAD BOX BEAM WITH TWO SIDEWALKS PLAN, ELEVATION & TRANSVERSE SECTION
5 OF 11	ALTERNATIVE 1B - 45'-0" SPAN, SPREAD BOX BEAM WITH ONE SIDEWALK PLAN, ELEVATION & TRANSVERSE SECTION
6 OF 11	ALTERNATIVE 2 - 45'-0" SPAN, 22'-0" ROADWAY SPREAD BOX BEAM KEY PLAN & PROFILES
7 OF 11	ALTERNATIVE 2 - 45'-0" SPAN, 22'-0" ROADWAY SPREAD BOX BEAM PLAN, ELEVATION & TRANSVERSE SECTION
8 OF 11	ALTERNATIVE 3 - 30'-8" SPAN ARCH KEY PLAN & PROFILES
9 OF 11	ALTERNATIVE 3 - 30'-8" SPAN ARCH PLAN, ELEVATION & TRANSVERSE SECTION
10 OF 11	ALTERNATIVE 4 - 24'-8" SPAN ARCH PLAN, ELEVATION & TRANSVERSE SECTION
11 OF 11	ALTERNATIVE 5 - 22'-0" SPAN RIGID FRAME PLAN, ELEVATION & TRANSVERSE SECTION



EXISTING SOUTH ELEVATION (UPSTREAM)
SCALE: 3/16" = 1'-0"



EXISTING NORTH ELEVATION (DOWNSTREAM)
SCALE: 3/16" = 1'-0"



EXISTING TRANSVERSE SECTION
SCALE: 3/8" = 1'-0"

INDEX

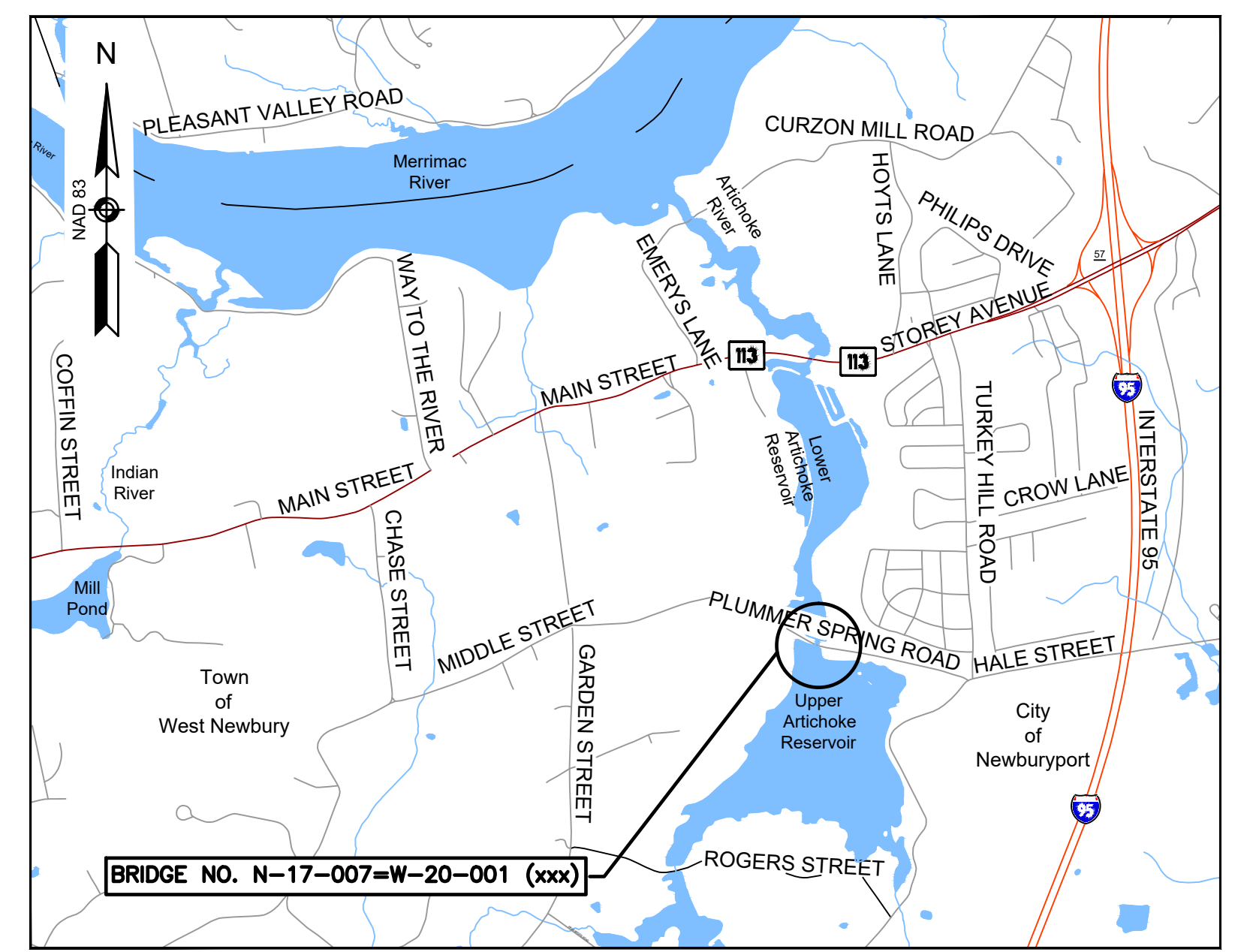
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11 OF 11	ALTERNATIVE 5 - 22'-0" SPAN RIGID FRAME PLAN, ELEVATION & TRANSVERSE SECTION

**NEWBURYPORT
PLUMMER SPRING ROAD**

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	11

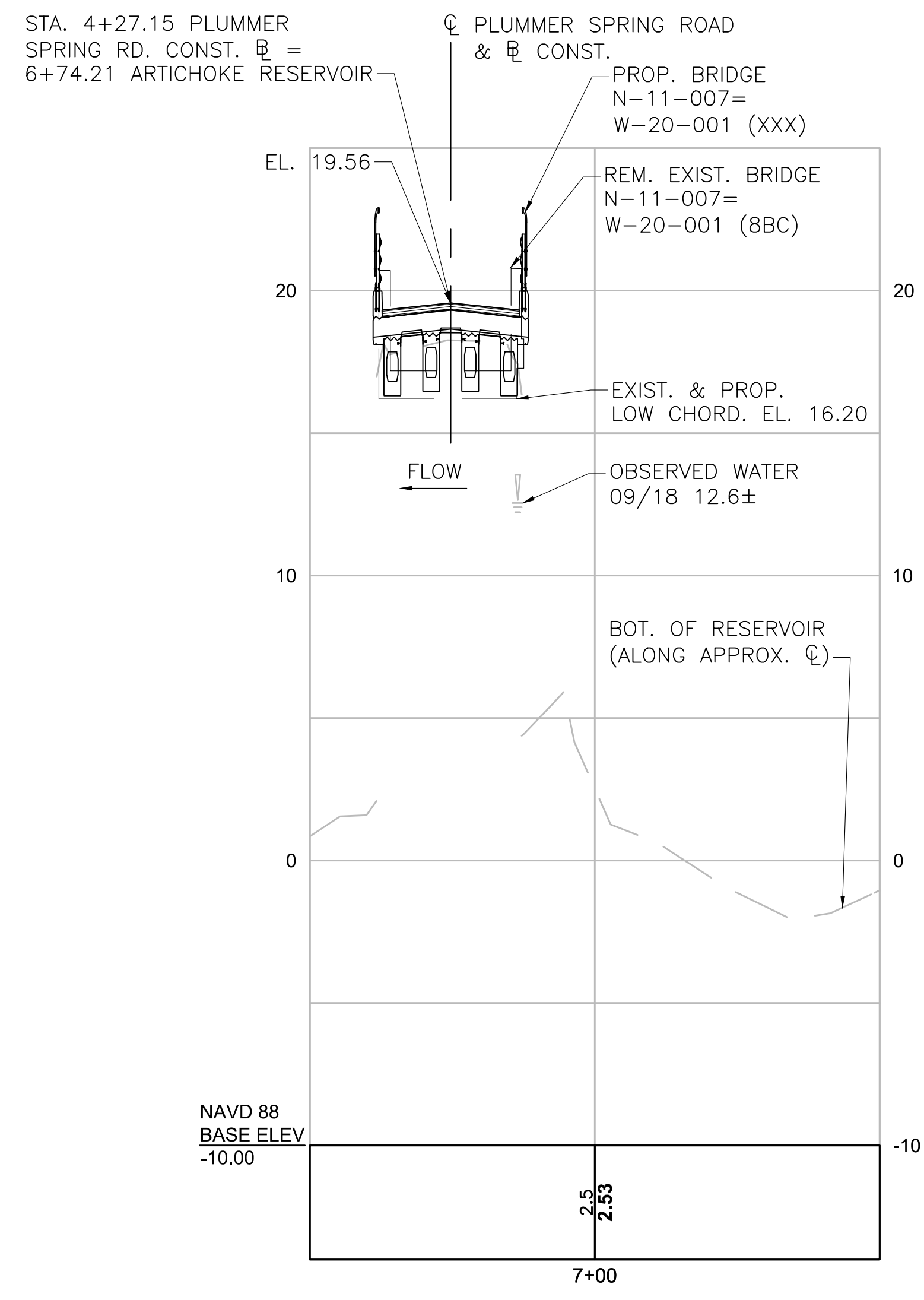
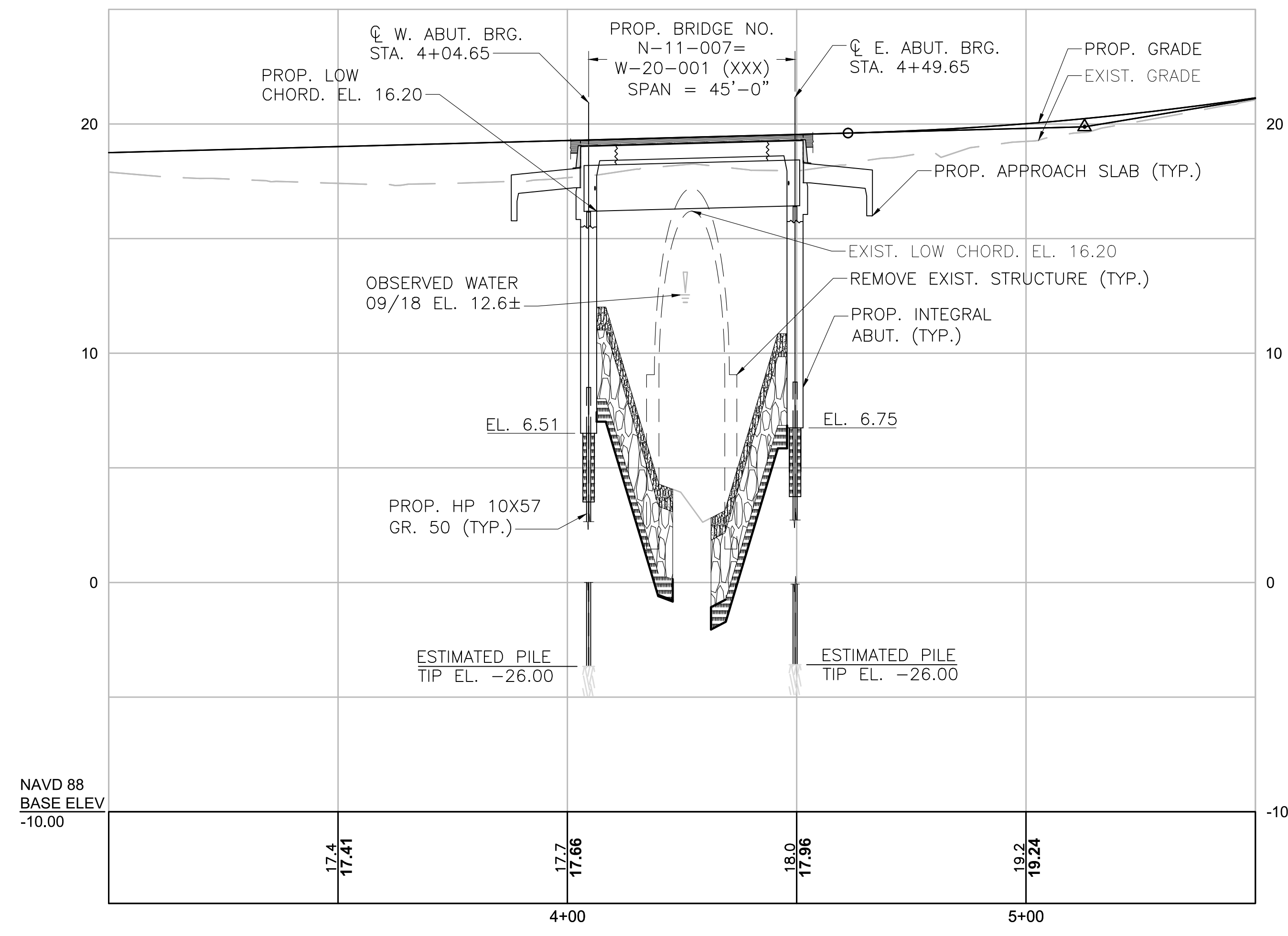
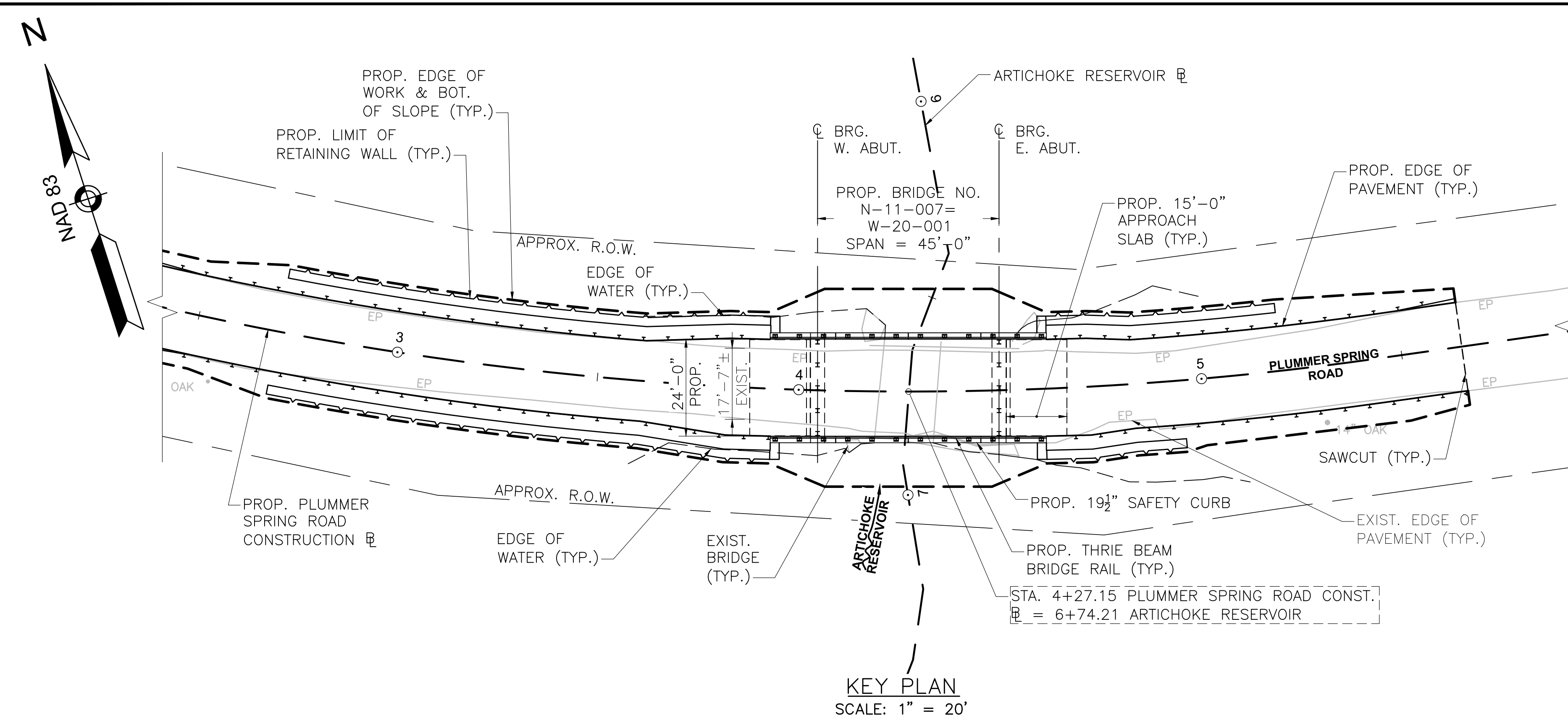
PROJECT FILE NO. N/A

