

**WEST MAIN STREET OVER NONACOICUS BROOK
BRIDGE REPLACEMENT PROJECT
25DPW14**

**AYER DEPARTMENT OF PUBLIC WORKS
AYER, MASSACHUSETTS**

**BIDDING AND CONTRACT
REQUIREMENTS AND
SPECIFICATIONS**

DECEMBER 2024



Bids Due February 7, 2025, 2:00 PM

Ayer Department of Public Works
25 Brook Street
Ayer, MA 01432

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SECTION 00020
ADVERTISEMENT TO BID

TOWN OF AYER, MASSACHUSETTS
25DPW14
WEST MAIN STREET OVER NONACOICUS BROOK BRIDGE REPLACEMENT
PROJECT

The Town of Ayer DPW is seeking bids for the "**25DPW14 – West Main Street over Nonacoicus Brook Bridge Replacement**" project.

Sealed Bids for the General Contract will be received from General Contractors for construction of the "**25DPW14 - West Main Street over Nonacoicus Brook Bridge Replacement**" project at the **Ayer Department of Public Works Office, 25 Brook Street, Ayer, MA 01432** until **2:00 PM on February 7, 2025**. At that time and place, bids will be publicly opened and read aloud.

The work involves the staged replacement of the existing West Main Street bridge structure carrying traffic over the Nonacoicus Brook with a three-sided precast concrete rigid frame. The replacement bridge will have a clear span length of 28 feet. Concurrent to the replacement of the bridge structure, roadway infrastructure improvements extending approximately 200 feet along each West Main Street approach will include but not limited to full depth pavement reconstruction, cement concrete sidewalks and pedestrian curb ramps, driveway aprons, drainage system improvements, installation of guardrail, signing, pavement markings and related work as directed by the Ayer Department of Public Works. The Contractor shall be responsible for coordination with impacted utility companies for temporary and/or permanent relocations required as part of this project.

The bidding and award of this Contract will be under the provisions of M.G.L. Chapter 30, Section 39M. Complete instructions for filing Bids are included in the Instructions to Bidders.

Each General Bid shall be submitted in accordance with the Instructions to Bidders and shall be accompanied by a Bid Security in the amount of 5% of the Bid.

No Bidder may withdraw his Bid for a period of sixty (60) days, excluding Saturdays, Sundays, and legal holidays after the actual date of the opening of the General Bids. This advertisement does not obligate the Owner for any costs associated with preparing or submitting bids.

The successful General Bidder must furnish a 100% Performance Bond and a 100% Payment Bond with a surety company acceptable to the Owner.

Minimum wage rates as determined by the Commissioner of Department of Workforce Development under the provisions of M.G.L., Chapter 149, Section 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request, if necessary, any additional information on Prevailing Wage Rates for those trades people who may be employed for the proposed work under this contract.

All bidders must be pre-qualified by the Massachusetts Department of Transportation as follows. The MassDOT Prequalification Office will provide the Town with an official, and a waiver, contractor bid list for all contractors prequalified in the specified class of work within the parameters of this project. MassDOT prequalification of contractors with the class of work as, **Bridge – Construction**, for the project with an **estimated value of \$4,326,552.50** will be required.

Only those bidders listed in the official or waiver contractor lists issued by the MassDOT Prequalification Office will be allowed to submit a bid.

Complete digital Bidding Documents may be obtained or viewed at the Town of Ayer website: <https://www.ayer.ma.us/bids> as a Portable Document Format (PDF) file free of charge starting on **December 23, 2024, at 3:00 PM**. To bid on this project and be considered a plan holder, the Bidder **MUST** download the digital project bidding documents from the Town of Ayer Website. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including Addenda if any, obtained from sources other than the Town of Ayer. All interested bidders are encouraged to attend in order to prepare acceptable bid submissions.

A non-mandatory Pre-Bid Meeting will be held at **10:00AM** local time on **January 15, 2025**, at the Ayer Department of Public Works Office, 25 Brook Street, Ayer, MA 01432. Questions received at the Pre-Bid Meeting will be documented and distributed to plan holders as an addendum. A site walk, if deemed necessary, will follow the meeting.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents. The Owner reserves the right to waive any informality in or to reject any or all Bids if deemed to be in its best interest.

Owner: TOWN OF AYER, MASSACHUSETTS
By: Dan Van Schalkwyk, PE
Title: Director – Ayer Public Works Department

END OF SECTION

SECTION 00100
INSTRUCTIONS TO BIDDERS
(SECTION 00111 INVITATION FOR BIDS)

1.01 BIDDING DOCUMENTS

Bids for "**25DPW14 - West Main Street over Nonacoicus Brook Bridge Replacement**" project will be received at the Office of the DPW Superintendent, 25 Brook Street, Ayer, MA 01432 until **2:00 PM on February 7, 2025**, at which time they will be opened and read aloud.

Each bid shall be submitted in a **SEALED ENVELOPE MARKED "25DPW14 – WEST MAIN STREET OVER NONACOICUS BROOK BRIDGE REPLACEMENT"**.

Complete digital Bidding Documents may be obtained or viewed at the Town of Ayer website: <https://www.ayer.ma.us/bids> as a Portable Document Format (PDF) file free of charge starting on **December 23, 2024, at 3:00 PM**. To bid on this project and be considered a plan holder, the Bidder **MUST** download the digital project bidding documents from the Town of Ayer Website. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including Addenda if any, obtained from sources other than the Town of Ayer. All interested bidders are encouraged to attend in order to prepare acceptable bid submissions.

Complete sets of Bidding Documents must be used in preparing Bids. The Owner does not assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

1.02 BIDDING REQUIREMENTS

Questions, Clarifications and Interpretations: Bidders shall promptly notify the Town of Ayer DPW Director of questions, ambiguities, inconsistencies, errors, or omissions which they may discover upon examination of the Contract and Specification documents, the site and local conditions.

Written Request Required: Submit written request for clarification and interpretation to the Town of Ayer DPW Director via email **dvanschalkwyk@ayer.ma.us**.

Time Required: Requests for clarifications and interpretations must be received by the Town of Ayer DPW Director at least ten (10) working days [Saturdays, Sundays, Holidays excluded] prior to the date bids are due.

Response, Addenda: The response will be in the form of written addenda, which shall become part of the Contract Documents. Clarifications and interpretations offered by the Town in any form other than formal written addenda shall be invalid.

Issuance of Addenda: Addenda will be posted to Town of Ayer website <https://www.ayer.ma.us/bids>. An email notification will be issued to plan holders registered through the town website when an addendum is posted. Bidders shall confirm the number of issued addenda with the DPW Director prior to the bidding deadline.

Addenda Must Be Acknowledged: Bidders shall acknowledge Addenda in the spaces provided on the bid forms. Failure of a bidder to acknowledge Addenda in the spaces provided on the bid form may cause rejection of the bid or lead to protest. Failure of a bidder to receive any addenda shall not relieve it from any obligation under its bid as submitted.

1.03- BID SECURITY

The Bid must be accompanied by Bid security made payable to Owner in an amount of 5% of Bidder's maximum Bid price and in the form of a certified or bank check or a Bid Bond on the form attached issued by a surety meeting the requirements of the General Conditions.

All Bid Securities of Bidders except those of the three lowest responsible and eligible Bidders will be returned within five days, Saturdays, Sundays and legal holidays excluded, after opening of the General Bids. The Bid security of the three lowest Bidders will be retained until the Successful Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited to the Owner as liquidated damage. The amount forfeited to Owner shall not exceed the difference between the Bid Price of said Bidder and that of the next lowest responsible and eligible bidder and provided further that, in case of death, disability, or other unforeseen circumstances affecting the Bidder, such Bid Security may be returned to the Bidder.

All Bid Securities will be returned on the execution of the Agreement or if no award is made within sixty (60) days, excluding Saturdays, Sundays, and legal holidays after the actual date of the opening of the Generals Bids, unless forfeited under the conditions herein stipulated.

1.04 PREPARATION OF BID

The Bid Form is included within this Bid Book. All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed. A Bid price shall be indicated for each Bid item listed therein.

A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.

A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown below the signature.

A Bid by an individual shall show the Bidder's name and official address.

A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture must be shown below the signature.

All names shall be typed or printed in ink below the signatures. The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form. The address and telephone number for communications regarding the Bid shall be shown.

1.05 SUBMITTAL OF BID

Each prospective Bidder is furnished one electronic copy of the Bidding Documents including one copy each of the Bid Form and the Bid Bond. The Bid Form is to be completed and submitted with the following:

- A. The Bid Form in its Entirety
- B. Required Bid Security
- C. Required Experience Statement with supporting data

A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate envelope plainly marked on the outside with the notation "**25DPW14 – WEST MAIN STREET OVER NONACOICUS BROOK BRIDGE REPLACEMENT**". A mailed Bid shall be addressed to:

Town of Ayer
Department of Public Works
25 Brook Street
Ayer, MA 01432

A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

1.06 OPENING OF BIDS

Bids will be opened at the time and place indicated in the Advertisement to Bid and, unless obviously non-responsive, read aloud, and recorded. An abstract of the amounts of the Bids and major alternates, if any, will be made available to Bidders after the opening of Bids. All Bids will remain subject to acceptance for 60 days from the date of the Bid opening, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

1.07 BASIS OF BID; EVALUATION OF BIDS

Bidders shall submit a Bid on a lump sum basis for each lump sum item of Work and on a unit price basis for each unit price item of Work described in the Bidding Documents as provided for in the Bid Form. The total of all estimated prices will be determined as the sum of the products of the estimated quantity of each item and the unit price Bid for the item. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

1.08 CONTRACT TIME

Contract Time: The period for this contract is as specified in the Agreement Form and Bid Form.

1.09 CONTRACT AWARD

Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of the Bidder and other individuals or entities proposed for those portions of the Work.

Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability to perform the Work in accordance with the Contract Documents.

1.10 SALES AND USE TAXES

Section 6(f) of Chapter 64 H of the Massachusetts General Laws exempts building materials and supplies to be used in the project from Massachusetts sales tax, and bidders shall not include in their bids any amount therefore. The words "building materials and supplies" shall include all materials and supplies consumed, employed or expended in the construction, reconstruction, alteration, remodeling or repair of any building, structure, public highway, bridge or other such public work project, as well as such material and supplies physically incorporated therein. Said words shall also include rental charges for construction vehicles, equipment and machinery rented specifically for use on the site of the project or while being used exclusively for the transportation of materials for the project.

1.11 DELETION OF ITEMS

Owner reserves the right to reduce project scope by the elimination of Bid items, reduction of quantities on unit price Bid items, or deleting elements of lump sum Bid items. No adjustment to other Bid items prices will be permitted. In the case of a reduction of quantities on unit price items, the unit price will not be adjusted.

1.12 SPECIAL LEGAL REQUIREMENTS

Minimum Wage Rates as determined by the Commissioner of Department of Workforce Development under the provision of the Massachusetts General Laws, Chapter 149, Sections 26 to 27D, as amended, apply to this project. It is the responsibility of the contractor, before bid opening, to request if necessary, any additional information on Minimum Wage Rates for those trades people who may be employed for the proposed work under this contract. The State schedule of minimum wage rates is included in the Appendix.

This project is subject to the Safety and Health Regulations of the U.S. Department of Labor set forth in Title 29 CFR, Part 1926 and to all subsequent amendments, and to the Massachusetts Department of Labor and Industries, Division of Industrial Safety 'Rules and Regulations for the Prevention of Accidents in Construction Operations' (Chapter 454 CMR 10.00 et seq.). Contractors shall be familiar with the requirements of these regulations.

END OF SECTION

SECTION 00300
FORM FOR GENERAL BID

Ayer Department of Public Works
Ayer, Massachusetts
West Main Street over Nonacoicus Brook Bridge Replacement

The following Bid is submitted to: Town of Ayer Department of Public Works
25 Brook Street
Ayer, MA 01432

By (Contractor Name): _____
(Address for Giving Notice): _____

A. The Undersigned proposes to furnish all labor and materials required for the **West Main Street over Nonacoicus Brook Bridge Replacement** in Ayer, Massachusetts, in accordance with the accompanying plans and specifications prepared by The Ayer DPW for the contract price specified below, subject to additions and deductions according to the terms of the specifications.