EXISTING CONDITIONS & LOCUS



LOCUS PLAN
SCALE: 1" = 2000'

 803 SUMMER STREET BOSTON, MA 02127 (617) 896-4300 www.bscgroup.com	MONTH DD, YYYY ISSUED FOR CONSTRUCTION
	<p align="center">BRIDGE REPLACEMENT NEWBURYPORT/WEST NEWBURY</p> <p align="center">PLUMMER SPRING RD. OVER ARTICHOKE RESERVOIR</p>
 CITY OF NEWBURYPORT MASSACHUSETTS 60 PLEASANT ST. NEWBURYPORT, MA 01950	



ALTERNATIVE 1 PRELIMINARY DESIGN

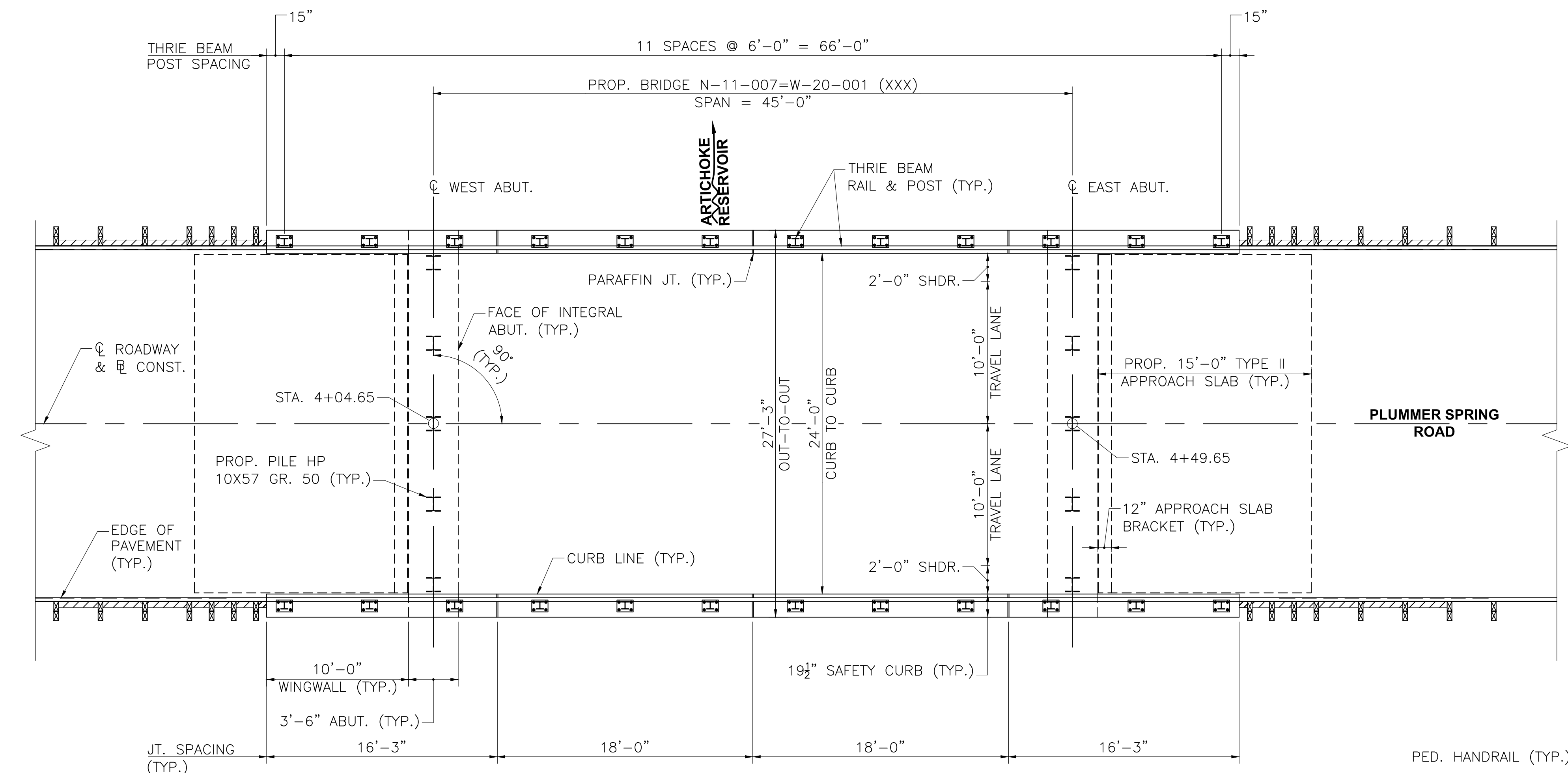
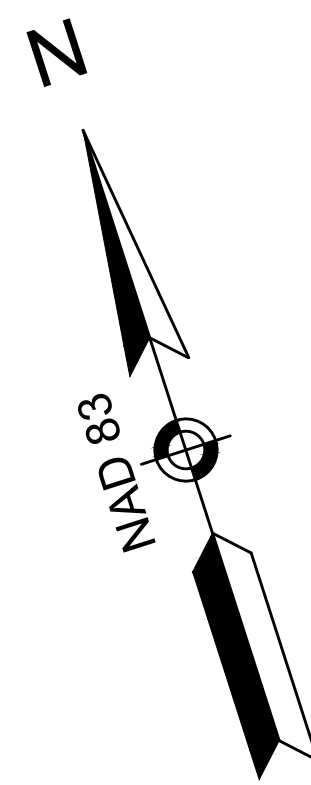
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

SPREAD BOX REV 1.DWG Plotted on 6-Jun-2019 10:06 AM Plans Submittal (SPX) XX-XX-201X

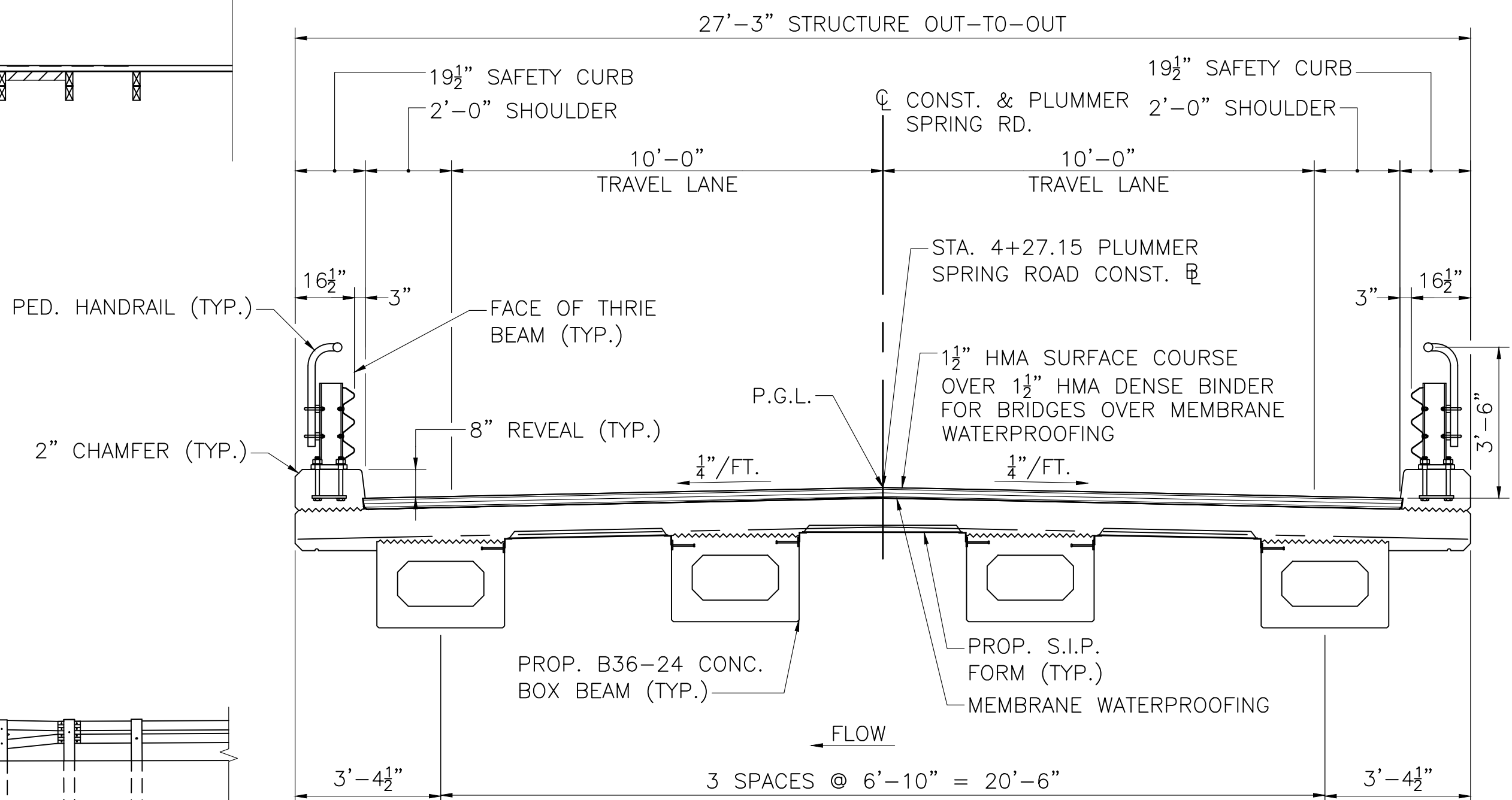
**NEWBURYPORT
PLUMMER SPRING ROAD**

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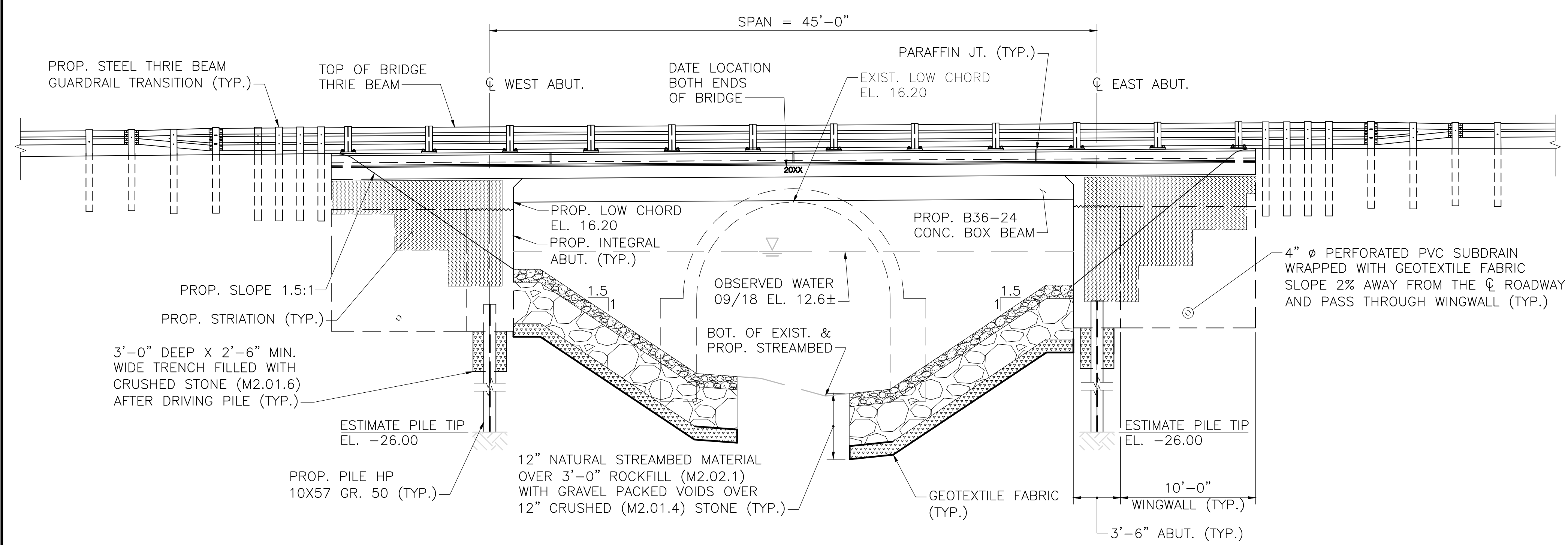
**ALTERNATIVE 1 - 45'-0" SPAN, 24'-0"
ROADWAY SPREAD BOX BEAM PLAN,
ELEVATION & TRANSVERSE SECTION**



PROPOSED PLAN
SCALE: 3/16" = 1'-0"



PROPOSED TRANSVERSE SECTION
SCALE: 3/8" = 1'-0"



PROPOSED SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

**ALTERNATIVE 1
PRELIMINARY DESIGN**

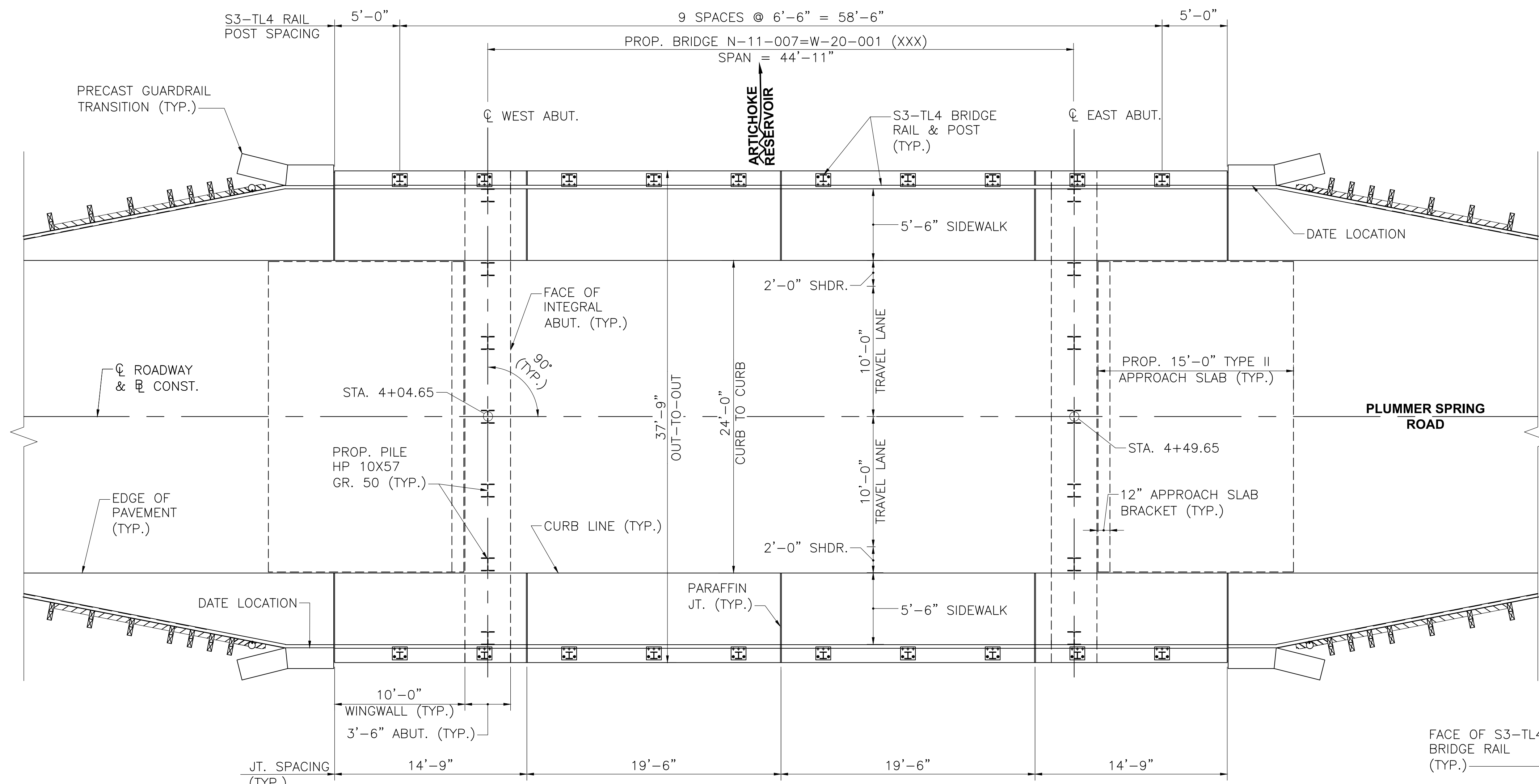
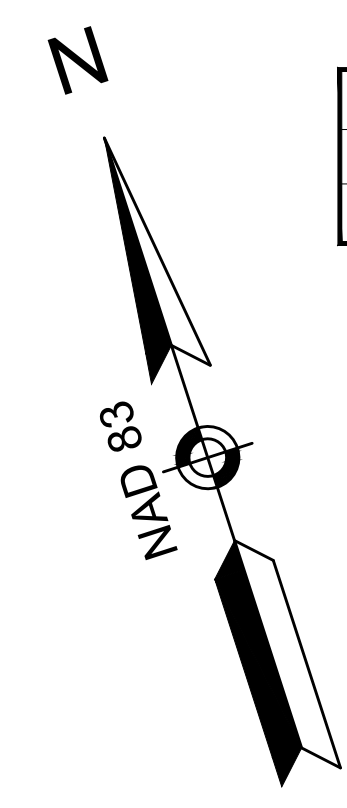
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
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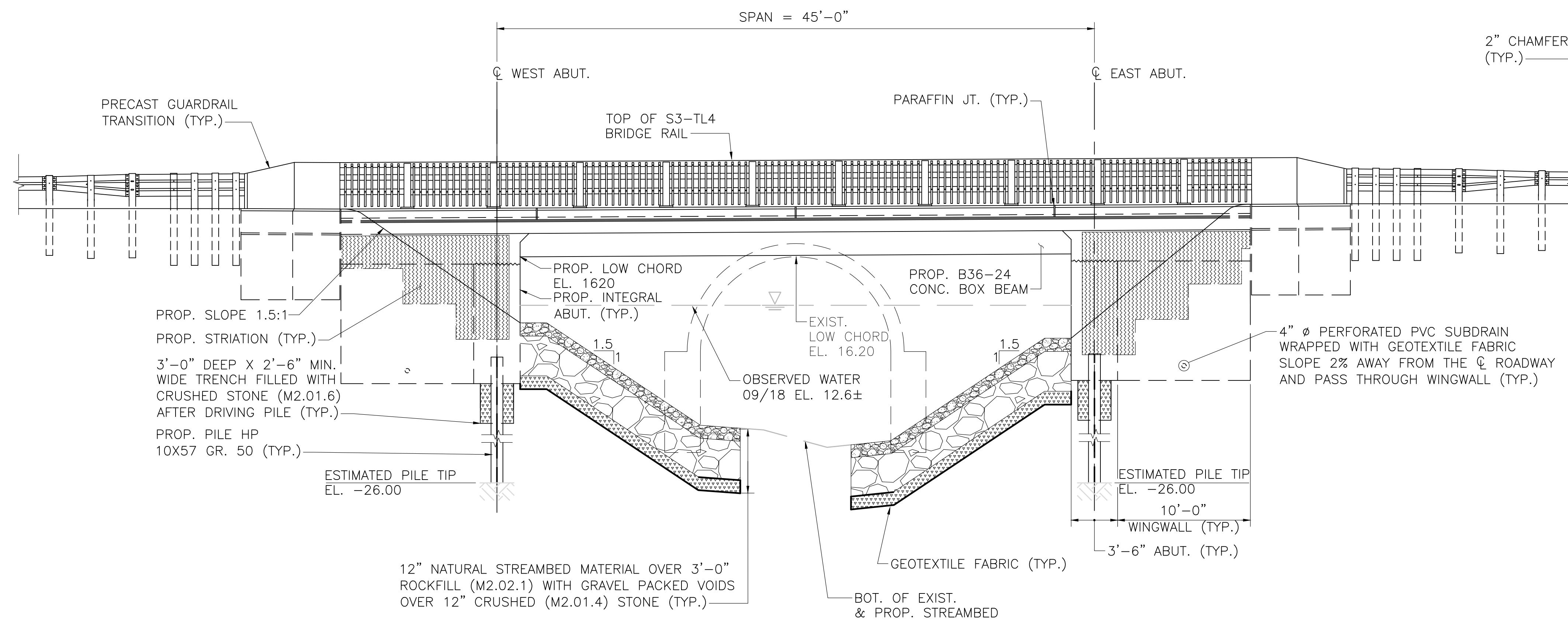
**NEWBURYPORT
PLUMMER SPRING ROAD**

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PROJECT FILE NO.		N/A	

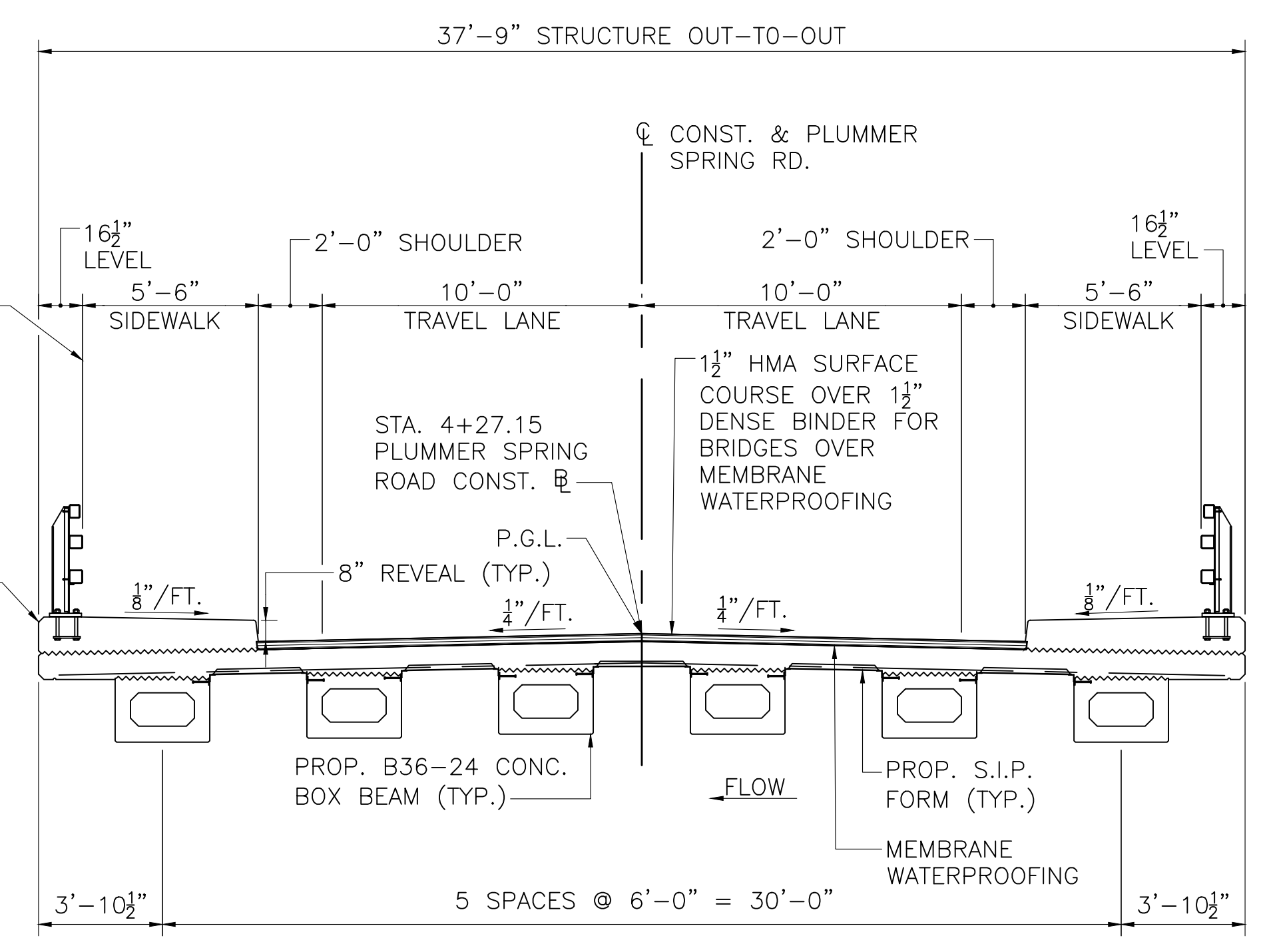
**ALTERNATIVE 1A - 45'-0" SPAN
SPREAD BOX BEAM WITH TWO
SIDEWALKS PLAN, ELEVATION &
TRANSVERSE SECTION**



PROPOSED PLAN
SCALE: 3/16" = 1'-0"



PROPOSED SOUTH ELEVATION
SCALE: 3/16" = 1'-0"



PROPOSED TRANSVERSE SECTION
SCALE: 1/4" = 1'-0"

**ALTERNATIVE 1A
PRELIMINARY DESIGN**

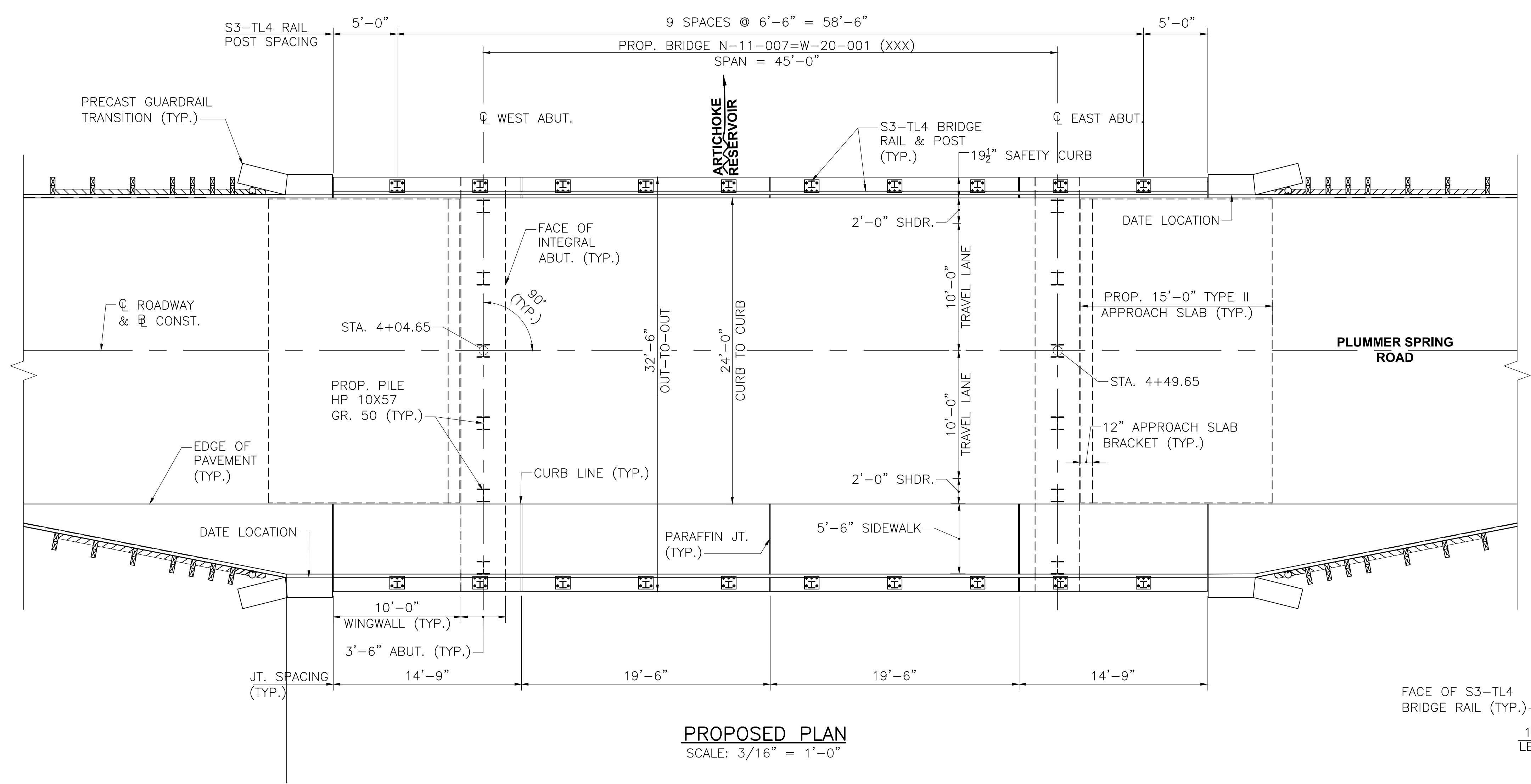
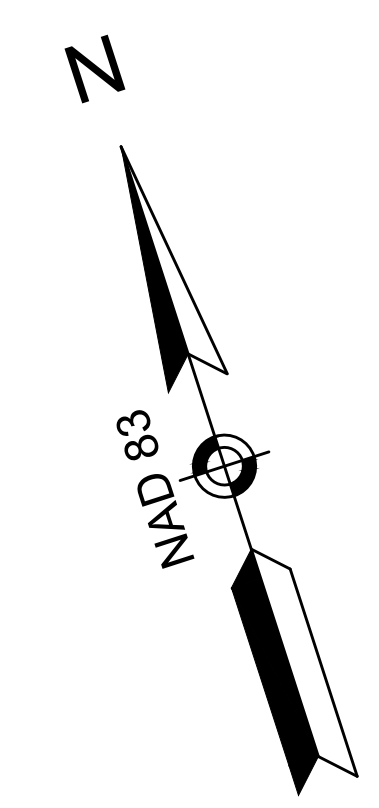
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