B. This bid includes addenda:

Number _____
Dated _____

C. BID -The proposed contract price for the **Bid** complete is:

_____ dollars (\$ _____).
(in Words) (in Figures)

D. NOT USED

E. Refer to bid tabulation sheets:

E: The subdivision of the proposed contract price is as follows:

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
102.	0.20	SELECTIVE CLEARING AND THINNING AT PER ACRE				
102.1	200	TREE TRIMMING AT PER FOOT				
*102.511	2	TREE PROTECTION - ARMORING & PRUNING AT PER EACH				
*102.521	200	TREE AND PLANT PROTECTION FENCE AT PER FOOT				
103.	2	TREE REMOVED-DIAMETER UNDER 24 INCHES AT PER EACH				
104.	5	TREE REMOVED-DIAMETER 24 INCHES AND OVER AT PER EACH				
*115.1	1	DEMOLITION OF BRIDGE NO. A-19-014 (79A) AT PER LUMP SUM				
*119.	1	RODENT CONTROL AT PER LUMP SUM				
*120.1	1,500	UNCLASSIFIED EXCAVATON AT PER CUBIC YARD				
140.	700	BRIDGE EXCAVATION AT PER CUBIC YARD				
141.1	50	TEST PIT FOR EXPLORATION AT PER CUBIC YARD				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
142.	15	CLASS B TRENCH EXCAVATION AT PER CUBIC YARD				
143.	350	CHANNEL EXCAVATION AT PER CUBIC YARD				
144.	15	CLASS B ROCK EXCAVATION AT PER CUBIC YARD				
146.	5	DRAINAGE STRUCTURE REMOVED AT PER EACH				
150.	700	ORDINARY BORROW AT PER CUBIC YARD				
151.	440	GRAVEL BORROW AT PER CUBIC YARD				
151.1	100	GRAVEL BORROW FOR BRIDGE FOUNDATION AT PER CUBIC YARD				
151.2	450	GRAVEL BORROW FOR BACKFILLING STRUCTURES AND PIPES AT PER CUBIC YARD				
156.	950	CRUSHED STONE AT PER TON				
170.	2,000	FINE GRADING AND COMPACTING - SUBGRADE AREA AT PER SQUARE YARD				
*200.1	1	DRAINAGE & WATER SYSTEM AS-BUILT DRAWINGS AT PER LUMP SUM				
201.	10	CATCH BASIN AT PER EACH				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
202.	6	MANHOLE AT PER EACH				
204.	1	GUTTER INLET AT PER EACH				
*210.1	2	SANITARY SEWER MANHOLE MUNICIPAL STANDARD AT PER EACH				
220.	22	DRAINAGE STRUCTURE ADJUSTED AT PER EACH				
220.2	10	DRAINAGE STRUCTURE REBUILT AT PER FOOT				
220.3	1	DRAINAGE STRUCTURE CHANGE IN TYPE AT PER EACH				
220.5	7	DRAINAGE STRUCTURE REMODELED AT PER EACH				
*220.6	10	SANITARY STRUCTURE REBUILT AT PER FOOT				
220.7	6	SANITARY STRUCTURE ADJUSTED AT PER EACH				
*220.8	2	SANITARY STRUCTURE REMODELED AT PER EACH				
*222.3	22	FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD AT PER EACH				
223.2	8	FRAME AND GRATE (OR COVER) REMOVED AND DISCARDED AT PER EACH				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
224.10	8	10 INCH HOOD AT PER EACH				
227.3	12	REMOVAL OF DRAINAGE STRUCTURE SEDIMENT AT PER CUBIC YARD				
227.31	50	REMOVAL OF DRAINAGE PIPE SEDIMENT AT PER FOOT				
227.4	25	MASONRY PLUG AT PER SQUARE FOOT				
238.10	180	10 INCH DUCTILE IRON PIPE AT PER FOOT				
243.12	420	12 INCH REINFORCED CONCRETE PIPE CLASS IV AT PER FOOT				
*250.10	1	10 INCH POLYVINYLCHLORIDE SANITARY SEWER PIPE AT PER LUMP SUM				
258.	15	STONE FOR PIPE ENDS AT PER SQUARE YARD				
*303.12	1	12 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT) AT PER LUMP SUM				
*350.12	1	12 INCH GATE AND GATE BOX AT PER EACH				
358.	16	GATE BOX ADJUSTED AT PER EACH				
*381.	2	SERVICE BOX AT PER EACH				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
381.25	2	SERVICE BOX REMOVED AND DISCARDED AT PER EACH				
381.3	6	SERVICE BOX ADJUSTED AT PER EACH				
402.	150	DENSE GRADED CRUSHED STONE FOR SUB-BASE AT PER CUBIC YARD				
415.2	600	PAVEMENT FINE MILLING AT PER SQUARE YARD				
431.	10	HIGH EARLY STRENGTH CEMENT CONCRETE BASE COURSE AT PER SQUARE YARD				
440.	4,000	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL AT PER LB				
443.	4	WATER FOR ROADWAY DUST CONTROL AT PER MGL				
450.23	180	SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) AT PER TON				
450.32	175	SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC-19.0) AT PER TON				
450.42	315	SUPERPAVE BASE COURSE - 37.5 (SBC-37.5) AT PER TON				
450.61	10	SUPERPAVE BRIDGE SURFACE COURSE - 12.5 (SSC-B - 12.5) AT PER TON				
450.71	10	SUPERPAVE BRIDGE PROTECTIVE COURSE - 12.5 (SPC-B - 12.5) AT PER TON				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
*450.99	35	TEMPORARY HOT MIX ASPHALT AT PER TON				
451.	35	HMA FOR PATCHING AT PER TON				
452.	165	ASPHALT EMULSION FOR TACK COAT AT PER GAL				
453.	1,640	HMA JOINT ADHESIVE AT PER FOOT				
472.	250	TEMPORARY ASPHALT PATCHING AT PER TON				
482.4	35	SAWCUTTING PORTLAND CEMENT CONCRETE AT PER FOOT				
504.	570	GRANITE CURB TYPE VA4 - STRAIGHT AT PER FOOT				
504.1	35	GRANITE CURB TYPE VA4 - CURVED AT PER FOOT				
509.	10	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - STRAIGHT AT PER FOOT				
509.1	15	GRANITE TRANSITION CURB FOR PEDESTRIAN CURB RAMPS - CURVED AT PER FOOT				
514.	6	GRANITE CURB INLET - STRAIGHT AT PER EACH				
515.	1	GRANITE CURB INLET - CURVED AT PER EACH				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
516.	2	GRANITE CURB CORNER TYPE A AT PER EACH				
580.	150	CURB REMOVED AND RESET AT PER FOOT				
594.	25	CURB REMOVED AND DISCARDED AT PER FOOT				
620.13	75	GUARDRAIL, TL-3 (SINGLE FACED) AT PER FOOT				
627.1	2	TRAILING ANCHORAGE AT PER EACH				
627.82	2	GUARDRAIL TANGENT END TREATMENT, TL-2 AT PER EACH				
628.24	4	TRANSITION TO BRIDGE RAIL AT PER EACH				
628.31	4	TEMPORARY IMPACT ATTENUATOR FOR SHLDR, INCAPABLE OF REDIRECTION AT PER EACH				
*628.4	10	TEMPORARY IMPACT ATTENUATOR REMOVED AND RESET AT PER EACH				
630.2	325	HIGHWAY GUARD REMOVED AND DISCARDED AT PER FOOT				
*657.	750	TEMPORARY FENCE AT PER FOOT				
*657.5	750	TEMPORARY FENCE REMOVED AND RESET AT PER FOOT				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
670.	50	FENCE REMOVED AND RESET AT PER FOOT				
*697.1	13	SILT SACK AT PER EACH				
701.	550	CEMENT CONCRETE SIDEWALK AT PER SQUARE YARD				
701.1	60	CEMENT CONCRETE SIDEWALK AT DRIVEWAYS AT PER SQUARE YARD				
701.2	20	CEMENT CONCRETE PEDESTRIAN CURB RAMP AT PER SQUARE YARD				
702.	15	HOT MIX ASPHALT SIDEWALK OR DRIVEWAY AT PER TON				
748.	1	MOBILIZATION AT PER LUMP SUM				
751.1	125	LOAM FOR LAWNS AT PER CUBIC YARD				
*755.	50	WETLAND REPLICATION AREA AT PER SQUARE YARD				
*755.9	24	PROFESSIONAL WETLAND SPECIALIST AT PER HR				
*756.	1	NPDES STORMWATER POLLUTION PREVENTION PLAN AT PER LUMP SUM				
*765.	850	SEEDING AT PER SQUARE YARD				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
*767.121	500	SEDIMENT CONTROL BARRIER AT PER FOOT				
767.31	20	STRAW MULCH AT PER SQUARE YARD				
767.6	5	AGED PINE BARK MULCH AT PER CUBIC YARD				
*767.9	500	MATTING FOR EROSION CONTROL AT PER SQUARE YARD				
769.	300	PAVEMENT MILLING MULCH UNDER GUARD RAIL AT PER FOOT				
*816.81	1	TEMPORARY TRAFFIC CONTROL SIGNAL AT PER LUMP SUM				
832.	50	WARNING-REGULATORY AND ROUTE MARKER - ALUMINIUM PANEL (TYPE-A) AT PER SQUARE FOOT				
833.5	10	DEMOUNTABLE REFLECTORIZED DELINEATOR - GUARD RAIL AT PER EACH				
833.7	4	DELINEATION FOR GUARD RAIL TERMINI AT PER EACH				
847.1	8	SIGN SUP (N/GUIDE)+ RTE MKR W/1 BRKWAY POST ASSEMBLY - STEEL AT PER EACH				
852.	625	SAFETY SIGNING FOR TRAFFIC MANAGEMENT AT PER SQUARE FOOT				
*852.12	4	TEMPORARY PEDESTRIAN CURB RAMP AT PER EACH				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
853.1	6	PORTABLE BREAKAWAY BARRICADE TYPE III AT PER EACH				
*853.33	720	TEMPORARY BARRIER - LIMITED DEFLECTION (TL-3) AT PER FOOT				
*853.331	2,900	TEMPORARY BARRIER - LIMITED DEFLECTION (TL-3) REMOVED AND RESET AT PER FOOT				
854.016	3,000	TEMPORARY PAVING MARKINGS-6 INCH (PAINTED) AT PER FOOT				
854.036	900	TEMPORARY PAVING MARKINGS-6 INCH (TAPE) AT PER FOOT				
854.1	2,750	PAVEMENT MARKING REMOVAL AT PER SQUARE FOOT				
856.	1,100	ARROW BOARD AT PER DAY				
856.12	3,600	PORTABLE CHANGEABLE MESSAGE SIGN AT PER DAY				
859.	1,100	REFLECTORIZED DRUM AT PER DAY				
859.1	2,200	REFLECTORIZED DRUMS WITH SEQUENTIAL FLASHING WARNING LIGHTS AT PER DAY				
864.04	20	PAVEMENT ARROWS AND LEGENDS REFL. WHITE (THERMOPLASTIC) AT PER SQUARE FOOT				
866.106	1,125	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT PER FOOT				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
867.106	1,100	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC) AT PER FOOT				
867.112	105	12 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC) AT PER FOOT				
874.2	1	TRAFFIC SIGN REMOVED AND RESET AT PER EACH				
*874.41	5	TRAFFIC SIGN REMOVED AND DISCARDED AT PER EACH				
*950.1	1	TEMPORARY SHORING AT PER LUMP SUM				
*953.	260	PERMANENT STEEL SHEETING AT PER FOOT				
*953.3	400	EXCAVATION SUPPORT SYSTEM AT PER SQUARE YARD				
*983.03	70	PARTIALLY GROUTED RIPRAP AT PER CUBIC YARD				
*983.4	50	NATURAL STREAMBED MATERIAL AT PER CUBIC YARD				
*991.1	1	CONTROL OF WATER - STRUCTURE NO. A-19-014 (C1R) AT PER LUMP SUM				

*Denotes Special Provision

ITEM NO.	QTY	ITEM WITH UNIT BID PRICE WRITTEN IN WORDS	UNIT PRICE		AMOUNT	
			Dollars	Cents	Dollars	Cents
*995.01	1	BRIDGE STRUCTURE, BRIDGE NO. A-19-014 (C1R) AT PER LUMP SUM				
*1000.1	1	DATA CONDUIT ACCOMODATIONS AT PER LUMP SUM				
*1000.2	1	GAS MAIN ACCOMODATIONS AT PER LUMP SUM				
		TOTAL				

*Denotes Special Provision

F. NOT USED

- G. The undersigned agrees that, if selected as general contractor, he/she will within five days, Saturdays, Sundays and legal holidays excluded, after presentation thereof by the awarding authority, execute a contract in accordance with the terms of this bid and furnish a performance bond and also a labor and materials or payment bond, each of a surety company qualified to do business under the laws of the commonwealth and satisfactory to the awarding authority and each in the sum of the contract price, the premiums for which are to be paid by the general contractor and are included in the contract price.

The undersigned declares that the only persons or parties interested in this Bid as principals are as stated; that the Bid is made without any collusion with other persons, firms, or corporations; that all, the Contract Documents as prepared by Hoyle, Tanner and Associates, Inc. / Tighe & Bond, Inc. and dated December 2024 have been carefully examined; that the undersigned is fully informed in regard to all conditions pertaining to the Work and the place where it is to be done, and from them the undersigned makes this Bid. These prices shall cover all expenses incurred in performing the Work required under the Contract Documents, of which this Bid Form is a part.

The time period for holding bids, where Federal approval is not required is 30 days, Saturdays, Sundays and legal holidays excluded, after the opening of bids.

The Bid Security accompanying this Bid shall be in the amount of 5% of the Bid. The Bid Security shall be sealed in a separate envelope from the Bid and then attached to the envelope containing the Bid.

If a Notice of Award accompanied by at least six unsigned copies of the Agreement and all other applicable Contract Documents is delivered to the undersigned within thirty days, excluding Saturdays, Sundays, and legal holidays after the actual date of the opening of the General Bids, the undersigned will within five days, excluding Saturdays, Sundays, and legal holidays, after the date of receipt of such notification, execute and return all copies of the Agreement and all other applicable Contract Documents to Owner. The premiums for all Bonds required shall be paid by Contractor and shall be included in the Contract Price. The undersigned Bidder further agrees that the Bid Security accompanying this Bid shall become the property of Owner if the Bidder fails to execute the Agreement as stated above.