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SIDEWALK.DWG
Plans Submittal (SPX) XX-XX-201X

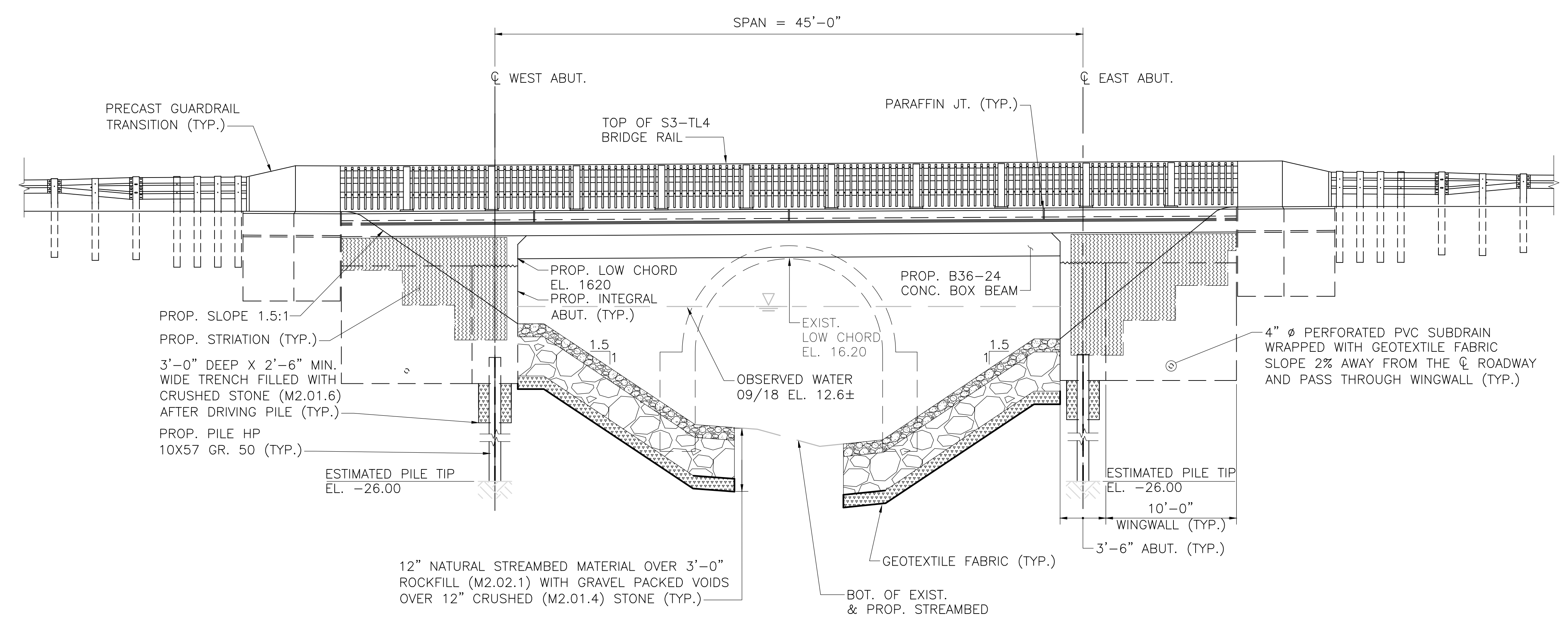
**NEWBURYPORT
PLUMMER SPRING ROAD**

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PROJECT FILE NO.		N/A	

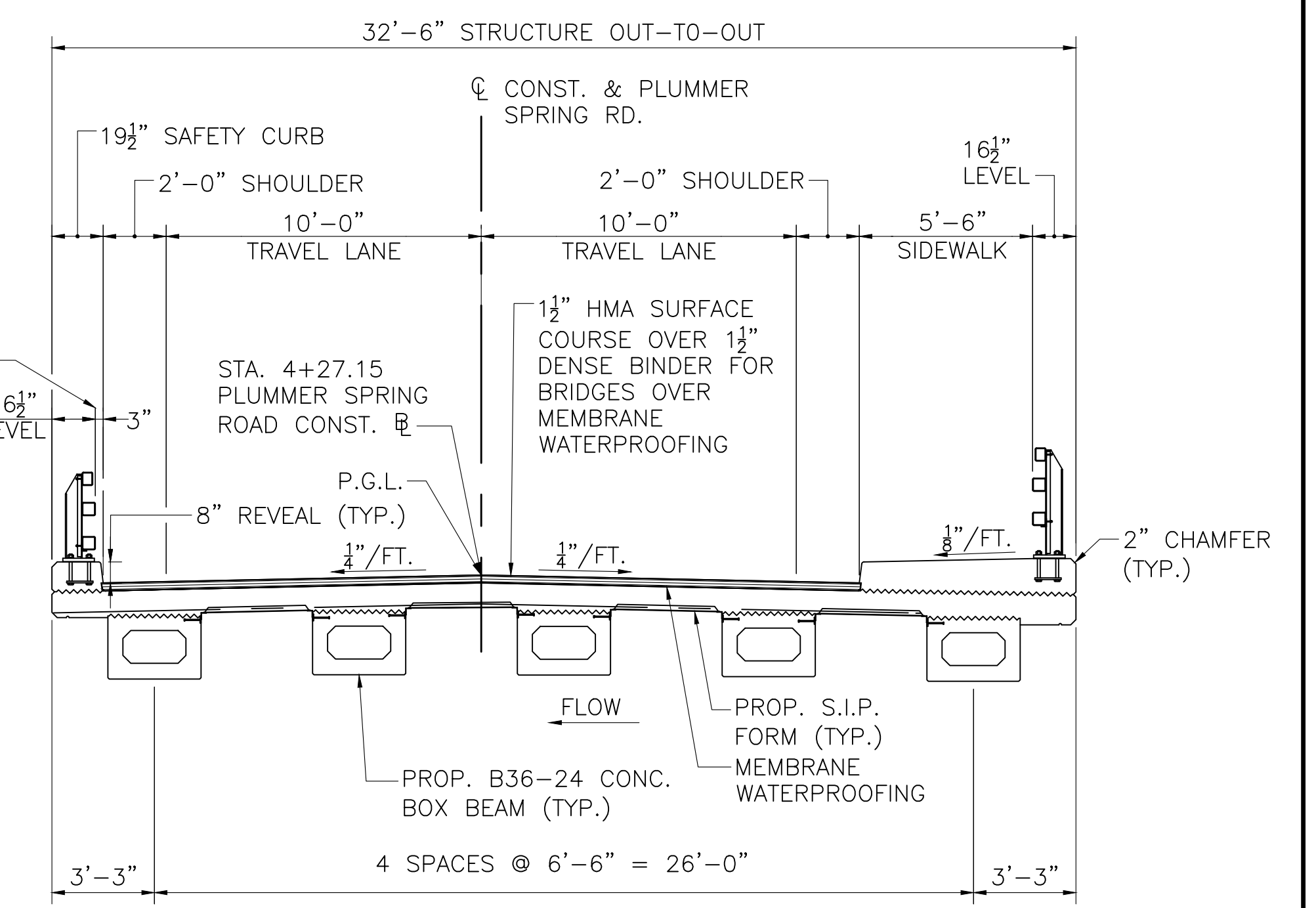
**ALTERNATIVE 1B - 45'-0" SPAN
SPREAD BOX BEAM WITH ONE
SIDEWALK PLAN, ELEVATION &
TRANSVERSE SECTION**



PROPOSED PLAN
SCALE: 3/16" = 1'-0"



PROPOSED SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

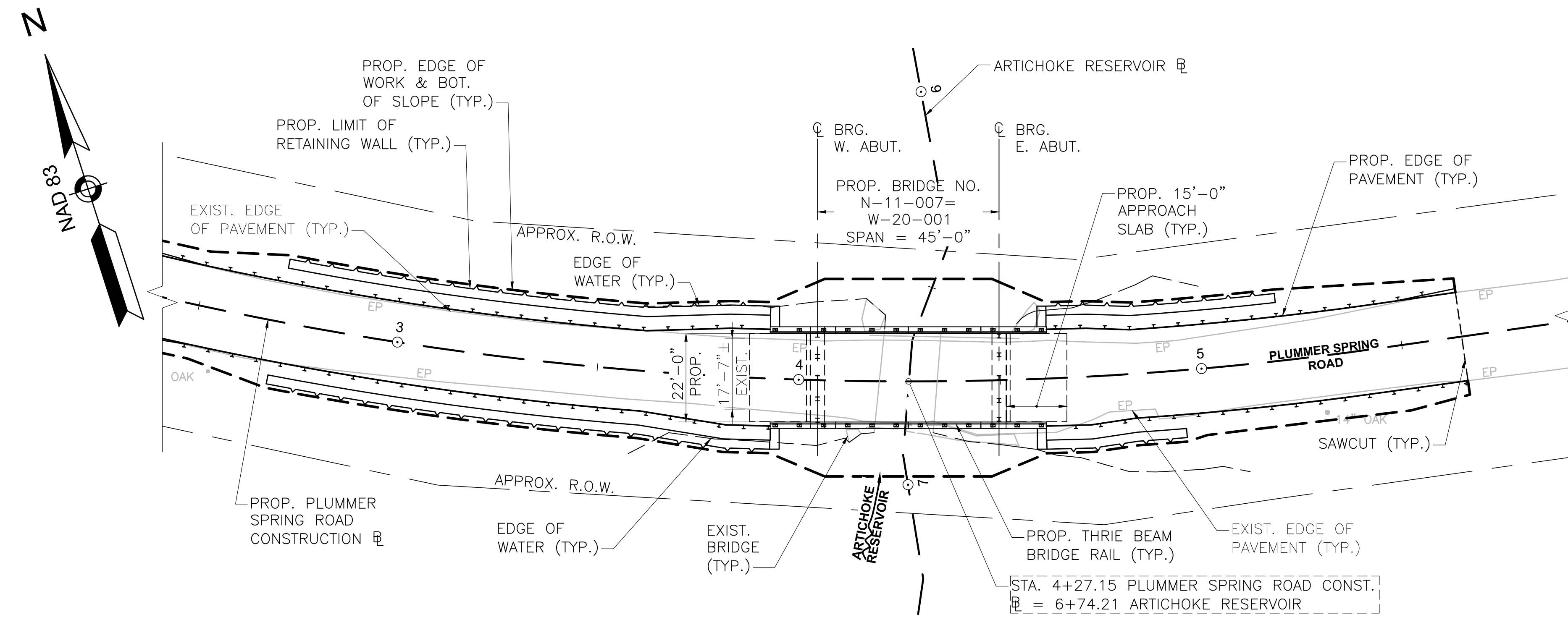


PROPOSED TRANSVERSE SECTION
SCALE: 1/4" = 1'-0"

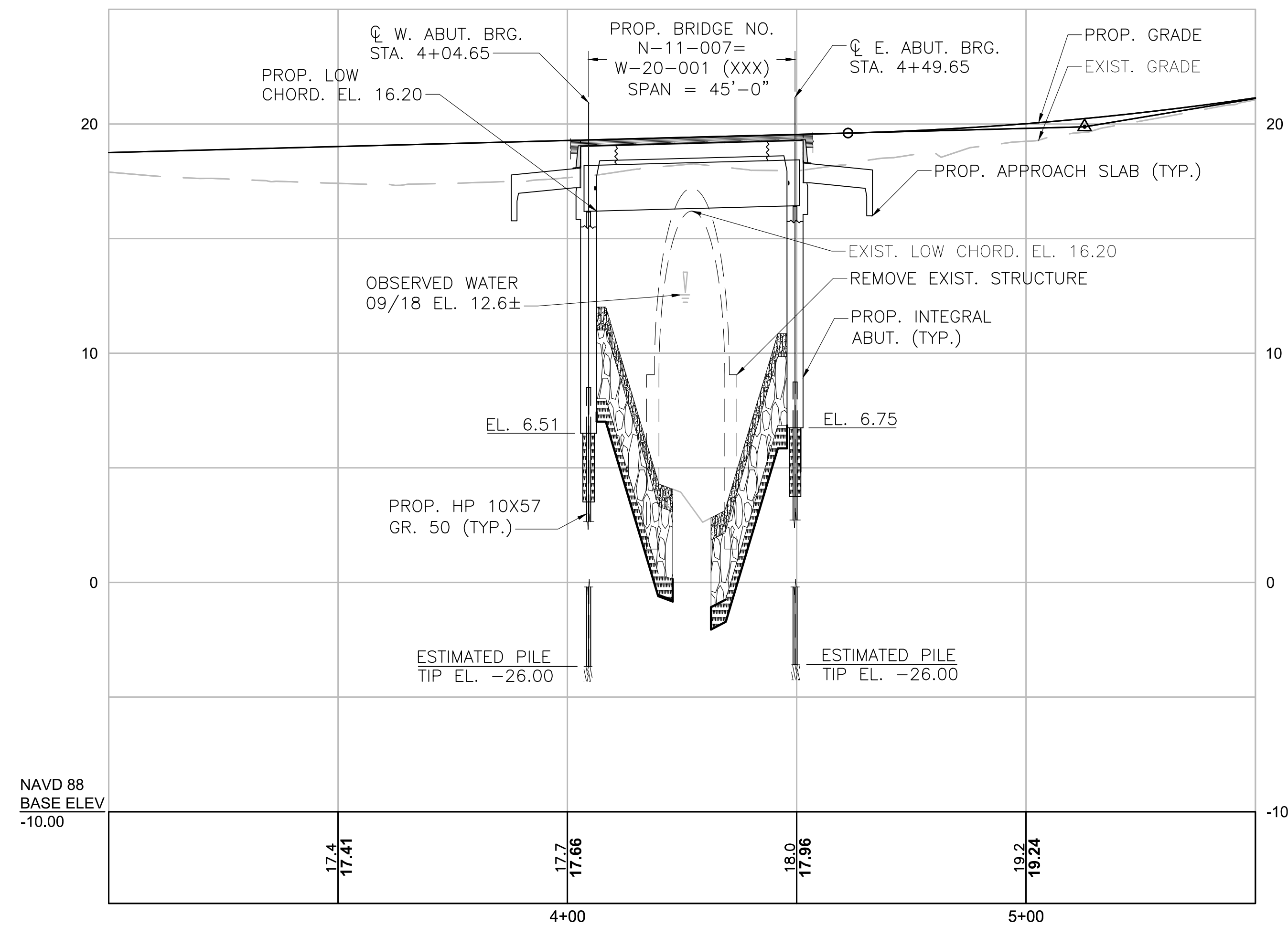
**ALTERNATIVE 1B
PRELIMINARY DESIGN**

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

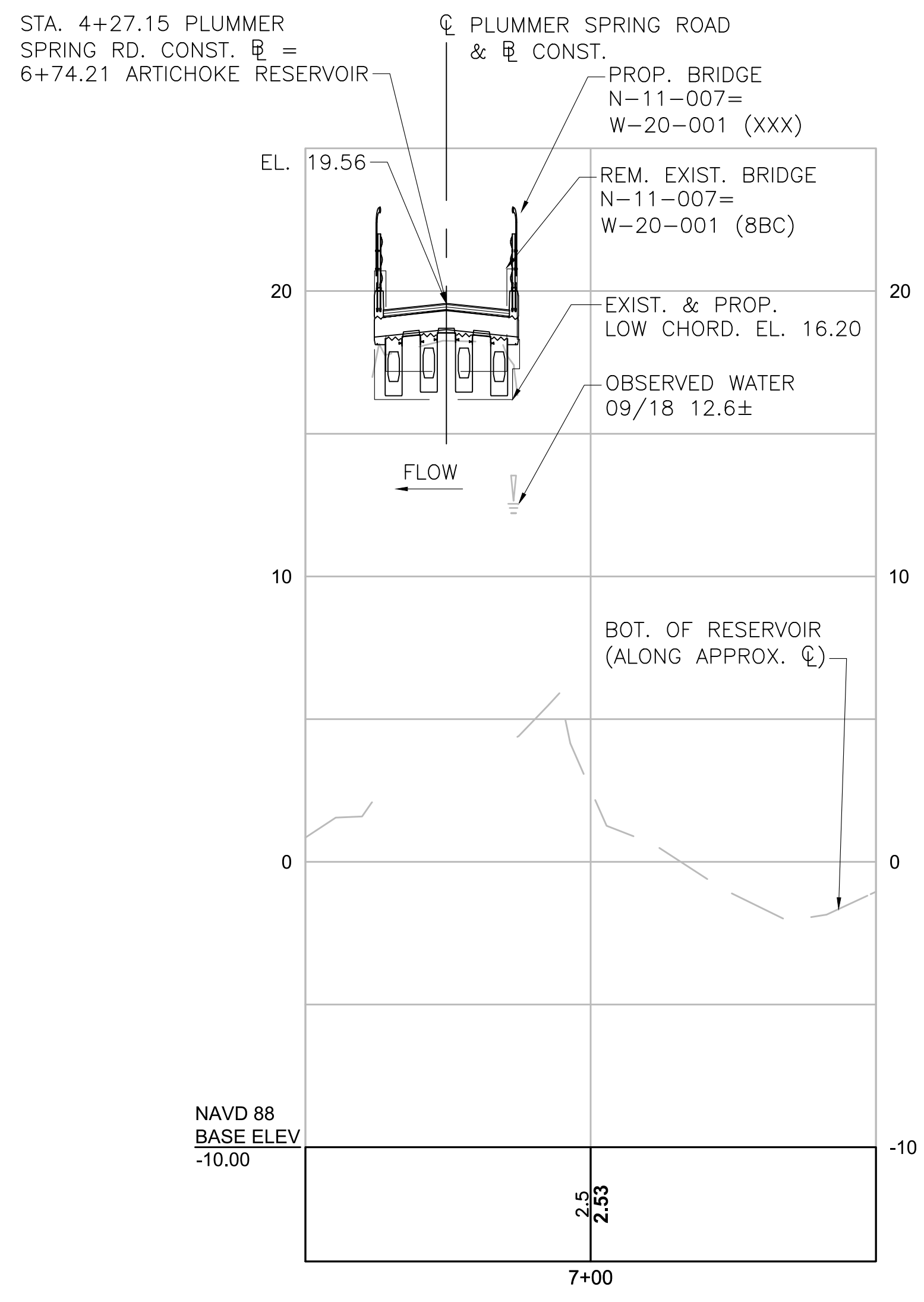
Plotted on 10-Jun-2019 7:56 AM
SIDEWALK.DWG
Plans Submittal (SPX) XX-XX-201X



KEY PLAN
 SCALE: 1" = 20'



PLUMMER SPRING ROAD PROFILE
 1" = 20' HORIZONTAL
 1" = 4' VERTICAL



ARTICHOKE RESERVOIR PROFILE
 1" = 20' HORIZONTAL
 1" = 4' VERTICAL

ALTERNATIVE 2 PRELIMINARY DESIGN

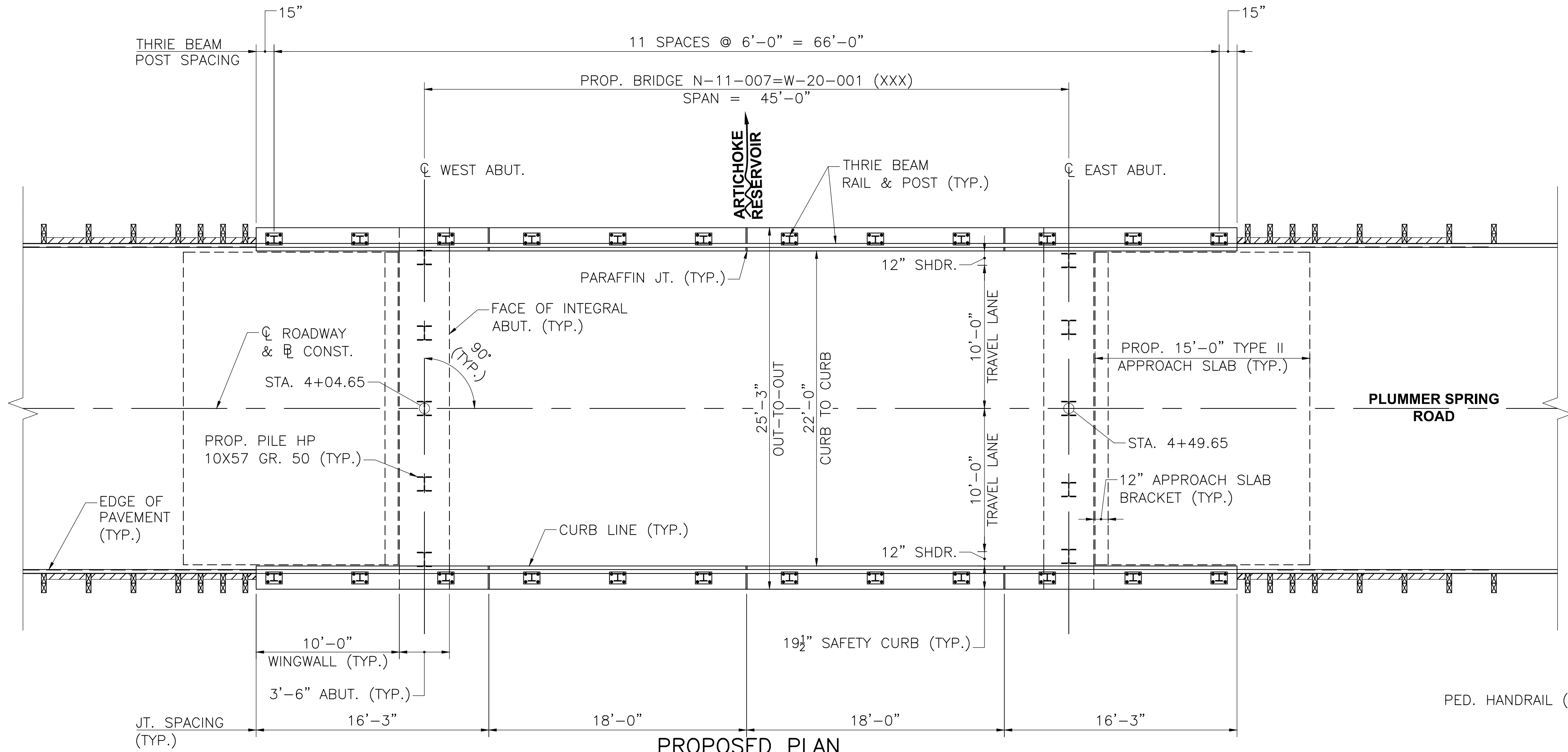
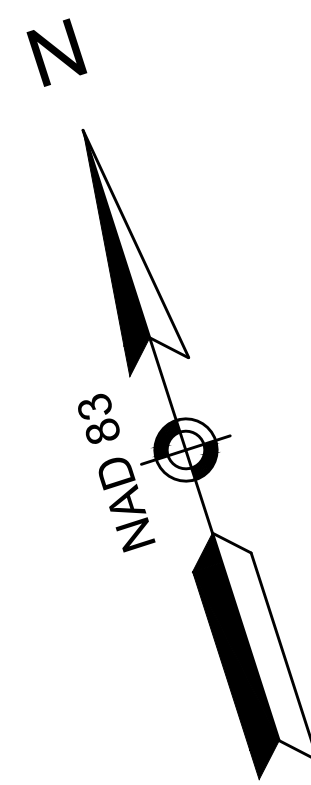
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

SPREAD BOX - 22 FT ROADWAY.DWG Picked on 6-Jun-2019 11:38 AM Plans Submittal (SPX) XX-XX-201X

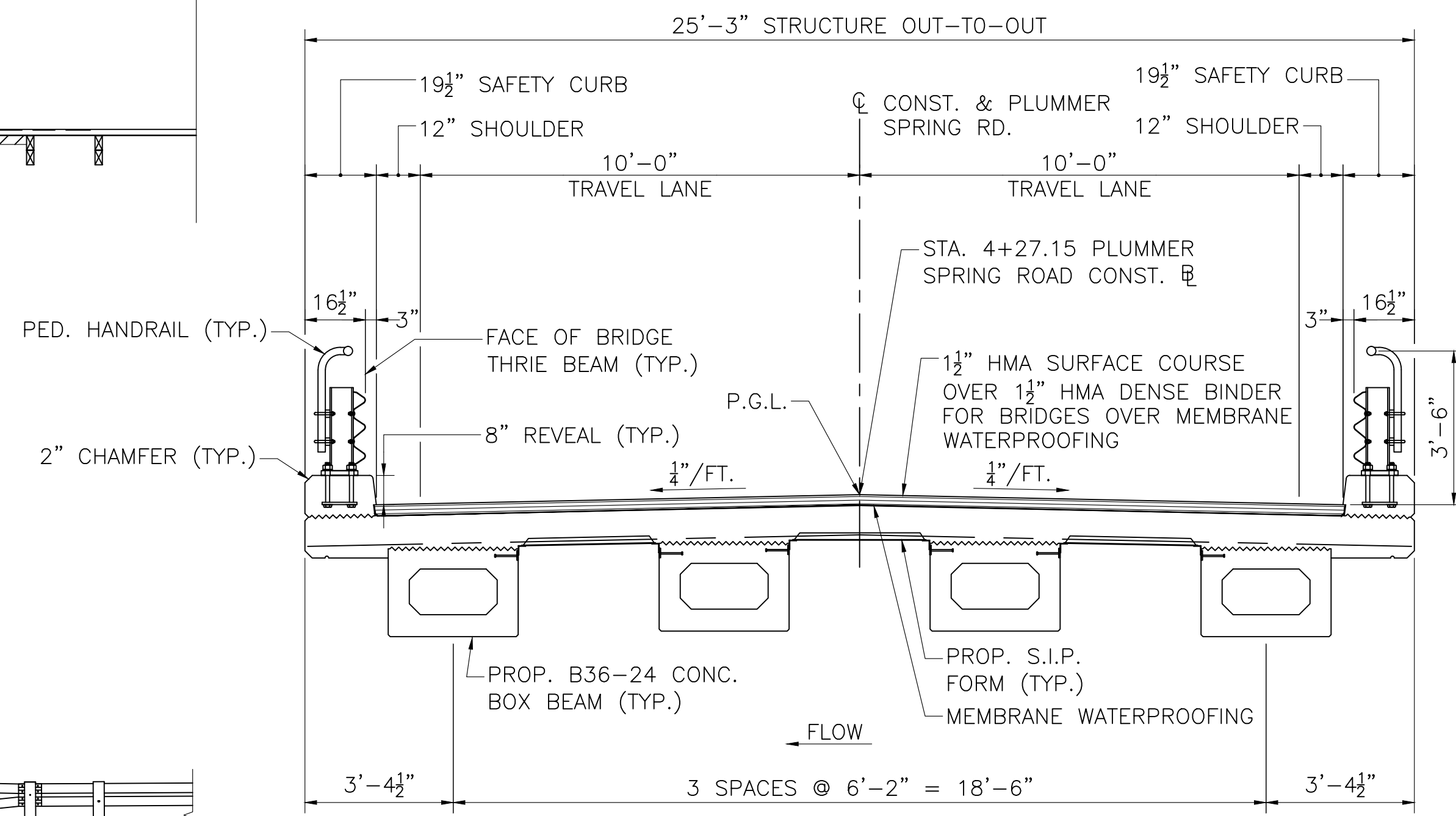
**NEWBURYPORT
PLUMMER SPRING ROAD**

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	7	11
PROJECT FILE NO.		N/A	

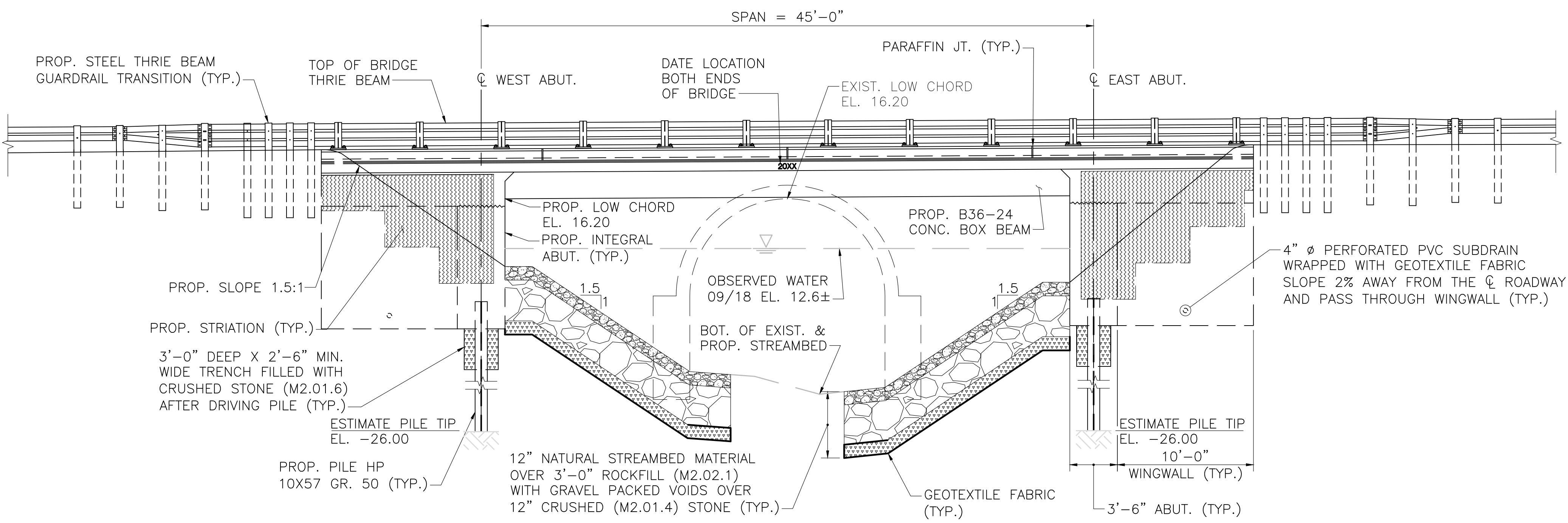
**ALTERNATIVE 2 - 45'-0" SPAN, 22'-0"
ROADWAY SPREAD BOX BEAM PLAN,
ELEVATION & TRANSVERSE SECTION**