The undersigned hereby agrees that the Contract Time shall commence twenty days following the Effective Date of the Agreement and that the Work will be substantially complete and completed and ready for final payment in accordance with paragraph the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement. Work will be substantially complete within **894 calendar days** after the date when the Contract Time commences to run provided in the General Conditions and completed and ready for final payment within **986 calendar days** after the date when the Contract Time commences to run.

The undersigned further understands that delays in completion of the Work will cause the Owner to suffer damages and incur substantial costs, and will expose the Owner to other substantial liabilities, and that if the selected Contractor shall neglect, fail or refuse to achieve Substantial Completion or final completion of the Work within the times specified above, as such times may be extended pursuant to the provisions of the Contract Documents, the Owner will hold the selected Contractor strictly liable for all such damages and any other damages, costs, expenses or liabilities sustained or incurred by the Owner arising out of such delays, as further provided in the Agreement, or for any delay in achieving any other milestones set forth in the Contract Documents in accordance with the terms of the Agreement. The undersigned accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work on time in the amount of \$1,000 per day after substantial completion time limits and \$1,000 per day after final completion time limits.

In accordance with the above understanding, the undersigned proposes to perform the Work, furnish all materials and complete the work in its entirety in the manner and under the conditions required.

The Owner shall select the low responsive and responsible bidder based on the Bid and available funding.

The undersigned agrees that extra work, if any, will be performed in accordance with Article 10 of the General Conditions of the Contract and will be paid for in accordance with Article 11 of the General Conditions of the Contract.

The bidding and award of this Contract will be in accordance with M.G.L. Chapter 30, Section 39M.

The undersigned must furnish a 100% Performance Bond and a 100% Payment Bond with a surety company acceptable to Owner.

Where indicated for amounts to be shown in both words and figures, in case of discrepancy, the amount shown in words shall govern.

The following documents are attached to and made a condition of this Bid:

- (a) This Bid Form in its Entirety
- (b) Required Bid Security
- (c) Required Experience Statement with supporting data

CERTIFICATIONS

Pursuant to M.G.L. Ch. 62C, sec. 49A, I certify under the penalties of perjury that I, to my best knowledge and belief, have filed all state tax returns and paid all state taxes required under law.

The undersigned hereby certifies that he/she is able to furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work and that he/she will comply fully with all laws and regulations.

The undersigned further certifies under the penalties of perjury that this bid is in all respects bona fide, fair and made without collusion or fraud with any other person. As used in this subsection the word "person" shall mean any natural person, joint venture, partnership, corporation or other business or legal entity.

The undersigned further certifies under penalty of perjury that the said undersigned is not presently debarred from doing public construction work in the Commonwealth under the provisions of Section Twenty-nine F of Chapter Twenty-nine, or any other applicable debarment provisions of any other chapter of the General Laws or any rule or regulation promulgated thereunder.

Social Security Number or
Federal Identification Number

Individual or Corporate Name
(Print or Type)

By: _____
(Signature)

RESPECTFULLY SUBMITTED on _____, 20__

An Individual

By (Individual's Name) _____

(SEAL)

doing business as _____

Business address: _____

Phone No.: _____

A Partnership

By (Firm Name) _____

(SEAL)

(General Partner) _____

Business address: _____

Phone No.: _____

A Corporation

By (Corporation Name) _____ (Corporate Seal)

(State of Incorporation) _____

By (Name and Title of Person Authorized to Sign) _____

Attest (Secretary) _____

Business address: _____

Phone No.: _____

A Joint Venture

By (Name) _____ (SEAL)

(Address) _____

Phone No.: _____

By (Name) _____ (SEAL)

(Address) _____

Phone No.: _____

By (Name) _____ (SEAL)

(Address) _____

Phone No.: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership and corporation that is a party to the joint venture should be in the manner indicated above).

SECTION 00302
CERTIFICATE OF AUTHORITY TO SIGN

At a duly authorized meeting of the Board of Directors of _____
(Company Name)
held on _____, at which all the Directors were present or waived notice, it was
voted _____
(Date)

that _____, _____, _____
(Officer Names)
of this Company, be and he/she/they hereby is/are authorized to execute Bidding Document,

Contracts and Bonds in the name and on behalf of said Company, and affix its corporate seal
thereto, and such execution of any contract or obligation in this Company's name on its behalf by
such _____ under seal of the Company shall be valid and binding upon this Company.
(Officer/Title)

I hereby certify that the above vote has not been amended or rescinded and remains in full effect
as of this date _____.

A true copy,
ATTEST _____
Clerk
(Corporate Seal)

(General Bidders and Sub-Bidders shall complete and submit this Form or a similar Form as proof of Authority to Sign)

SECTION 00405
EXPERIENCE STATEMENT

All questions must be answered with clear and comprehensive data; if necessary, add additional pages. This statement must be notarized.

1. Name of Bidder.

2. Permanent Main Office address.

3. When organized.

4. Where incorporated.

5. How many years have you been engaged in the contracting business under your present firm name? Also state names and dates of previous firm names, if any.

6. State work of a similar nature to that stated in the Bid Proposal, including references that will assist the Owner to judge experience, skill and business standing:

7. Contracts on hand. (Schedule these, showing gross amount of each contract and the approximate anticipated dates of completion.)

8. General character of work performed by your company.

9. Have you ever failed to complete any work awarded to you? ___(Yes) ___(No) If so, where and why?

10. Have you ever defaulted on a contract? ___(Yes) ___(No). If so, where and why?

11. List the more important contracts recently executed by your company, stating approximate cost for each, and the month and year completed.

12. List your major equipment available for this contract.

13. List your key personnel such as Project Superintendent and foremen available for this contract.

14. List any subcontractors whom you would expect to use and the general components of the Project (e.g. Paving, Utilities, etc.) for which they will be responsible. Indicate other projects on which the proposed subcontractor has worked with you.

15. Name and address of banking institutions with whom you do business.

Do you grant the Engineer permission to contact this (these) institutions? ___(Yes) ___(No)

Dated at _____ this _____ day of _____, 20__

(Name of Bidder)

By _____

State of _____ S Title _____

County of _____)

_____ being duly sworn, deposes and says that he is

of _____ and that the answers to the foregoing
(Name of Organization)

questions and all statements contained therein are true and correct.

Sworn to before me this _____ day of _____, 20__.

(Notary Public)

My commission expires _____.

END OF SECTION

SECTION 00410
BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER:

Town of Ayer
One Main Street
Ayer, MA 01432

BID:

Bid Due Date: February 7, 2025
Project (Brief Description Including Location): West Main Street over Nonacoicus Brook Bridge Replacement

BOND:

Bond Number:
Date (Not later than Bid due date):

Penal sum _____
(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

SURETY

Bidder's Name and Corporate Seal Seal

Surety's Name and Corporate Seal Seal

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

4.02 *Days to Achieve Substantial Completion and Final Payment*

- A. The Work will be substantially completed within 894 days after the date when the Contract Times commence to run as provided in Paragraph 3 of the General Conditions and completed and ready for final payment in accordance with Paragraph 3.9 of the General Conditions within 986 days after the date when the Contract Times commence to run.
- B. It is anticipated that the Phase I Notice to Proceed will be issued March 2025 in order to complete shop drawing review and utility coordination prior to the Contractor taking site. It is anticipated that the Contract will be allowed to take the site April 2025 under the second phase of the Notice to Proceed.
- C. The following conditions shall be satisfied in order to achieve Substantial Completion, in addition to the other requirements for the determination of Substantial Completion included in this Agreement:
 1. The temporary traffic control plan (single lane of signalized alternating traffic) shall be fully removed, and the West Main Street Bridge shall be open to two lanes of unrestricted vehicular traffic at the end of each construction day, and at least one lane of pedestrian traffic shall be open in the final location of either the northern or southern permanent sidewalk. Daytime lane closures between the period of Substantial and Final completion may be allowed, as permitted by the Owner or Engineer, to complete remaining work necessary to achieve Final Completion.
 2. Binder course pavement shall be installed in the entirety of the project limits with any necessary temporary pavement markings installed.
 3. Installation of the permanent guardrail system shall be complete within the project limits, including bridge and approach rail on the West Main Street Bridge.
 4. Temporary traffic control signage shall be removed.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner \$1,000 for each day that expires after the time specified in Paragraph 4.02 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner \$1,000 for each day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraph 5.01A.

A. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 5 of the General Conditions. Applications for Payment will be processed by the Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 30th day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured based on the number of units completed or, in the event there is no schedule of values, as provided in the General Requirements:

B. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with the General Conditions:

a. 95 percent of Work completed (with the balance being retainage); and

b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

C. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 97.5 percent of the Work completed, less such amounts as Engineer shall determine in accordance with the General Conditions.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with the General Conditions and the Supplementary Conditions, Owner shall pay the remainder of the Contract Price as recommended by the Engineer and as provided in the General Conditions, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages.

ARTICLE 7 – INTEREST

7.01 Not Applicable

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities).
- E. Contractor has obtained and carefully studied (or assumes responsibility for doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.
- F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- H. Contractor has correlated the information known to Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- I. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

- A. The Contract Documents consist of the following:
1. This Agreement (pages 1 to 7, inclusive).
 2. Performance Bond and Payment Bond
 3. General Conditions
 4. Supplementary Conditions
 5. Special Provisions and Appendices
 6. Drawings consisting of 44 sheets with each sheet bearing the following general title:
Ayer - West Main Street
 7. Addenda (numbers _____ to _____, inclusive).
 8. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid (pages _____ to _____, inclusive).
 - b. Documentation submitted by Contractor prior to Notice of Award (pages _____ to _____, inclusive).
 - c. _____.
 9. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
 - a. Notice to Proceed (pages _____ to _____, inclusive).
 - b. Work Change Directives.
 - c. Change Order(s).
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

- A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in four copies. One counterpart each has been delivered to Owner, Contractor, Engineer, and Agency. All portions of the Contract Documents have been signed, initialed, or identified by Owner and Contractor or identified by Engineer on their behalf.

This Agreement is dated _____

OWNER:
Board of Selectmen
Town of Ayer
Ayer, Massachusetts

CONTRACTOR

By: _____
Title
. Chairman

By: _____

By: _____
Title
. Member

By: _____
Title
. Member

Title

[CORPORATE SEAL]

[CORPORATE SEAL]

Approve
d. _____
Title: Treasurer

Attest: _____
Title: Clerk

Attest

Title: _____

Address for giving notices:

Address for giving notices:

Agent for service of process:

(If Contractor is a corporation or a partnership,
attach evidence of authority to sign.)

SECTION 00610
PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER:
Town of Ayer
1 Main Street
Ayer, MA 01432

CONTRACT:
Date:
Amount:
Description (Name and Location):

BOND:
Bond Number:
Date (Not earlier than Contract Date):
Amount:
Modifications to this Bond Form:

Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL
Company:

SURETY

Signature: _____ (Seal)
Name and Title:

Surety's Name and Corporate Seal (Seal)

By: _____
Signature and Title
(Attach Power of Attorney)

(Space is provided below for signatures of additional parties, if required.)

Attest: _____
Signature and Title

CONTRACTOR AS PRINCIPAL
Company:

SURETY

Signature: _____ (Seal)
Name and Title:

Surety's Name and Corporate Seal (Seal)

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title:

EJCDC No. C-610 (2002 Edition)

Originally prepared through the joint efforts of the Surety Association of America, Engineers Joint Contract Documents Committee, the Associated General Contractors of America, and the American Institute of Architects.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner for the performance of the Contract, which is incorporated herein by reference.

2. If Contractor performs the Contract, Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in Paragraph 3.1.

3. If there is no Owner Default, Surety's obligation under this Bond shall arise after:

3.1. Owner has notified Contractor and Surety, at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and

3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in Paragraph 3.1; and

3.3. Owner has agreed to pay the Balance of the Contract Price to:

1. Surety in accordance with the terms of the Contract;
2. Another contractor selected pursuant to Paragraph 4.3 to perform the Contract.

4. When Owner has satisfied the conditions of Paragraph 3, Surety shall promptly and at Surety's expense take one of the following actions:

4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or

4.2. Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and Contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or

4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to Owner and, as soon as practicable after the amount is determined, tender payment therefor to Owner; or
2. Deny liability in whole or in part and notify Owner citing reasons therefor.

5. If Surety does not proceed as provided in Paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Paragraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under Paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To a limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, Surety is obligated without duplication for:

6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;

6.2. Additional legal, design professional, and delay costs resulting from Contractor's Default, and resulting from the actions or failure to act of Surety under Paragraph 4; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of Contractor.

7. Surety shall not be liable to Owner or others for obligations of Contractor that are unrelated to the Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than Owner or its heirs, executors, administrators, or successors.

8. Surety hereby waives notice of any change, including changes of time, to Contract or to related subcontracts, purchase orders, and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within two years after Contractor Default or within two years after Contractor ceased working or within two years after Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

12.1 Balance of the Contract Price: The total amount payable by Owner to Contractor under the Contract after all proper adjustments have been made, including allowance to Contractor of any amounts received or to be received by Owner in settlement of insurance or other Claims for damages to which Contractor is entitled, reduced by all valid and proper payments made to or on behalf of Contractor under the Contract.