PROPOSED PLAN
3/16" = 1'-0"



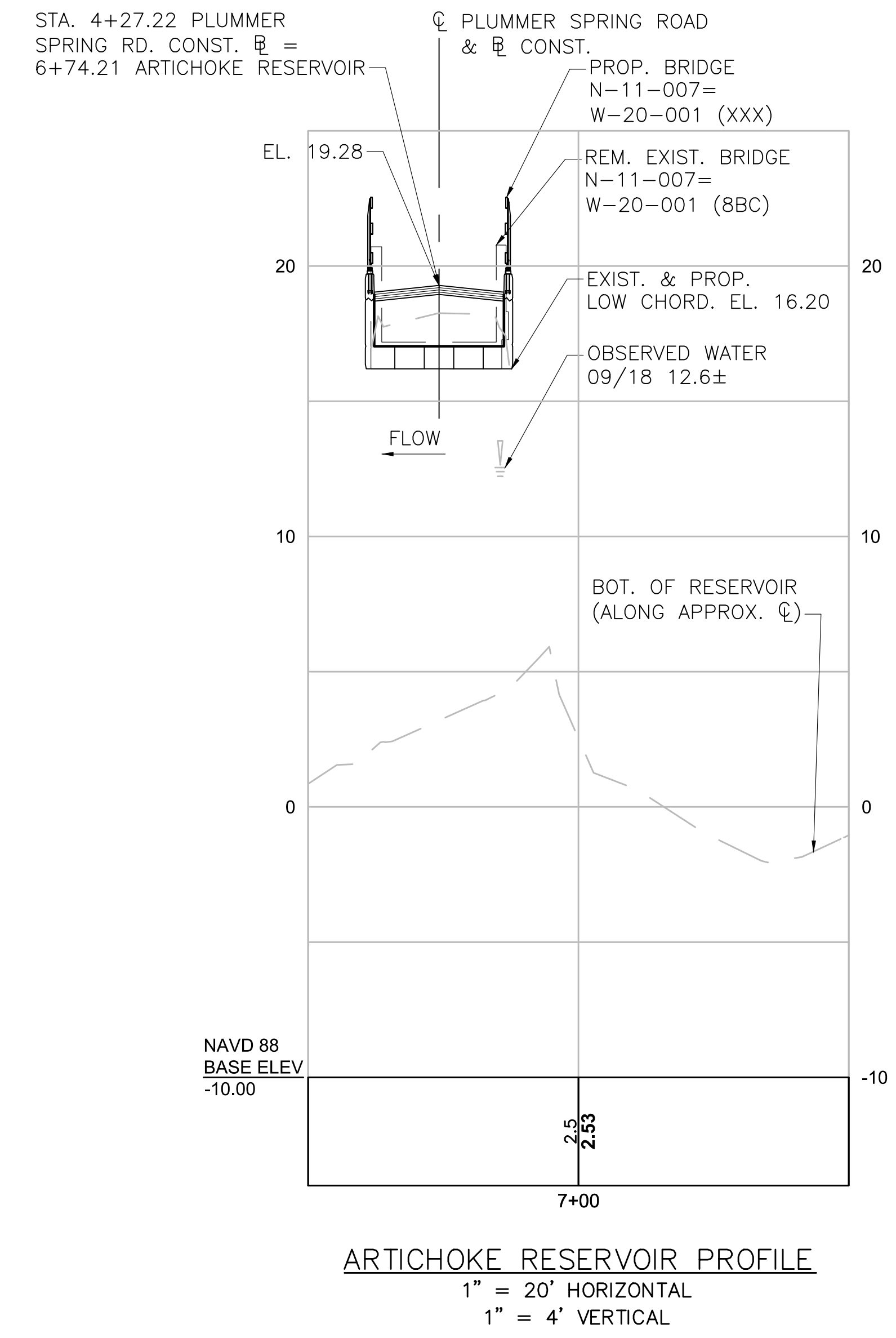
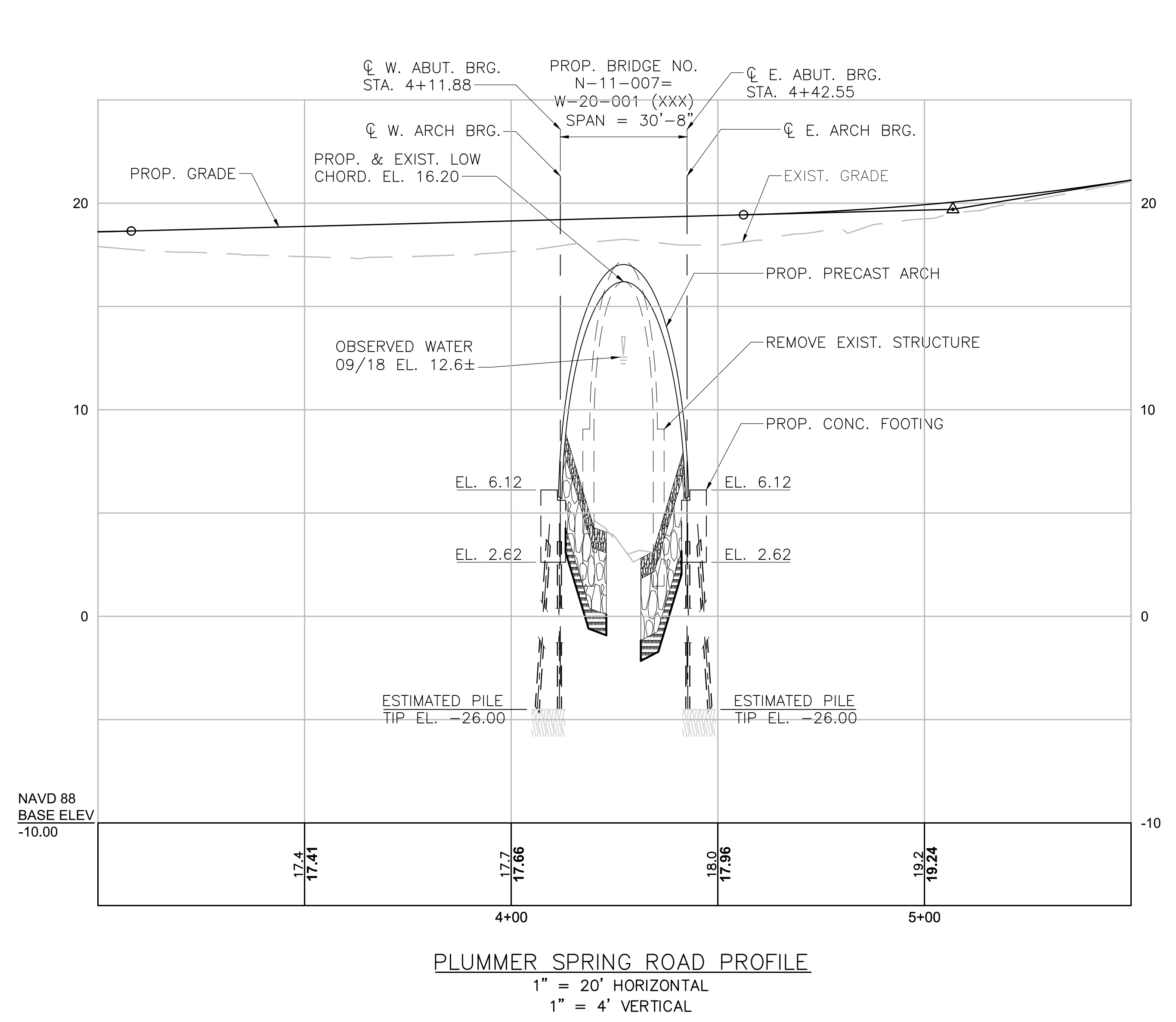
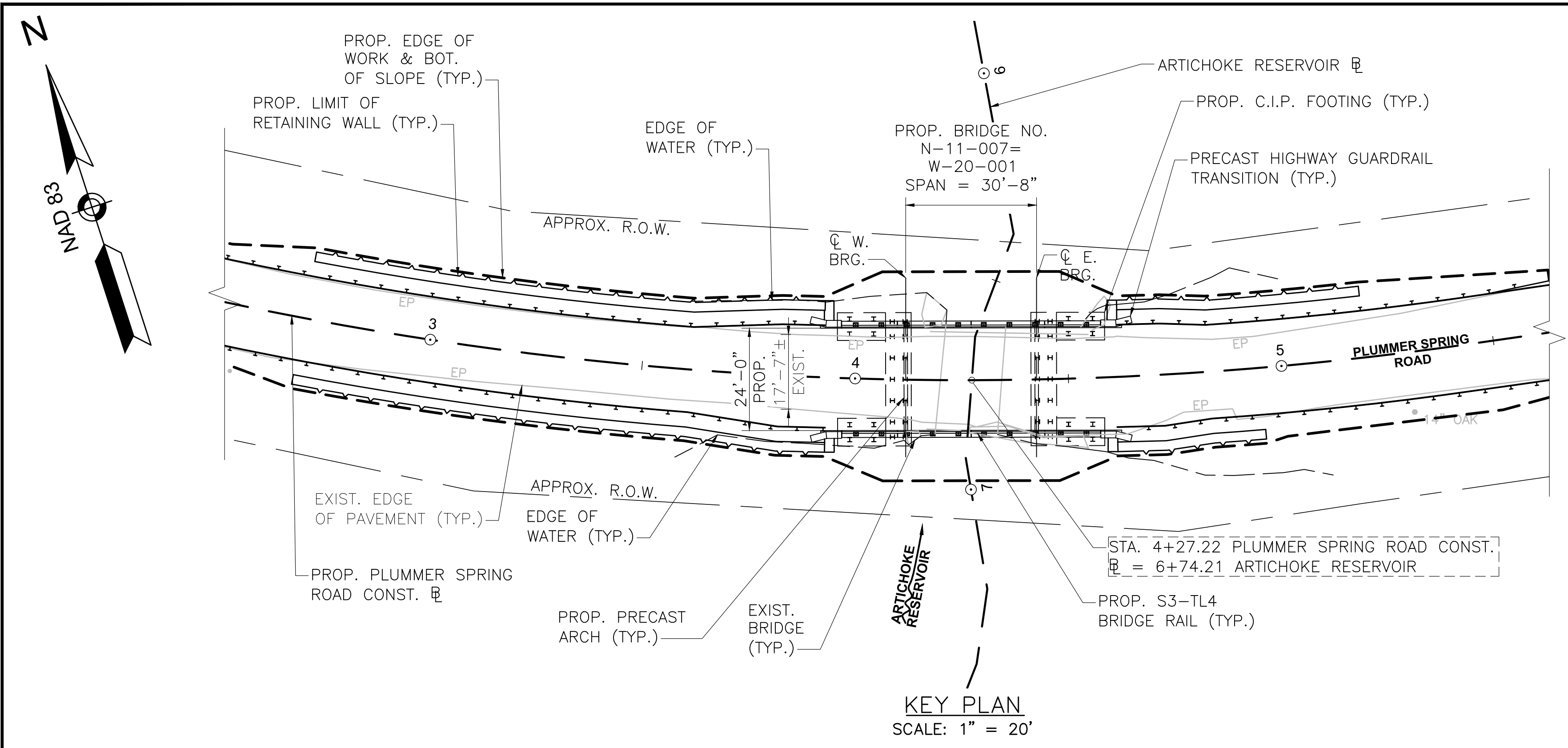
PROPOSED TRANSVERSE SECTION
3/8" = 1'-0"