12.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

SECTION 00620
PAYMENT BOND

Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

CONTRACTOR (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):

Town of Ayer
1 Main Street
Ayer, MA 01432

CONTRACT

Effective Date of Agreement: _____

Amount: _____

Description (*Name and Location*): _____

BOND

Bond Number: _____

Date (*Not earlier than Effective Date of Agreement*): _____

Amount: _____

Modifications to this Bond Form: _____

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal (Seal)

Surety's Name and Corporate Seal (Seal)

By: _____
Signature

By: _____
Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Note: Provide execution by additional parties, such as joint venturers, if necessary.

1. Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to Owner to pay for labor, materials, and equipment furnished by Claimants for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to Owner, this obligation shall be null and void if Contractor:
 - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and
 - 2.2 Defends, indemnifies, and holds harmless Owner from all claims, demands, liens, or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials, or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens, or suits to Contractor and Surety, and provided there is no Owner Default.
3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.
4. Surety shall have no obligation to Claimants under this Bond until:
 - 4.1 Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.
 - 4.2 Claimants who do not have a direct contract with Contractor:
 1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials or equipment were furnished or supplied, or for whom the labor was done or performed; and
 2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and
 3. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.
5. If a notice by a Claimant required by Paragraph 4 is provided by Owner to Contractor or to Surety, that is sufficient compliance.
6. Reserved.
7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by Surety.
8. Amounts owed by Owner to Contractor under the Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any performance bond. By Contractor furnishing and Owner accepting this Bond, they agree that all funds earned by Contractor in the performance of the Contract are dedicated to satisfy obligations of Contractor and Surety under this Bond, subject to Owner's priority to use the funds for the completion of the Work.
9. Surety shall not be liable to Owner, Claimants, or others for obligations of Contractor that are unrelated to the Contract. Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.
10. Surety hereby waives notice of any change, including changes of time, to the Contract or to related subcontracts, purchase orders, and other obligations.
11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Paragraph 4.1 or Paragraph 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
12. Notice to Surety, Owner, or Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, Owner, or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.
13. When this Bond has been furnished to comply with a statutory requirement in the location where the Contract was to be performed, any provision in this Bond conflicting with said statutory requirement shall be deemed deleted herefrom and provisions conforming to such statutory requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.
14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.
15. Definitions
 - 15.1 Claimant: An individual or entity having a direct contract with Contractor, or with a first-tier subcontractor of Contractor, to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
 - 15.2 Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 15.3 Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract, or to perform and complete or otherwise comply with the other terms thereof.

SECTION 00700
GENERAL CONDITIONS

**STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT**

Prepared By



Endorsed By



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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*
 - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue

- that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.
- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. A demand for money or services by a third party is not a Claim.
11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
 12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.
 13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
 14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
 15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
 16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
 17. *Cost of the Work*—See Paragraph 13.01 for definition.
 18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
 19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
 20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
 21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of

- text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.
22. *Engineer*—The individual or entity named as such in the Agreement.
 23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
 24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
 25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
 26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
 27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
 28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
 29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
 30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
 31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.
 32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
 33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.
36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers’ instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion of such Work.
43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
 - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,”

“proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

- C. *Day*: The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective*: The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
1. does not conform to the Contract Documents;
 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

- A. *Performance and Payment Bonds:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner's Insurance:* After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
 - 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- G. Nothing in the Contract Documents creates:
 - 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
 - 2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

- 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- 2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

- 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
- 2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract

Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its

- consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. Abnormal weather conditions;
 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
 4. Acts of war or terrorism.
- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
 1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
 1. The circumstances that form the basis for the requested adjustment;
 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
 4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 Availability of Lands

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and

Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.
- C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
 - 2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
 - 3. Technical Data contained in such reports and drawings.
- B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.
- C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

- D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
 2. is of such a nature as to require a change in the Drawings or Specifications;
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;
- then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.
- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings

or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

- D. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;
 - b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice required by Paragraph 5.04.A.
 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 2. complying with applicable state and local utility damage prevention Laws and Regulations;
 3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
 2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
 3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
 4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its

presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or

make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable

Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.
- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining

the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.
- H. Contractor shall require:
 - 1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
 - 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.
- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
1. include at least the specific coverages required;
 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
 4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds:* The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);
 4. not seek contribution from insurance maintained by the additional insured; and
 5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

- B. *Property Insurance for Facilities of Owner Where Work Will Occur:* Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities:* Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.
 - 1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
 - 2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy

or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.
- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 “Or Equals”

- A. *Contractor’s Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or equal” item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an “or equal” item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.
 - b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor’s Expense:* Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.
- C. *Engineer’s Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete and Engineer determines that the proposed item is an “or-equal,” which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer’s Determination:* Neither approval nor denial of an “or-equal” request will result in any change in Contract Price. The Engineer’s denial of an “or-equal” request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

- E. *Treatment as a Substitution Request:* If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

- A. *Contractor’s Request; Governing Criteria:* Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
 - a. will certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design;
 - 2) be similar in substance to the item specified; and
 - 3) be suited to the same use as the item specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from the item specified; and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer’s Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole

judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

- C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages

(including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These

record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

- 1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
 - 2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
- 2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
1. *Shop Drawings*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.
 2. *Samples*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.
 3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Engineer's Review of Shop Drawings and Samples*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.
 5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.
 8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.
- D. *Resubmittal Procedures for Shop Drawings and Samples*
1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
 2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
 3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.
- E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*
1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
 - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.
 - d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
 - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
 - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
 - 1. Observations by Engineer;
 - 2. Recommendation by Engineer or payment by Owner of any progress or final payment;
 - 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 - 4. Use or occupancy of the Work or any part thereof by Owner;
 - 5. Any review and approval of a Shop Drawing or Sample submittal;
 - 6. The issuance of a notice of acceptability by Engineer;
 - 7. The end of the correction period established in Paragraph 15.08;
 - 8. Any inspection, test, or approval by others; or
 - 9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.
- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility

owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 2. An itemization of the specific matters to be covered by such authority and responsibility; and
 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any

such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER’S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer’s status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner’s duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner’s duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner’s identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner’s responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner’s responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner’s responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.
- E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 - 2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 - 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
 - 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.
- B. If Owner has issued a Work Change Directive and:
 - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 - 1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
 - 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 - 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
 - 1. A mutually acceptable fixed fee; or
 - 2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

- e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
- f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

- 1. *Submittal:* Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
- 2. *Supporting Data:* The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

- 3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion

Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 5. *Binding Decision:* Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion:* Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*
1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work:* The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.
 - c. *Construction Equipment Rental*
 - 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent

and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
 - h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
 - i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.
- C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
 - 2. The cost of purchasing, renting, or furnishing small tools and hand tools.
 - 3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 - 6. Expenses incurred in preparing and advancing Claims.
 - 7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.
- D. *Contractor's Fee*
- 1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.
- E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances*: Contractor agrees that:
 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such

matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
3. by manufacturers of equipment furnished under the Contract Documents;
4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable

engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
 - 2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 - 3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work;
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. The Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. The Contract Price has been reduced by Change Orders;

- i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
 - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
 - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes

from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
 - 2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 - 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof,

is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all duly pending Change Proposals and Claims; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

- B. *Engineer's Review of Final Application and Recommendation of Payment:* If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

- C. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such adjacent areas;
 - 2. correct such defective Work;
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or

relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.

- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any

Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:
1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:
1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
 2. agree with the other party to submit the dispute to another dispute resolution process; or
 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SECTION 00800
SUPPLEMENTARY CONDITIONS
(EJCDC Form C-800, Modified)

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, "Paragraph SC-4.05."

DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

SC-1.01 Add the following definition below 1.01.A.51

52. Contracting Authority: See definition of "Owner" in 1.01.A.30.

53. Jurisdiction: the Superior Court of the Commonwealth of Massachusetts for Middlesex County, MA, and in no other court.

54. Contractor: means any person, corporation, partnership, joint venture, sole proprietorship, or other entity awarded this Contract.

55. Contract: means any contract awarded or executed pursuant to M.G.L. c.30 §39M or M.G.L. c.149 §44A-J, which is for an amount greater than one hundred thousand dollars (\$100,000.). Contract shall also have the definition of "agreement" in Section 00700.

56. Records: means books of original entry, accounts, checks, bank statements and all other banking documents, correspondence, memoranda, invoices, computer printouts, tapes, discs, papers and other documents or transcribed information of any type, whether expressed in ordinary or machine language.

57. Independent Certified Public Accountant: means a person duly registered in good standing and entitled to practice as a certified public accountant under the laws of the place of his/her residence or principal office and who is in fact independent.

58. Audit: when used in regard to financial statements, means an examination of records by an independent certified public accountant in accordance with generally accepted accounting principles and auditing standards for the purpose of expressing a certified opinion thereon, or, in the alternative, a qualified opinion or a declination to express an opinion for stated reasons.

59. Accountant's Report: when used in regard to financial statements, means a document in which an independent certified public accountant indicates the scope of the audit which he/she has made and sets forth his/her opinion regarding the financial statements taken as a whole with a listing of noted exceptions and qualifications, or an assertion to the effect that an overall opinion cannot be expressed. When an overall opinion cannot be expressed the reason therefor shall be stated. An accountant's report shall include a signed statement by the responsible corporate officer attesting that management has fully disclosed all material

facts to the independent certified public accountant, and that the audited financial statement is a true and complete statement of the financial condition of the Contractor.

60. Management: when used herein, means the chief executive officers, partners, principals or other person or persons primarily responsible for the financial and operational policies and practices of the Contractor.

61. Accounting terms, unless otherwise defined herein, shall mean in accordance with generally accepted accounting principles and auditing standards.

PRELIMINARY MATTERS

2.02 Copies of Documents

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor one printed copy of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy of the Contract Documents (including one fully signed counterpart of the Agreement) in electronic portable document format (PDF).

2.04 Preconstruction Conference; Designation of Authorized Representatives

SC-2.04.A. Amend the second line of paragraph 2.04.A to read as follows:

"...others as appropriate MAY be held to establish a working..."

2.05 Acceptance of Schedules

SC-2.05 Add the following new paragraph immediately after paragraph 2.05 A.4.

- B. If the Contractor's submitted Progress Schedule, Schedule of Submittals and Schedule of Values are acceptable to the Engineer a Conference may not be required.

COMMENCEMENT AND PROGRESS OF THE WORK

Commencement of Contract Times; Notice to Proceed

SC-4.01.A Delete paragraph 4.01A in its entirety and replace with the following

The contract times will commence to run on the day indicated in the Notice to Proceed. In no event will the Contract Times commence to run later than the 60th day after the date of the bid opening.

4.02 Starting the Work

SC-4.02 Amend the 4.02 A to read as follows:

- A. Contractor shall start to perform their obligations under the Contract Documents when the Contract Times commence to run. No Work may be done at the Site prior to the date indicated in the Notice to Proceed.

SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

- E. Refer to Appendices for any available reports or explanations of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:
- F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None.		

5.04 *Differing Subsurface or Physical Conditions*

SC-5.04 Add the following new paragraph immediately before 5.04.A.

Pursuant to MGL Chapter 30 § 39N; If, during the progress of the work, the contractor or the awarding authority discovers that the actual subsurface or latent physical conditions encountered at the site differ substantially or materially from those shown on the plans or indicated in the contract documents either the Contractor or the Contracting Authority may request an equitable adjustment in the contract price of the contract applying to work affected by the differing site conditions. A request for such an adjustment shall be in writing and shall be delivered by the party making such claim to the other party as soon as possible after such conditions are discovered. Upon receipt of such a claim from a contractor, or upon its own initiative, the contracting authority shall make an investigation of such physical conditions, and, if they differ substantially or materially from those shown on the plans or indicated in the contract documents or from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the plans and contract documents and are of such a nature as to cause an increase or decrease in the cost of performance of the work or a change in the construction methods required for the performance of the work which results in an increase or decrease in the cost of the work, the contracting authority shall make an equitable adjustment in the contract price and the contract shall be modified in writing accordingly.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

- 4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None.		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None.		

BONDS AND INSURANCE

6.02 Insurance—General Provisions

SC-6.02 Delete Paragraph 6.02.B in its entirety and insert the following in its place:

No insurance shall be obtained from an insurer which:

- (1) is not licensed to sell insurance in the Commonwealth of Massachusetts; or
- (2) is not authorized to provide insurance as an excess or surplus lines insurer, and does not have a current Best’s rating of A or better.

SC-6.02 Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker’s compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker’s compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker’s compensation insurance for similar projects by the state within the last 12 months.

SC-6.02 Delete Paragraph 6.02.N and replace it with the following:

N. All certificates and policies shall contain the following provision:

“Notwithstanding any other provision herein, should any of the above policies be cancelled or materially amended before the expiration date thereof, the issuing company will mail thirty (30) days prior written notice thereof to the named certificate holder and to the Ayer Department of Public Works, 25 Brook Street, Ayer, MA 01432 before such cancellation or amendment shall take place.”

M. Certificates evidencing such insurance in five (5) copies shall be furnished to the Town at the execution of the Agreement. Such certificates shall not merely name the types of policy provided, but shall specifically refer to the Agreement and shall state that such insurance is as required by this Agreement. The Contractor shall make no claims against the Town of Ayer or its officers for any injury to any of its officers or employees or for damage to its equipment arising out of work contemplated by the Agreement.

6.03 Contractor’s Insurance

SC-6.03 Amend the first sentence of Paragraph 6.03A to read as follows:

“...and maintain Worker’s Compensation (meeting the Commonwealth of Massachusetts limits)...”

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following:
- Town of Ayer, Ayer, Massachusetts
 - Hoyle Tanner & Associates, Inc.
 - Tighe & Bond, Inc.
- E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory*
Applicable Federal (e.g., Longshoreman's)	Statutory*
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory*
Bodily injury by accident—each accident	\$ 500,000
Bodily injury by disease—aggregate	\$ 500,000
Employer's Liability	
Each accident	\$ 1,000,000
Each employee	\$ 1,000,000
Policy limit	\$ 1,000,000

* Meeting the Commonwealth of Massachusetts Required Limits.

- F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.

- a. Such insurance must be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor’s contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.
 6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
 7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 “Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured” or its equivalent.
- H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of “insured contract” (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
 2. Any exclusion for water intrusion or water damage.
 3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
 4. Any exclusion of coverage relating to earth subsidence or movement.
 5. Any exclusion for the insured’s vicarious liability, strict liability, or statutory liability (other than worker’s compensation).
 6. Any limitation or exclusion based on the nature of Contractor’s work.
 7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.
- I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	\$ 2,000,000
Products—Completed Operations Aggregate	\$ 2,000,000
Personal and Advertising Injury	\$ 1,000,000
Bodily Injury and Property Damage—Each Occurrence	\$ 1,000,000

- J. *Automobile Liability*: Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	\$ 1,000,000
Each Accident	\$ 1,000,000
Property Damage	
Each Accident	\$ 1,000,000
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	\$ 2,000,000

- K. *Umbrella or Excess Liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer’s liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	\$ 5,000,000
General Aggregate	\$ 5,000,000

- L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements*: Contractor may meet the policy limits specified for employer’s liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy’s policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of \$1,000,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

- M. *Contractor’s Pollution Liability Insurance*: Not used.

- N. *Contractor’s Professional Liability Insurance*: If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	\$500,000
Annual Aggregate	\$500,000

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).
 - a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
 - b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.
2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of \$ 100,000.
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of \$ 100,000.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.
9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:
 - a. None.
11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:
 - a. None.
12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of \$100,000.
13. In addition to the coverage sublimits stated above, the following coverages are also subject to sublimits, as follows:
 - a. None.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision:

- G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

CONTRACTOR'S RESPONSIBILITIES

7.03 Labor; Working Hours

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be 7:30 AM to 5:00 PM. Requests to work other than regular working days / hours shall be submitted to Engineer and the Town not less than one week prior to any proposed work.
2. Owner's legal holidays are the same as the Massachusetts Legal Holidays <https://www.sec.state.ma.us/divisions/cis/holiday-info.htm>

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "...all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will

not perform Work on a Saturday, Sunday, or any legal holiday without permission of the owner.”

7.07 *Concerning Subcontractors and Suppliers*

SC-7.07.D Amend the last sentence of Paragraph 7.07.D to read as follows “...objection within thirty days.”

7.09 *Permits*

SC-7.09 Add the following new paragraphs immediately after paragraph 7.09.A

- B. The Contractor must apply for the following local permits prior to the start of construction; please note that fees for the local permits through Ayer DPW will be waived:
- Town of Ayer Street Opening Permit and Bond.
 - Town of Ayer Trench Permit.
 - Refer to Appendices regarding additional environmental permits and their requirements.

7.10 *Taxes*

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

- A. Owner is exempt from payment of sales and compensating use taxes of the State of Massachusetts and of cities and counties thereof on all materials to be incorporated into the Work. To the extent that materials and supplies are used or incorporated in the performance of this Contract, the Contractor is considered an exempt purchaser under the Massachusetts Sales Act, Chapter 14 of the Acts of 1966.
1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
 2. Owner’s exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

7.13 *Safety and Protection*

SC-7.13 Add a new paragraph immediately after Paragraph 7.13.J

- K. If the Contractor uses or stores toxic or hazardous substances it is subject to M.G.L. c.111F §2, the "Right to Know" law and regulations promulgated by the Department of Public Health, 105 CMR 670, the Department of Environmental Protection, 310 CMR 33, and the Department of Labor and Workforce Development, 441 CMR 21; and must post a Workplace Notice obtainable from the Department of Labor and Workforce Development.

7.16 *Submittals*

SC-7.16.A Add the following new paragraph immediately after paragraph 7.16.A.3:

4. Contractor shall submit the number of copies which the Contractor requires, plus two copies (which will be retained by the Engineer) of shop drawings and other submittals to Engineer for review. If the submittal is made electronically, no paper copies will be provided to the Contractor.

ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
 2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
 3. *Liaison*
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
 4. *Review of Work; Defective Work*
 - a. Conduct on-site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
 5. *Inspections and Tests*
 - a. Observe Engineer-arranged third-party inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing the public or other agencies having jurisdiction over the Work.
 6. *Payment Requests:* Review Applications for Payment with Contractor.
 7. *Completion*
 - a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.

- c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
 5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
 6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
 7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11 – CHANGES TO THE CONTRACT

11.11 Statutory Change Order Provisions

SC-11.11 Add the following paragraph directly below section 11.10

11.11. Statutory Change Order Provisions

The Contractor's attention is directed to the Massachusetts General Laws Chapter 30, §§ 39I, 39J, 39N, 39O and 39P, the provisions of which apply to this Contract.

ARTICLE 13 - COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 Cost of the Work

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of "*Rental Rate Blue Book for Construction Equipment*" published by *Equipment Watch*.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

- a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than \$500.

13.03 Unit Price Work

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. *Adjustments in Unit Price*

1. The Owner reserves the right to increase or decrease the amount of any item of the work listed as may be found desirable or necessary during the carrying out of this contract and the unit prices quoted in the Proposal shall apply without change to such variation in the quantity of each of the Items

13.04 *Prevailing Wage Rates*

SC-13.04 Add the following after paragraph 13.03:

- A. The Director of the Department of Labor and Workforce Development has established a schedule for the prevailing minimum wage rates that must be paid to all workers employed on the Contract. Such Schedule shall continue to be the minimum rate of wages payable to workers on this Contract throughout the term of the Contract. The Contractor shall not have any claim for extra compensation from the Owner if the actual wages paid to employees on the Contract exceeds the rates listed on the Schedule. The Contractor shall cause a copy of said Schedule to be kept in a conspicuous place at the Project site during the term of the Contract. (See M.G.L c.149 §27.) If reserve police officers are employed by the Contractor, they shall be paid the prevailing wage of regular police officers. (See M.G.L c.149 §34B). A current wage determination must be requested through the <https://www.mass.gov/prevailing-wage-program> website.

ARTICLE 14 – TEST AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.02 *Tests, Inspections, and Approvals*

SC-14.02 Add the following paragraph immediately after paragraph 14.02.F:

- G. Contractor shall pay all costs associated with any re-inspection and/or retesting of materials and equipment required by the Engineer as a result of failure of previous test or rejected work as determined by the Engineer. Contractor shall also pay all costs associated with any additional testing requested by the Contractor.

ARTICLE 15 – PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01.D.1 Amend the first line of paragraph 15.01.D.1 to read as follows:

Thirty days after presentation of the...

15.03 *Substantial Completion*

SC-15.03.A Add the following new subparagraph to Paragraph 15.03.A:

1. Substantial Completion shall be as defined in Section 4.02.C of the Agreement.

SC-15.03.B Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

SC-15.03.E Delete the second sentence of paragraph 15.03.E in its entirety.

15.08 *Correction Period*

SC-15.08 Add the following new Paragraph 15.08.G:

- E. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

SC-16.01 Delete Article 16.01 in its entirety and replace with the following:

16.01 *Owner May Suspend Work*

- A. The Owner may delay the commencement of the Work, or any part thereof, due to unforeseen circumstances or conditions which have a bearing on the Work required under this Contract or for any other reason if it is deemed to be in the best interest of the Owner to do so. Except as expressly provided in the following Subparagraphs 16.01.A, 16.01.B, and 16.01C the Contractor shall have no claim for additional compensation on account of such delay, but shall be entitled to an extension of Contract Time as determined reasonable by the Engineer.
- B. The Contractor and the Owner agree that the following Subparagraphs provide the Contractor with the right to request additional compensation for Owner caused delays only in the following two circumstances:
 - 1. When the Owner provides the Contractor with a written order to suspend or delay the Work, or a portion thereof, for a period of fifteen days or more.
 - 2. When the Owner or its Engineer fails to make a decision within the period described Section 00700 such failure delays the Work, or a portion thereof, for fifteen days or more.
- C. The Owner may, for its convenience, order the Contractor in writing to suspend, delay, or interrupt all or any part of the Work for such period of time as it may determine appropriate, provided however, that if there is a suspension, delay, or interruption for fifteen days or more or there is a failure of the Owner to act within the time specified in this Contract, the Owner shall make an adjustment in the Contract price for any increase in the cost of performance of this Contract, but shall not include any profit to the Contractor on account of such increase; and provided further, that the Owner shall not make any adjustment in the Contract price under this provision for any suspension, delay, interruption, or failure to act to the extent that such is due to any cause for which this Contract provides for an equitable adjustment of the Contract price under any other Contract provisions. MGL c.30 §390 (a).
- D. The Contractor must submit the amount of a claim under 16.01.C to the Owner in writing as soon as practicable after the end of the suspension, delay, interruption, or failure to act and, in any event, not later than the date of final payment under this Contract and except for costs due to a suspension order, the Owner shall not approve any costs in the claim incurred more than twenty days before the Contractor notified the Owner in writing of the act or failure to act involved in the claim. MGL c.30 §390 (b).
- E. The Owner and the Contractor agree that the preceding section 16.01.D places a burden on the Contractor to inform the Owner, whenever the Contractor considers that an action or inaction of the Owner or its Engineer could result or has resulted in a delay in the Project, thereby providing the Owner with the opportunity to take action to avoid or lessen the

time extensions or damages that might be associated with such action or inaction.

- F. The Contractor must file any claim for additional compensation made pursuant to section 16.01.D as a Change Order request. The amount of any such claim shall be calculated only in accordance with the provisions of 00700 Section 11.
- G. In the event a suspension, delay, interruption or failure to act of the awarding authority increases the cost of performance to any subcontractor, that subcontractor shall have the same rights against the general contractor for payment for an increase in the cost of his performance as provisions C and D give the general contractor against the awarding authority, but nothing in provisions C and D shall in any way change, modify or alter any other rights which the general contractor or the subcontractor may have against each other.

ARTICLE 17 – CONTRACTOR’S RESPONSIBILITIES

SC-17.20 Add the following Article after 17.19

17.20 Contractor’s Accounting Requirements (MGL c 30, §39R)

- A. Definitions: Refer to Section 00800 SC-1.01
- B. Record Keeping
 - 1. The Contractor shall make, and keep for at least six years after final payment, books, records, and accounts which in reasonable detail accurately and fairly reflect the transactions and dispositions of the Contractor.
 - 2. Until the expiration of six years after final payment, the Inspector General, the Owner, and the Department shall have the right to examine any books, documents, papers or records of the Contractor and Subcontractors that directly pertain to, and involve transactions relating to the Contractor and Subcontractors.
 - 3. The Contractor shall describe any change in the method of maintaining records or recording transactions which materially affects any statements filed with the Owner including the date of the change and reasons therefor, and shall accompany said description with a letter from the Contractor's independent certified public accountant approving or otherwise commenting on the changes.
 - 4. Prior to the execution of the Contract, the Contractor shall file a statement of management on internal accounting controls as set forth in Paragraph 13.3.
 - 5. Prior to the execution of the Contract, the Contractor shall file an audited financial statement for the most recent completed fiscal year as set forth in Paragraph 13.4 below and will continue to file such statement annually during the term of the Contract.
- C. Statement of Management Controls -- Applicable on contracts of \$100,000 or more
 - 1. Prior to execution of the Contract, the Contractor shall file with the Owner a statement of management as to whether the system of internal accounting controls of the Contractor and its subsidiaries reasonably assures that:
 - a. Transactions are executed in accordance with management's general and specific authorization;
 - b. Transactions are recorded as necessary to:

- i. permit preparation of financial statements in conformity with generally accepted accounting principles, and
 - ii. maintain accountability for assets;
 - e. Access to assets is permitted only in accordance with management's general or specific authorization; and
 - f. The recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action was taken with respect to any difference.
 - 2. Prior to execution of the Contract, the Contractor shall also file with the Owner a statement prepared and signed by an independent certified public accountant, stating that the accountant has examined the statement of management on internal accounting controls, and expressing an opinion as to:
 - a. whether the representations of management in response to subparagraph 13.3.1 above are consistent with the results of management's evaluation of the system of internal accounting controls; and
 - b. whether such representations of management are reasonable with respect to transactions and assets in amounts which would be material when measured in relation to the applicant's financial statement.
- D. Annual Financial Statement
- 1. Every Contractor awarded a contract shall annually file with the Owner during the term of the Contract a financial statement prepared by an independent certified public accountant on the basis of an audit by such accountant. The final statement filed shall include the date of final payment. All statements shall be accompanied by an accountant's report.