PROPOSED SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

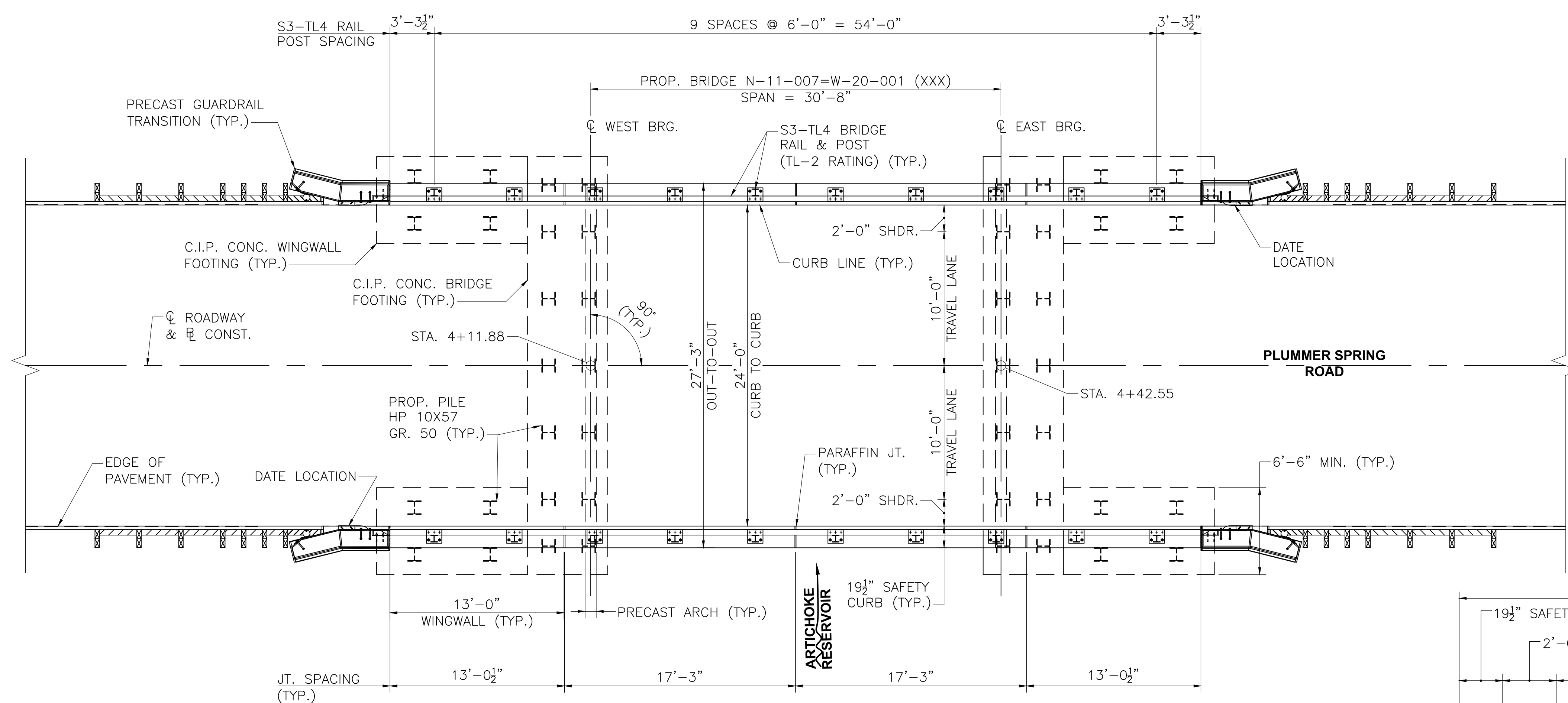
**ALTERNATIVE 2
PRELIMINARY DESIGN**

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
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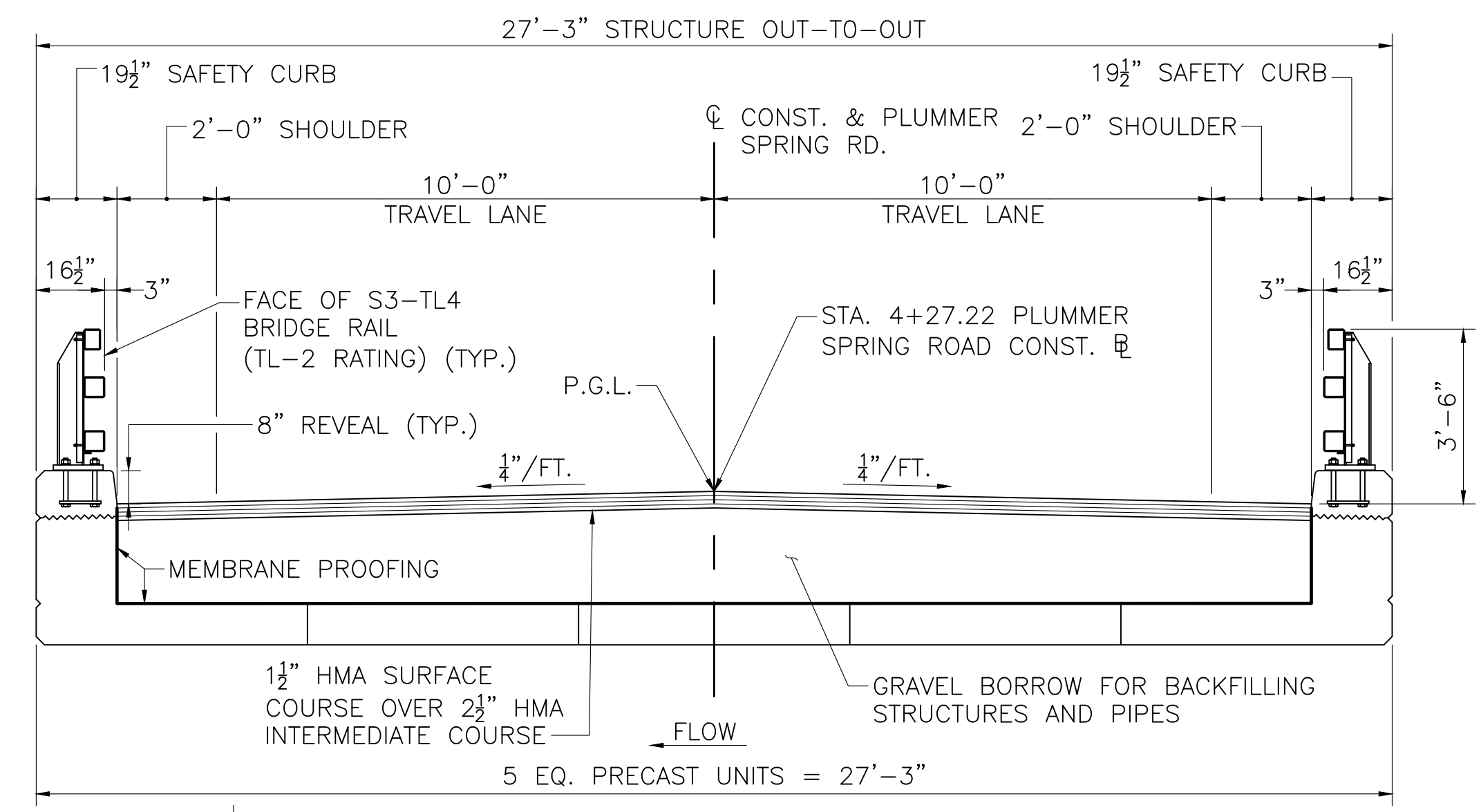


**ALTERNATIVE 3
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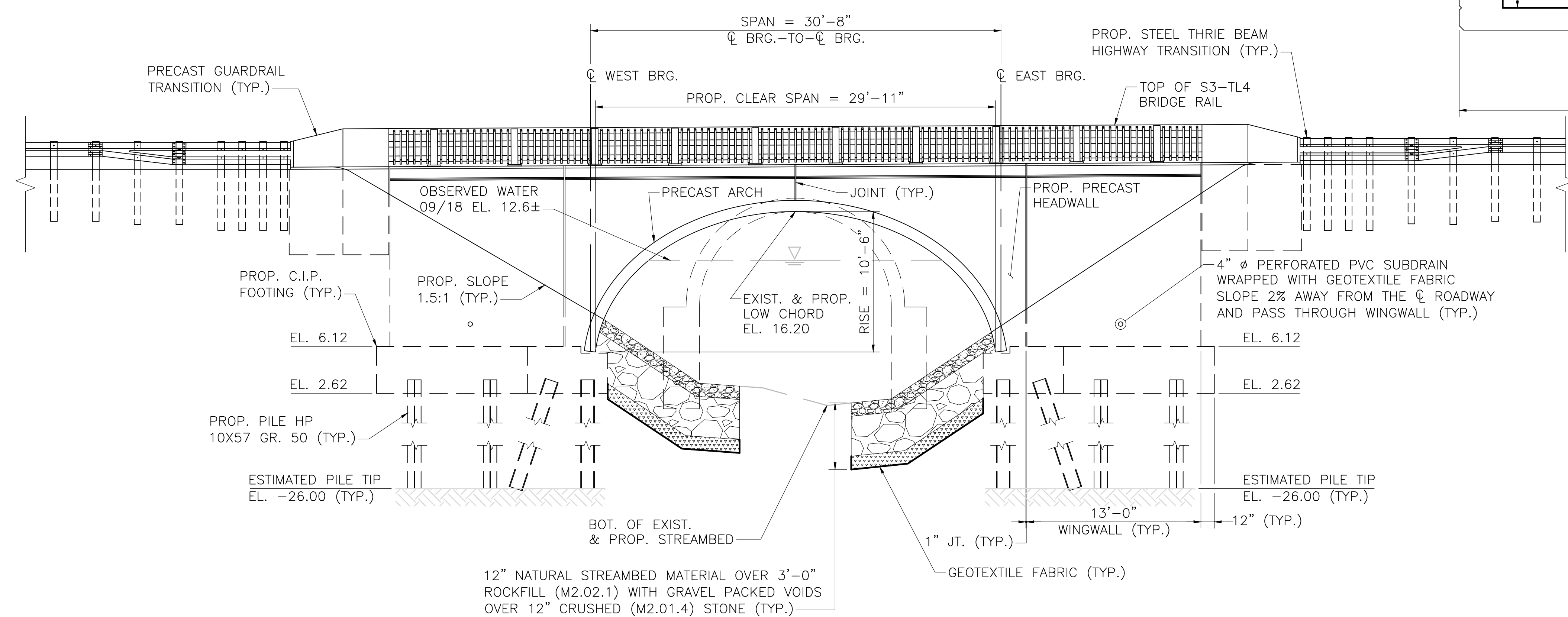
MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	



PROPOSED PLAN
SCALE: 3/16" = 1'-0"



PROPOSED TRANSVERSE SECTION
SCALE: 3/8" = 1'-0"



PROPOSED SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

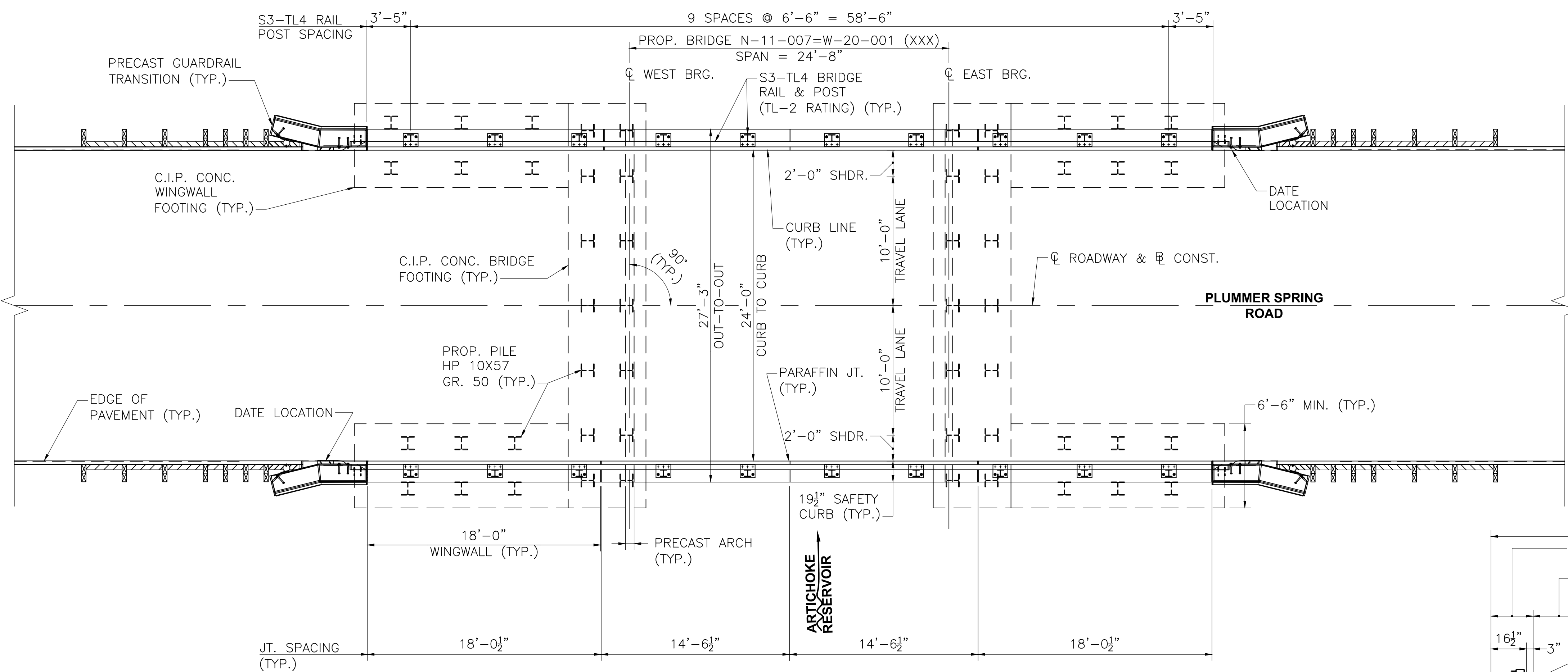
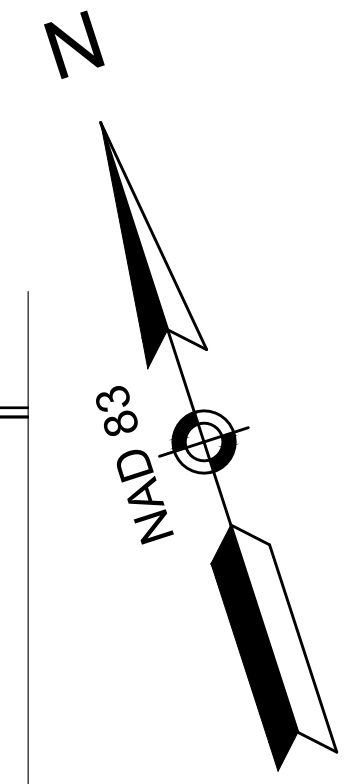
**ALTERNATIVE 3
PRELIMINARY DESIGN**

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
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USE ONLY PRINTS OF LATEST DATE	

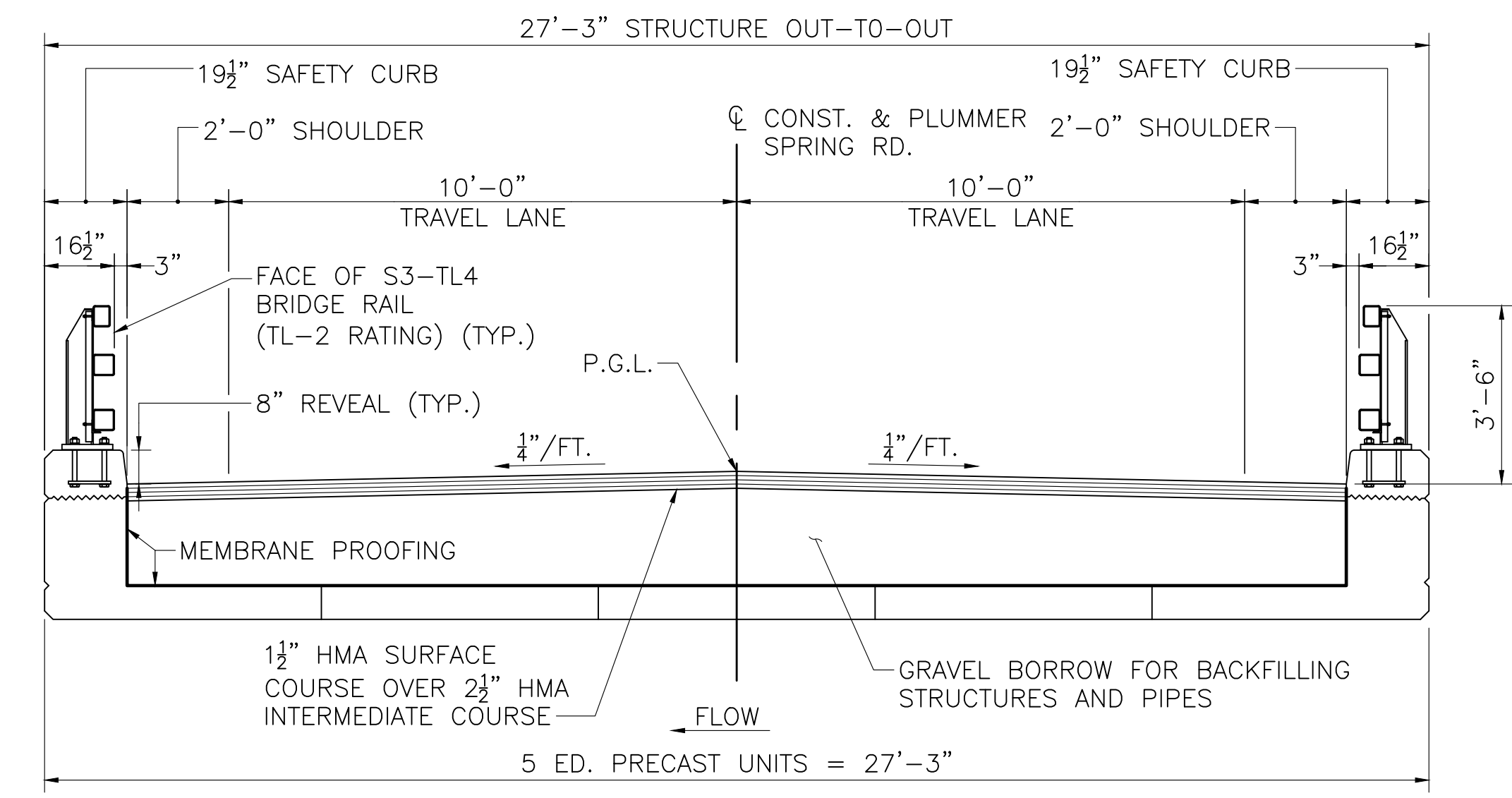
**NEWBURYPORT
PLUMMER SPRING ROAD**

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	10	11
PROJECT FILE NO.		N/A	

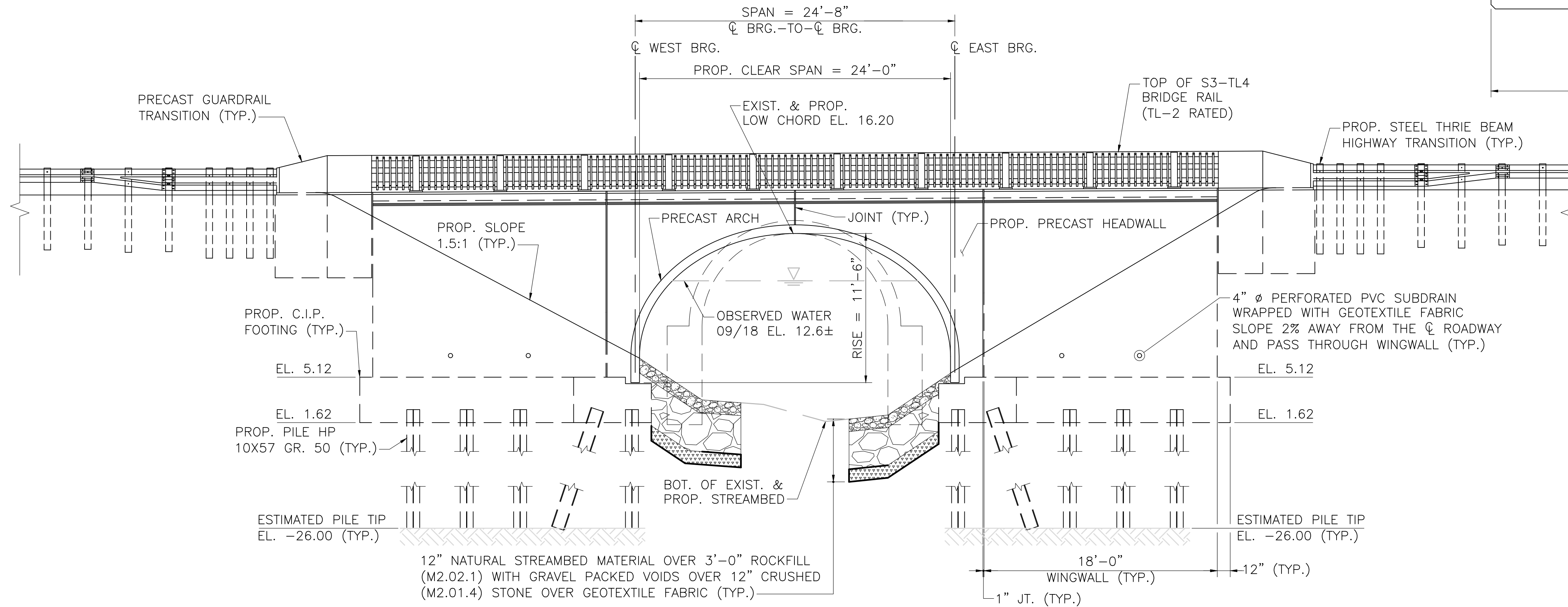
**ALTERNATIVE 4 - 24'-8" SPAN
ARCH PLAN, ELEVATION
& TRANSVERSE SECTION**



PROPOSED PLAN
SCALE: 3/16" = 1'-0"



PROPOSED TRANSVERSE SECTION
SCALE: 3/8" = 1'-0"

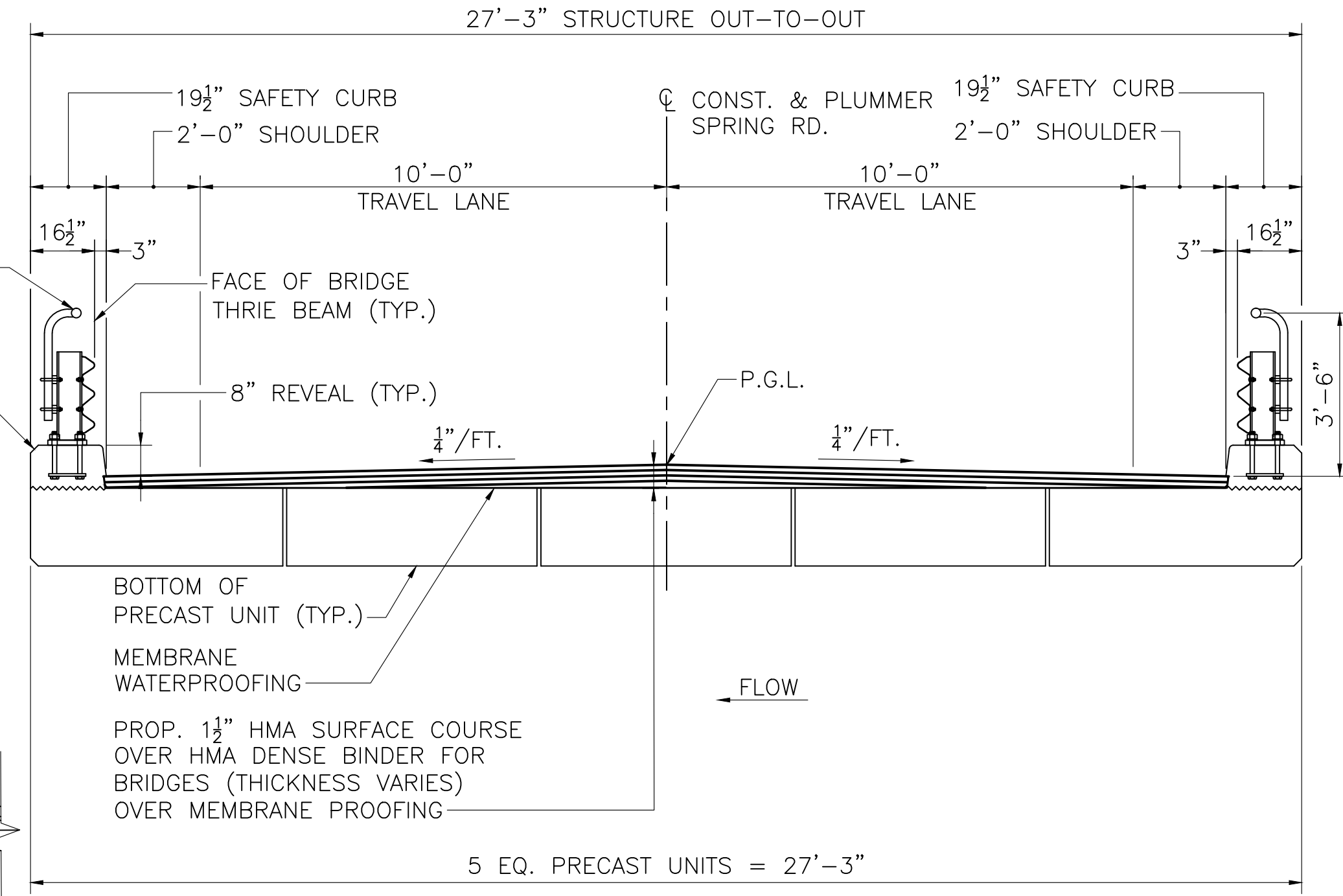
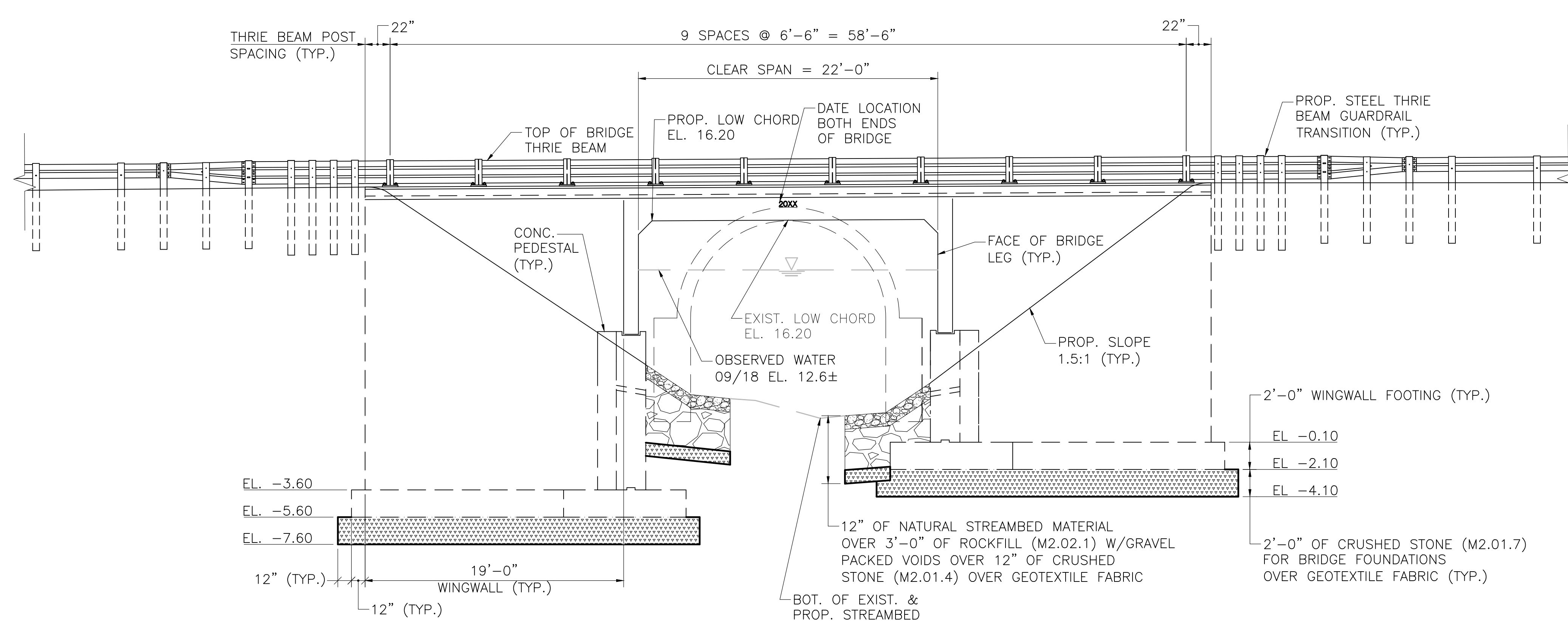
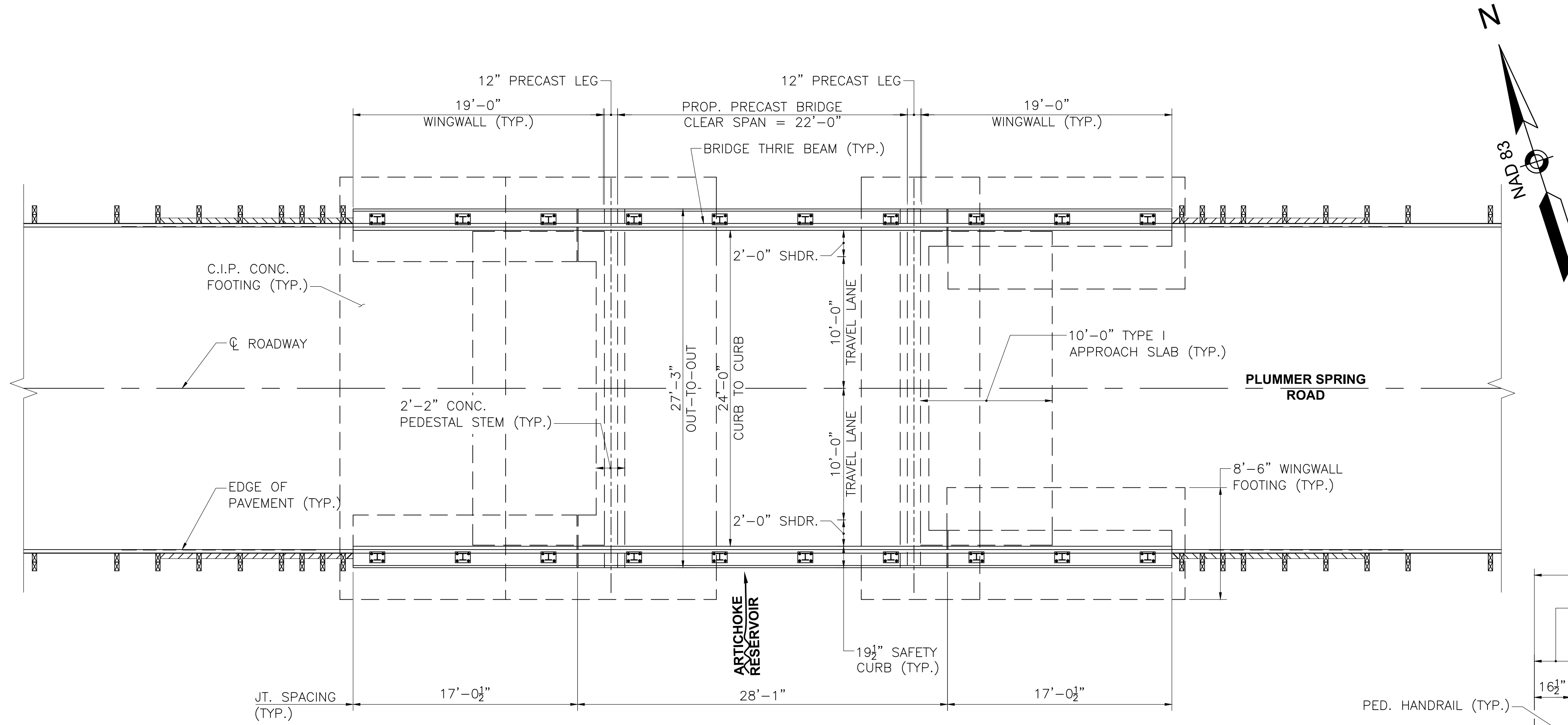


PROPOSED SOUTH ELEVATION
SCALE: 3/16" = 1'-0"

**ALTERNATIVE 4
PRELIMINARY DESIGN**

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

Plotted on 6-Jun-2019 11:39 AM
24 FT SPAN ARCH.DWG
Plans Submittal (SPX) XX-XX-201X



**ALTERNATIVE 5
PRELIMINARY DESIGN**

MONTH DD, YYYY	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

Plotted on 6-Jun-2019 11:39 AM RIGID FRAME.DWG Plans Submittal (SPX) XX-XX-201X