PART II – STATE GOVERNMENT PROVISIONS

State Government Provisions included herein, have been selected from those to which specific references have been made elsewhere in the Contract Documents. Each and every other provision of law or clause required by law to be inserted in this Contract shall be deemed to be also inserted herein in accordance with the Supplementary Conditions.

COMMONWEALTH OF MASSACHUSETTS PROVISIONS

1. The Owner and Contractor agree that the following Commonwealth of Massachusetts Provisions apply to the work to be performed under this Contract and that these provisions supersede any conflicting provisions of this Contract.
2. Applicable provisions of Massachusetts General Laws and Regulations and/or the United States Code and Code of Federal Regulations govern this Contract and any provision violation of the foregoing shall be deemed null, void and of noeffect.
3. Massachusetts General Laws
 - 3.1 Chapter 30, Section 39F
 - 3.2 Chapter 30, Section 39I
 - 3.3 Chapter 30, Section 39J
 - 3.4 Chapter 30, Section 39K
 - 3.5 Chapter 30, Section 39L
 - 3.6 Chapter 30, Section 39M
 - 3.7 Chapter 30, Section 39N
 - 3.8 Chapter 30, Section 39O
 - 3.9 Chapter 30, Section 39P
 - 3.10 Chapter 30, Section 39R
 - 3.11 Chapter 44, Section 31C
 - 3.12 Chapter 82 Section 40
 - 3.13 Chapter 149, Section 34
 - 3.14 Chapter 149, Section 44F
 - 3.15 Chapter 149, Section 44H
 - 3.16 Chapter 149, Section 44J
 - 3.17 State Prevailing Wage Rates

END OF SECTION

SECTION 00810
NOTICE OF AWARD

Dated _____

Project: 25DPW14	Owner: Town of Ayer	Owner's Contract No.:
Contract: <u>West Main Street over Nonacoicus Brook Bridge Replacement</u>		Engineer's Project No.: 17-023.01

Bidder: _____

Bidder's Address: (send Certified Mail, Return Receipt Requested)

You are notified that your Bid dated _____ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for _____
(Indicate total Work, alternates or sections or Work awarded.)

The Contract Price of your Contract is _____ Dollars (\$ _____).
(Insert appropriate data if Unit Prices are used. Change language for Cost-Plus contracts.)

_____ copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award.

_____ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within [5] days of the date you receive this Notice of Award.

1. Deliver to the Owner _____ fully executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Bidders.
3. Other conditions precedent:

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Contract Documents.

Owner

By: _____
Authorized Signature

Title

SECTION 00811
NOTICE TO PROCEED

Dated _____

Project: 25DPW14	Owner: Town of Ayer	Owner's Contract No.:
Contract: <u>West Main Street over Nonacoicus Brook Bridge Replacement</u>		Engineer's Project No.: 17-023.01

Contractor:

Contractor's Address: [send Certified Mail, Return Receipt Requested]

You are notified that the Contract Times under the above contract will commence to run on _____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is _____, and the date of readiness for final payment is _____ [(or) the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you may start any Work at the Site, you must [add other requirements]:

Contractor
Received by: _____

Title

Date

Owner
Given by: _____
Authorized Signature

Title

Date

SECTION 00840
WORK CHANGE DIRECTIVE

No. _____

Date of Issuance: _____ Effective Date: _____

Project: 25DPW14	Owner: Town of Ayer	Owner's Contract No.:
Contract: West Main Street over Nonacoicus Brook Bridge Replacement		Date of Contract:
Contractor:		Engineer's Project No.: 17-023.01

You are directed to proceed promptly with the following change(s):

Description:

Purpose of Work Change Directive:

Attachments: (List documents supporting change):

If the Owner or Contractor believe that the above change has affected the Contract Price any Claim for a Change Order based thereon will involve one or more of the following methods as defined in the Contract Documents.

Method of Determining change in Contract Price:

- Unit Prices
- Lump Sum
- Cost of the Work

Estimated [Increase] [Decrease] in Contract Price:

\$ _____

Estimated [Increase] [Decrease] in Contract Times:

Substantial Completion: _____ Days

Final Completion: _____ Days

If the change involves an increase, the estimated amount is not to be exceeded without further authorization.

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____ Engineer (Authorized Signature)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Date: _____	Date: _____	Date: _____
Approved by Funding Agency (if applicable): _____		Date: _____

WORK CHANGE DIRECTIVE - INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed for use in situations involving changes in the Work which, if not processed expeditiously, might delay the Project. These changes are often initiated in the field and may affect the Contract Price or the Contract Times. This is not a Change Order, but only a directive to proceed with Work that may be included in a subsequent Change Order.

For supplemental instructions and minor changes not involving a change in the Contract Price or the Contract Times a Field Order should be used.

B. COMPLETING THE WORK CHANGE DIRECTIVE FORM

Engineer initiates the form, including a description of the items involved and attachments.

Based on conversations between Engineer and Contractor, Engineer completes the following:

METHOD OF DETERMINING CHANGE, IF ANY, IN CONTRACT PRICE: Mark the method to be used in determining the final cost of Work involved and the estimated net effect on the Contract Price. If the change involves an increase in the Contract Price and the estimated amount is approached before the additional or changed Work is completed, another Work Change Directive must be issued to change the estimated price or Contractor may stop the changed Work when the estimated time is reached. If the Work Change Directive is not likely to change the Contract Price, the space for estimated increase (decrease) should be marked "Not Applicable".

Once Engineer has completed and signed the form, all copies should be sent to Owner for authorization because Engineer alone does not have authority to authorize changes in Price or Times. Once authorized by Owner, a copy should be sent by Engineer to Contractor. Price and Times may only be changed by Change Order signed by Owner and Contractor with Engineer's recommendation.

The General Conditions included herein require that a Change Order be initiated and processed to cover any undisputed sum or amount of time for Work actually performed pursuant to this Work Change Directive.

Once the Work covered by this directive is completed or final cost and times are determined, Contractor should submit documentation for inclusion in a Change Order.

THIS IS A DIRECTIVE TO PROCEED WITH A CHANGE THAT MAY AFFECT THE CONTRACT PRICE OR CONTRACT TIMES. A CHANGE ORDER, IF ANY, SHOULD BE CONSIDERED PROMPTLY.

SECTION 00842
CHANGE ORDER

Date of Issuance: _____ Effective Date: _____ No. _____

Project: 25DPW14	Owner: Town of Ayer	Owner's Contract No.:
Contract: <u>West Main Street over Nonacoicus Brook Bridge Replacement</u>		Date of Contract:
Contractor:		Engineer's Project No.: 17-023.01

The Contract Documents are modified as follows upon execution of this Change Order:

Description:

Attachments: (List documents supporting change):

CHANGE IN CONTRACT PRICE:	CHANGE IN CONTRACT TIMES:
----------------------------------	----------------------------------

Original Contract Price: \$ _____	Original Contract Times: <input type="checkbox"/> Working days <input type="checkbox"/> Calendar days Substantial completion (days or date): _____ Ready for final payment (days or date): _____
--------------------------------------	--

[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____: Substantial completion (days): _____ Ready for final payment (days): _____
--	---

Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
--	---

[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
---	--

Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
---	--

RECOMMENDED: By: _____ Engineer (Authorized Signature)	ACCEPTED: By: _____ Owner (Authorized Signature)	ACCEPTED: By: _____ Contractor (Authorized Signature)
--	--	---

Date: _____ Date: _____ Date: _____

APPROVED: _____ Date: _____

Agency (Authorized Signature)

CHANGE ORDER – INSTRUCTIONS

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating Change Orders to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed in the Agreement, any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order should be used.

B. COMPLETING THE CHANGE ORDER FORM

Engineer normally initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Owner or Contractor for approval, depending on whether the Change Order is a true order to the Contractor or the formalization of a negotiated agreement for a previously performed change. After approval by one contracting party, all copies should be sent to the other party for approval. Engineer should make distribution of executed copies after approval by both parties.

If a change only applies to price or to times, cross out the part of the tabulation that does not apply.

SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. The work involves the staged replacement of the existing West Main Street bridge structure carrying traffic over the Nonacoicus Brook with a three-sided precast concrete rigid frame. The replacement bridge will have a clear span length of 28-feet. Subsequent to the replacement of the bridge structure, roadway infrastructure improvements extending approximately 200-feet along each West Main Street approach will include but not limited to full depth pavement reconstruction, cement concrete sidewalks and wheelchair ramps, driveway aprons, drainage system improvements, installation of guardrail, signing, pavement markings and related work as directed by the Ayer Department of Public Works.
2. The Contractor is responsible for all site restoration and pavement as specified.

B. Removals, Relocations and Rearrangements

1. Utility Coordination

There are utility installations in the area belonging to, but not limited to, the following:

National Grid - Electric Contact: Tzy Hsu Phone: (860) 259-7835 E-mail: tzy.hsu@nationalgrid.com	National Grid - Gas Contact: Tim Matook Phone: (781) 557-8358 E-mail: timothy.matook@nationalgrid.com
Pike Telecom & Renewables, LLC (Contractor for Verizon) Contact: Stacey Manseau Phone: (978) 339-5812 E-mail: smanseau@pike.com	American U-Tel (Contractor for Verizon) Contact: Andy Eld, P.E. Phone: (860) 334-2609 Email: andy@americanutel.com
Local Linx / Mass Broadband (Fiber Optic) Contact: Zachary Wengert Phone: (207) 944-8482 Email: zachary.wengert@locallinx.com	Verizon Contact: Paul Styspeck Phone: (413) 787-1845 Email: paul.m.styspeck@verizon.com
Town of Ayer DPW (Water / Sewer) Contact: Dan Van Schalkwyk, Director Phone: (978) 772-8240 E-mail: dVanSchalkwyk@ayer.ma.us	Comcast Contact: Julio Medina Phone: (603) 765-3221 E-mail: julio_medina@comcast.com
Town of Ayer DPW (Water / Sewer) Contact: Matt Hernon, Engineer Phone: (978) 772-8240 E-mail: mhernon@ayer.ma.us	Ayer Fire Department Contact: Chief Timothy Johnston Phone: (978) 772-8231 Email: tjohnston@ayer.ma.us

The Contractor is advised to use caution when working near aerial power distribution, transmission, and service wires, underground gas distribution and transmission mains. Contact the appropriate utility for the precautionary measures required the respective utility company.

Note: The Contractor shall be responsible for continuing to coordinate utility relocations upon issuance of the Notice to Proceed, as may be necessary. Arrangements and costs for the relocation of overhead and underground utilities shall be borne by the Contractor and the respective utility provider, as depicted in the Contract Drawings, as needed for construction phasing, staging, and the as-built condition, except for select gas main and data conduit accommodation efforts that are explicitly covered by contract pay items. The Contractor shall notify the utility companies a minimum of six (6) weeks prior to the start of work.

The Contractor shall coordinate with the Town of Ayer Public Works Department regarding the temporary and permanent relocation of the 10" diameter sewer main and 12" diameter water main. The Contractor shall install the utility supports, steel sleeves through the abutments, hangers, insulation, and sleeve caps for the permanent sewer main and water main locations, as shown on the Plans. The Contractor shall also install all sewer main and water main piping in the approach roadway as necessary to complete the permanent relocation work. All costs associated with the temporary relocation and permanent installation (including sleeves through the rigid frame legs, sleeve caps and utility supports) shall be included in Items 250.10 and 303.12.

The Contractor shall coordinate with National Grid (Gas) regarding the existing 8" diameter critical gas transmission main and the existing 4" diameter gas distribution main. Both the 8" gas transmission and 4" gas distribution mains will be relocated to the south fascia of the replacement bridge as part of this project. The Contractor's role and responsibilities related to the gas main work are paid for under Item 1000.2 Gas Main Accommodations; refer to the applicable Special Provisions for more detailed information.

The Contractor shall coordinate with Verizon regarding the 12-4" PVC telecom ducts within the structure. The telecom ducts will remain in service during construction and will be temporarily supported. The Contractor's role and responsibilities related to temporary and permanent work for Verizon's telecom ducts are paid for under Item 1000.1 Data Conduit Accommodations; refer to the applicable Special Provisions for more detailed information.

The Contractor shall coordinate with National Grid (Electric) regarding the relocation of utility poles and overhead wires associated with the removal of the existing structure / installation of precast elements / sheet piling. National Grid Electric shall be responsible for all costs related to utility pole / overhead wire relocations required as part of this project.

- C. Street and Roadway Paving
 - 1. The Contractor is responsible for installing temporary hot mix asphalt patches, where pavement is disturbed, to ensure safe passage of motor vehicles.
- D. Restoration of Disturbed Areas
 - 1. The Contractor is responsible for the restoration of all areas disturbed by the work to an equal or better condition than that encountered prior to construction; particularly in residential areas of the project.
- E. Construction Staging / Storage Area
 - 1. The property abutting the northeast corner of the existing structure is owned by the Town of Ayer and is available as a staging area. The Contractor shall note the parcel is adjacent to resource areas and will require coordination with the respective environmental agencies prior to using the land as a staging area. The parcel extends from West Main Street to the Town of Ayer Public Works Department Facility located on Brook Street. The access path leading from the project site to the backside of the DPW parcel requires the repair of a culvert crossing. The Contractor shall work with the Department of Public Works and the Ayer Conservation Commission regarding the suitability of the staging area prior to mobilizing to the project site.

Any and all staging areas shall be returned to the existing condition (or better, as agreed to by the Town of Ayer) following the completion of the contract (or sooner) at no extra cost to the Town. Erosion control required at these sites, beyond what is required for the construction of the proposed improvements, shall be considered incidental to the work.

1.2 COORDINATION WITH OTHERS

- A. Town of Ayer
 - 1. Contractor shall coordinate access, egress, detours and traffic control, if required, with the Ayer Police / Fire Departments. The Contractor shall notify Ayer Police and Fire Department and Ayer Shirley Regional School District at least 48 hours in advance of any street closings or detours.
 - 2. The Contractor shall be responsible for coordinating and maintaining public services to all public and private properties.
- B. Ayer DPW Water & Sewer Divisions
 - 1. All tie-ins and shutdowns of existing water mains and services shall be closely coordinated with the DPW.
 - 2. Final locations of services, hydrants, etc. will be decided by the DPW.
 - 3. All existing hydrants to be removed from the project site shall be stacked at the Water Division Grove Pond WTP at 99 Barnum Road.
- C. The Contractor shall provide the DPW with a construction schedule indicating the times to perform the water and sewer work required. The Contractor shall update the schedule when required and give the DPW one week's notice before the start of any work.

1.3 PERMITS

A. Contractor shall obtain a Road Opening Permit and Trench Permit. The Road Opening Permit and Trench permit fees for this project are waived by the Ayer DPW.

B. There are no other Town Permits required for this work. The Contractor shall arrange for, obtain, and pay for at his own expense all State and Federal permits required for the conduct of the Work.

C. Refer to conditions outlined in the Ayer Conservation Commission Order of Conditions, the Army Corp. of Engineers (ACOE) Permit, MassDEP – Minor Modification Approval, MA Division of Fisheries & Wildlife – Negative Determination, and the Environmental Notification Form – Certificate, included as appendices to this Document. The Contractor is required to meet all conditions and requirements of the respective permits. Refer to **Section 01110 Environmental Protection Provisions** related to the guidelines of the Invasive Plant Control Plan required as part of this Contract.

1.4 PROGRESS OF WORK

A. The Contractor shall promptly start construction work under this contract with the necessary crews and equipment to properly execute and complete this contract in the specified time. No cessation of Contractor's operations will be allowed without the approval of the Owner. The rate of progress shall be satisfactory to the Owner.

1.5 DETOURS AND ROAD ACCESSIBILITY

A. The Contractor shall contact the responsible heads of the Fire, Police, Post Office, School District and other appropriate governing bodies of the municipality in order to obtain necessary permits and determine the requirements of said departments with respect to traffic control, alternate vehicular access routes, etc. Wherever detours are permitted the size, construction and location of signs shall conform to local and state requirements and/or standards and the contract documents. Detour routes shall be adequately posted to assist the motorist to return to his route of travel. Where the roadway under construction is the only means of vehicular access to a particular area, the Contractor shall provide continual access to the area for residents and emergency vehicles.

B. The Contractor shall adhere to the Temporary Traffic Control Plans included as part of this Contract. If the Contractor requests a deviation from the traffic control plans included, a formal submission of revised plans shall be submitted to the Town of Ayer Public Works Department and the Engineer for review and approval. The review and approval of said plans shall not incur delay on the project schedule. Additional information regarding control of traffic is specified in **Section 01570 Traffic Regulation**.

1.6 CHANGES IN AMOUNT OF WORK

A. The Owner reserves the right to increase or decrease the amount of any item of the work listed as may be found desirable or necessary during the carrying out of this contract and the unit prices quoted in the Proposal shall apply without change to such variation in the quantity of each of the Items.

1.7 VISITS TO THE SITE

A. Before submitting a bid, the Contractor shall visit the project site, examine the conditions and thoroughly acquaint himself with the conditions for performing the work. He shall also study the drawings and compare the same with the information gathered during his examination of the sites, as no extra compensation will be authorized for extra work caused by his unfamiliarity with the sites and/or drawings or the conditions peculiar to this job.

1.8 DISPOSAL OF EXCESS MATERIAL

A. All excess soil and removed pavement shall be tested, transported and disposed of at approved locations in accordance with all applicable Laws and Regulations. Testing and disposal shall be considered incidental to Item 120.1 Unclassified Excavation as noted herein.

1.9 TECHNICAL SPECIFICATIONS

A. All technical specifications such as MassDOT, FHWA, MUTCD, ASTM, AWWA, AASHTO, etc., referred to in these specifications refer to the latest revision of such technical specifications.

1.10 SPECIAL CONDITIONS

A. The Contractor is advised that protection of the existing utilities in the vicinity of the project, and the assurance of uninterrupted service during the contract period is of the essence.

B. In the event that blasting, demolition, excavation, or other operations undertaken by the Contractor under this contract result in damages to, all necessary repairs shall be done by the Contractor. The Contractor shall provide, at no extra cost to the Owner, all necessary materials, equipment and labor necessary to satisfactorily excavate backfill, repair, etc., in conjunction with such repair work.

C. Prior to commencing excavation work, the Contractor shall notify Dig-Safe (1-800-344-7233) to have all existing public and private utility lines and underground structures marked out.

1.11 EXISTING UTILITIES AND STRUCTURES

A. The location and size of existing underground facilities such as sewers, drains, culverts, water mains, gas mains, cables, service pipes, etc., are shown on the plans, based on results of surveys and existing records, and are shown as approximate only. The plans do not show the exact location and depth of all utilities, nor do they show all utilities that may be encountered.

B. The Contractor shall assume existing underground utility connections to each and every building or structure, whether they appear on the drawings or not. The Contractor shall notify the proper utility companies and obtain and preserve the locations as marked for all existing gas, electric and other utilities that may be encountered, until such time as such markings are no longer required.

C. Test pits are to be made prior to commencing utility installations. The test pit locations shall be where requested by the Contractor and/or as directed by the Engineer and shall be paid for under the applicable bid item.

D. The Contractor shall dig by hand in advance of the trenching machinery to determine the exact location and depth of each utility to be encountered. Excavating machinery shall be stopped at least two feet away from each side of the utility to be crossed and the Contractor shall tunnel by hand under these utilities after he has ascertained their exact location and depth.

1.12 TWENTY-FOUR (24) HOUR EMERGENCY SERVICE

A. The Contractor shall maintain a 24-hour, 7-day a week telephone service and a local facility to handle emergency requirements such as settled trenches, clogged drains, rain damage, etc. The Contractor's emergency personnel shall be able to respond to emergency calls within thirty minutes. A list of the personnel and their telephone numbers shall be submitted to the Owner and Highway/Engineering Departments and to the local Police and Fire Departments. This requirement shall apply during the entire length of the project. This list shall be submitted on the Contractor's letterhead and shall state that should an emergency arise during the implementation of this project, these people are to be contacted. The Contractor shall submit this letter at the pre-construction conference.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.1 CONSTRUCTION SEQUENCE

- A. For the protection of life and property, all backfill operations shall follow closely behind excavation activity. The Contractor shall ensure that no excavation be left open, unguarded, or water filled during any period of time when work is not actually in progress. It is the purpose and intent that all excavations and backfill, including consolidation operations, the installation of service connections and temporary surfacing and pavements within an area be accomplished expeditiously before proceeding to other work areas. Construction scheduling and methods will be discussed at the pre-construction conference.
- B. The Owner reserves the right to schedule the Contractor to construct at any locations within the project area. At the same time the Owner may order the suspension of construction at any location.
- C. The Contractor shall submit to the Engineer for review and acceptance a complete schedule of his proposed sequence of construction operations prior to commencing any work. This schedule shall include the Contractor's plans for doing the work.
- D. The Contractor must submit to the Engineer a written request to deviate from the above sequence, provided he can demonstrate to the Engineer that the continuity will not be adversely affected.
- E. It shall be recognized that certain interruptions of, and disruptions to, the distribution system will be required to complete the work of this Contract. Scheduled interruptions shall be kept to a minimum frequency and duration. Such interruptions shall be coordinated by the Contractor and the Owner using the Contractor's proposed work schedule.
- F. The Contractor shall notify the Owner a minimum of seven (7) days in advance of any work which may affect or disrupt services. Once the interruption occurs the Contractor must maintain a workforce on-site to complete the work in the agreed upon time.
- G. The Contractor shall have all materials and equipment on-site, and shall receive the Owner's approval, prior to initiating work which requires any part of the existing distribution system to be off-line.
- H. Refer to construction phasing plans contained within the contract documents.

END OF SECTION

SECTION 01110
ENVIRONMENTAL PROTECTION PROVISIONS

PART 1- GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials and equipment and perform all work required for the prevention of environmental pollution in conformance with applicable laws and regulations, during and as the result of construction operations under this Contract. For the purpose of this Section, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires consideration of air, water and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Related Work:
 - 1. Item 697.1 Silt Sack
 - 2. Item 756. NPDES Stormwater Pollution Prevention Plan
 - 3. Item 767.121 Sediment Control Barrier
 - 4. Item 991.1 Control of Water – Structure No. A-19-014 (C1R)
- D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

1.2 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement. The Contractor's attention is specifically directed to the following requirements:
 - 1. The Contractor shall be responsible for securing NPDES Stormwater Permit for construction activities and maintaining compliance with all requirements on behalf of Owner in accordance with the permit.

1.3 NOTIFICATIONS

- A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any non-compliance with State or local requirements. After receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.4 IMPLEMENTATION

- A. Prior to commencement of the work, meet with the Engineer to develop mutual understandings relative to compliance with these provisions and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.
- C. Invasive Plant Control Plan
 - 1. Pre-Construction Phase - The project area will be assessed for presence of non-native invasive species prior to initiation of Project construction. Invasive plants such as European buckthorn and Asiatic bittersweet will be cut near ground level in the spring or early summer of 2025 to prevent plants from setting fruit and being spread during construction activities.
 - 2. Construction Phase - The Project specifications will require that material brought on-site by the contractor (e.g., erosion control materials, fill to be placed for construction access) be free of nonnative invasive plant propagules, and that the contractor's equipment to be used on-site be cleaned of material that may contain invasive plant propagules prior to mobilizing to the site.
 - 3. Post-Construction and Monitoring Phase - Potential establishment of non-native invasive plant species in restoration areas will be assessed by the Town at the end of the first full growing season following completion of construction. If nonnative invasive plant species exceed 5% cover, the DPW and/or its contractor may implement control measures (hand-pulling or localized herbicide application as appropriate) to reduce cover of nonnative invasive plant species below 5%.

The Massachusetts Invasive Plant Advisory Group (MIPAG) list of "Invasive" and "Likely Invasive" plants (available at: <http://www.massnrc.org/mipag/invasive.htm>) will be used as a reference for determining if a plant is invasive in the Commonwealth.
 - 4. The Invasive Species Control Plan as specified above shall be implemented by the Contractor throughout the duration of this Agreement and its costs are considered incidental to the project.

PART 2- PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EROSION CONTROL

- A. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are shown on the Drawings and specified herein. Provide any necessary supplemental erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams in accordance with conditions outlined in respective permit applications contained herein.

3.2 PROTECTION OF STREAMS AND SURFACE WATERS

- A. Take all precautions to prevent, or reduce to a minimum, any damage to any stream or surface water from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such streams.
 - 1. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Divert such waters through a settling basin or filter before being directed into streams or surface waters.
 - 2. Do not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved methods to reduce the amount of sediment contained in the water to allowable levels.
 - 3. Take all preventative measures to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Massachusetts Department of Environmental Protection. Submit two copies of approved contingency plans to the Engineer.
 - 4. Water being flushed from structures or pipelines after disinfection, with a Cl₂ residue of 0.15 mg/l or greater, shall be treated with a de-chlorination solution, in a method approved by the Engineer, prior to discharge.
- B. Refer to conditions outlined in the Ayer Conservation Commission Order of Conditions, the Army Corp. of Engineers (ACOE) Permit, MassDEP – Minor Modification Approval, MA Division of Fisheries & Wildlife – Negative Determination, and the Environmental Notification Form – Certificate, included as appendices to this Document. The Contractor is required to meet all the conditions and requirements of the respective permits. Refer to Section 01110 Environmental Protection Provisions related to the guidelines of the Invasive Plant Control Plan required as part of this Contract.

3.3 PROTECTION OF LAND RESOURCES

- A. Restore land resources within the project boundaries and outside the limits of permanent work to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas approved by the Owner.
- B. Outside of areas requiring earthwork for the construction of the new facilities, do not deface, injure, or destroy trees or shrubs, nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- C. Before beginning operations near them, protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping or other operations, by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.
- D. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original condition. The Engineer will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.
 1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1-in in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
 2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and are beyond saving in the opinion of the Engineer, shall be immediately removed and replaced.
- E. The locations of the Contractor's storage and other construction buildings, required temporarily in the performance of the work, shall be cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Engineer and shall not be within wetlands or floodplains. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the Engineer.
- F. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, he shall submit the following for approval at least ten days prior to scheduled start of such temporary work.
 1. A layout of all temporary roads, excavations, embankments and drainage to be constructed within the work area.
 2. Details of temporary road construction.
 3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
 4. A landscaping drawing showing the proposed restoration of the area. Indicate the proposed removal of any trees and shrubs outside the limits of existing clearing area. Indicate locations of guard posts or barriers required to control vehicular

traffic and protect trees and shrubs to be maintained undamaged. The Drawing shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation or embankment construction including disposal areas will be permitted.

- G. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of waste materials, or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling and plowing of roadways will be required to restore the area to near natural conditions which will permit the growth of vegetation thereon. The disturbed areas shall be prepared and seeded as approved by the Engineer.
- H. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.4 PROTECTION OF AIR QUALITY

- A. Burning - The use of burning at the project site for the disposal of refuse and debris will not be permitted.
- B. Dust Control - Maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas and all other work areas within or without the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.
- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products / chlorides is prohibited.
- D. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Engineer.
- E. Any sweeping operations must include a preliminary sprinkling step to dust.

3.5 NOISE CONTROL

- A. The construction shall not cause noise to increase at the property line, at the nearest residence, by more than 3 decibel above the ambient existing levels. The Contractor shall provide equipment to measure noise levels when requested by Engineer or Owner.
- B. Make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

3.6 MAINTENANCE OF POLLUTION CONTROL FACILITIES DURING CONSTRUCTION

- A. Maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

END OF SECTION

SECTION 01150
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. For lump sum items, payment shall be made to the Contractor in accordance with an accepted Progress Schedule and Schedule of Values on the basis of actual work completed.
- B. For unit-price items, payment shall be based on the actual amount of work accepted and for the actual amount of materials in place, as shown by the final measurements.
 - 1. All units of measurement shall be standard United States convention as applied to the specific items of work by tradition and as interpreted by the Engineer.
 - 2. At the end of each day's work, the Contractor's Superintendent or other authorized representative of the Contractor shall meet with the Construction Observer and determine the quantities of unit price work accomplished and/or completed during the work day.
 - 3. The Construction Observer will then prepare a "Daily Progress Report" which shall be signed by both the Construction Observer and Contractor's Representative.
 - 4. Once each month the Construction Observer will prepare a "Monthly Progress Summation" form from the month's accumulation of "Daily Progress Reports" which shall also be signed by both the Construction Observer and Contractor's Representative.
 - 5. These completed forms will provide the basis of the Engineer's monthly quantity estimate upon which payment will be made. Items not appearing on both the Daily Progress Reports and Monthly Progress Summation will not be included for payment. Items appearing on forms not properly signed by the Contractor will not be included for payment.
 - 6. After the work is completed and before final payment is made there for, the Engineer will make final measurements to determine the quantities of various items of work accepted as the basis for final settlement.

1.2 SCOPE OF PAYMENT

- A. Payments to the Contractor will be made for the actual quantities of the Contract items performed and accepted in accordance with the Contract Documents. Upon completion of the construction, if these actual quantities show either an increase or decrease from the quantities given in the Bid Form, the Contract unit prices will still prevail.
- B. The Contractor shall accept compensation, as herein provided, in full payment for furnishing all materials, labor, tools, equipment, and incidentals necessary to the completed work and for performing all work contemplated and embraced by the Contract; also for all loss or damage arising from the nature of the Work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the Work and until its final acceptance by the Engineer, and for all risks of every description connected with the prosecution of the work, except as provided herein, also for all expenses incurred in consequence of the suspension of the work as herein authorized.

- C. The payment of any partial estimate or of any retained percentage except by and under the approved final invoice, in no way shall affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for all damage due to such defects.

1.3 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

- A. When alterations in the quantities of work not requiring supplemental agreements, as hereinbefore provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract price for the actual quantities of work done. No allowance will be made for anticipated profits. Increased or decreased work involving supplemental agreements will be paid for as stipulated in such agreements.

1.4 OMITTED ITEMS

- A. Should any items contained in the bid form be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract, and such action shall in no way invalidate the Contract, and no allowance will be made for items so eliminated in making final payment to the Contractor.

1.5 PARTIAL PAYMENTS

- A. Partial payments shall be made monthly as the work progresses. Partial payment shall be made subject to the provisions of the Supplemental and General Conditions.
- B. A preliminary schedule of values for all Work which will include quantities and prices of items aggregating any Lump Sum Item Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

1.6 PAYMENT FOR MATERIAL DELIVERED

- A. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect Owner's interest therein, all of which will be satisfactory to Owner. The amount of retainage with respect to progress payments will be as stipulated in the agreement. Payments to the Contractor are governed by Massachusetts General Laws, Chapter 30, Section 39G, and are recited in Section 00780 of these specifications. Payments to subcontractors are governed by Massachusetts General Laws, Chapter 30, Section 39F.

1.7 FINAL PAYMENT

- A. The Engineer will make, as soon as practicable after the entire completion of the project, a final quantity invoice of the amount of the Work performed and the value of such Work. Owner shall make final payments of the sum found due less retainages subject to the provisions of the General and Supplementary Conditions.

1.8 INCIDENTAL WORK

A. Incidental work items for which separate payment is not made include (but are not limited to) the following items:

1. Coordination with the Owner, Regulatory Agencies, Utility Providers, and others, including related inspection cost, documentation required for final acceptance of applicable permits
2. Utility coordination, crossings, supports, monitoring, and relocations (temporary and permanent), unless payment is otherwise made herein
3. Project record documents and drawings
4. Materials and quality assurance testing required by the Contractor
5. Construction schedules, bonds, insurance, shop drawings, warranties, guarantees, certifications, and other submittals required by the Contract Documents
6. Repair and replacement of utilities damaged by construction activities and corresponding proper disposal of removed materials
7. Temporary utilities for construction and to maintain existing service during construction.
8. Temporary construction and other facilities not to be permanently incorporated into the Work necessary for construction sequencing and maintenance of operations
9. Weather protection
10. Permits not otherwise paid for or provided by the Owner
11. Visits to the Project site or elsewhere by personnel or agents of the Contractor, including manufacturer's representatives, as may be required
12. On-site and other facilities acceptable to Engineer for the storage of materials, supplies and equipment to be incorporated into the Work
13. Invasive Species Control Plan and Implementation
15. Preconstruction photos and videos
16. Construction administration and insurance
17. Testing, cleaning and disinfecting water mains including installation of blow-offs for air release, flushing, and air releases, and laboratory testing fees.
18. Connections to existing services and water mains
19. Storage of materials and equipment.
20. Testing of construction materials for adherence to MassDOT Specifications and the Special Provisions contained herein including but not limited to concrete, asphalt, and borrow materials
21. Testing and disposal of surplus borrow material as a result of construction.

1.9 DESCRIPTION OF PAY ITEMS

A. Refer to the Massachusetts Department of Transportation latest editions of the STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, the SUPPLEMENTAL SPECIFICATIONS, and the Special Provisions contained herein for descriptions related to Method of Measurement and Basis of Payment for the work to be done under the respective items listed in the Bid Form.

END OF SECTION

SECTION 01200
PROJECT SUBMITTALS, MEETINGS, AND QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Project Meetings: The Engineer will conduct project meetings throughout the construction period to enable orderly review during progress of the work, and to provide for systematic discussion of problems.
- B. Submittals: Submit to the Engineer, Shop Drawings, Operation and Maintenance Manuals, Manufacturers' Certificates, Project Data, and Samples required by the Specification Sections
- C. Quality Control: Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.2 QUALITY ASSURANCE

- A. Persons designated by the Contractor to attend and participate in the project meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meetings.
- B. Testing of construction materials for adherence to MassDOT Specifications and the Special Provisions contained herein including but not limited to concrete compressive strength, asphalt density, borrow materials (grain size, compaction)

1.3 PROJECT MEETINGS

- A. Agenda items: To the maximum extent practicable, advise the Engineer at least 24 hours in advance of project meetings regarding all items to be added to the agenda.
- B. Minutes: The Engineer will compile minutes of each project meeting and will furnish a copy to the Contractor. The Contractor may make and distribute such other copies as he wishes.

1.4 SHOP DRAWINGS

- A. Shop Drawings are required for each and every element of the work. Each shop drawing shall be assigned a sequential number for purposes of easy identification, and shall retain its assigned number, with appropriate subscript, on required resubmissions. A preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal shall be submitted at the Pre-construction Conference.
- B. Shop Drawings are generally defined as all fabrication and erection drawings, diagrams, brochures, schedules, bills of material, manufacturers data, spare parts lists, and other data prepared by the Contractor, his subcontractors, suppliers, or manufacturers which illustrate the manufacturer, fabrication, construction, and installation of the work, or a portion thereof.
- C. The Contractor shall submit to the Engineer electronic versions of Shop Drawings and approved data. The Engineer will retain an electronic copy (for Owner's, Engineer's and Field Representative's files) and return an electronic markup to the Contractor for distribution to subcontractors, suppliers and manufacturers.
- D. The Contractor shall provide a copy of the completed Submittal Certification Form (copy provided for Contractor's use at the end of this Specification Section) which shall be attached to every copy of each shop drawing. Shop Drawings shall show

the principal dimensions, weight, structural and operating features, space required, clearances, type and/or brand of finish or shop coat, grease fittings, etc., depending on the subject of the drawing. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct for the work.

- E. Shop Drawings shall be submitted as a complete package by specification section, unless otherwise reviewed and approved by the Engineer. It is the intent that all information, materials and samples associated with each specification section be included as a single submittal for the Engineer's review. Any deviation from this requirement, such as submitting miscellaneous metals grouped by structure, shall be requested in writing prior to any associated submittal.
- F. The Contractor shall be responsible for the prompt and timely submittal of all shop and working drawings so that there shall be no delay to the work due to the absence of such drawings.
- G. No material or equipment shall be purchased or fabricated especially for the Contract until the required shop and working drawings have been submitted as hereinabove provided and reviewed for conformance to the Contract requirements. All such materials and equipment and the work involved in their installation or incorporation into the Work shall then be as shown in and represented by said drawings.
- H. Until the necessary review has been made, the Contractor shall not proceed with any portion of the work (such as the construction of foundations), the design or details of which are dependent upon the design or details of work, materials, equipment or other features for which review is required.
- I. All shop and working drawings shall be submitted to the Engineer by and/or through the Contractor, who shall be responsible for obtaining shop and working drawings from his subcontractors and returning reviewed drawings to them. Shop drawings shall be of standardized sizes to enable the Owner to maintain a permanent record of the submissions.
- J. Only drawings which have been checked and corrected by the fabricator should be submitted to the Contractor by his subcontractors and vendors. Prior to submitting drawings to the Engineer, the Contractor shall check thoroughly all such drawings to satisfy himself that the subject matter thereof conforms to the Drawings and Specifications in all respects. All drawings which are correct shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer.
- K. If a shop drawing shows any deviation from the Contract requirements, the Contractor shall make specific mention of the deviations in his letter of transmittal.
- L. Should the Contractor submit equipment that requires modifications to the structures, piping, electrical conduit, wires and appurtenances, layout, etc., detailed on the Drawings, he shall also submit details of the proposed modifications. If such equipment and modifications are accepted, the Contractor, at no additional cost to the Owner, shall do all work necessary to make such modifications.

- M. A maximum of two submissions of each Shop Drawing will be reviewed, checked, and commented upon without charge to the Contractor. Any additional submissions which are ordered by the Engineer to fulfill the stipulations of the Drawings and Specifications, and which are required by virtue of the Contractor's neglect or failure to comply with the requirements of the Drawings and Specifications, or to make those modifications and/or corrections ordered by the Engineer in the review of the first two submissions of each Shop Drawing, will be reviewed and checked as deemed necessary by the Engineer, and the cost of such review and checking, as determined by the Owner, and based upon Engineer's documentation of time and rates established for additional services in the Owner-Engineer Agreement for this Project, may be deducted from the Contractor to make all modifications and/or corrections as may be required by the Engineer in an accurate, complete, and timely fashion.
- N. SAMPLES - The Contractor shall submit samples when requested by the Engineer to establish conformance with the specifications, and as necessary to define color selections available.

1.5 SUBMISSION REQUIREMENTS

- A. Accompany submittals with transmittal letter, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. The number of each Shop Drawing, Project Data and Sample submitted
 - 5. Notification of deviations from Contract Documents
 - 6. Other pertinent data
- B. A completed Submittal Certification Form shall be attached to each copy of each shop drawing and must include:
 - 1. Identification of deviations from Contract Documents
 - 2. Contractor's stamp, initialed or signed, certifying review of the submittal, verification of field measurements and compliance with Contract Documents.
 - 3. Where specified or when requested by the Engineer, manufacturer's certification that equipment, accessories and shop painting meet or exceed the Specification requirements.
 - 4. Where specified, manufacturer's guarantee.

1.6 RESUBMISSION REQUIREMENTS

- A. Revise initial drawings as required and resubmit as specified for initial submittal.
- B. Indicate on drawings any changes which have been made other than those required by Engineer.

1.7 ENGINEER'S REVIEW

- A. The review of shop and working drawings hereunder will be general only, and nothing contained in this specification shall relieve, diminish or alter in any respect the responsibilities of the Contractor under the Contract Documents and in particular, the specific responsibility of the Contractor for details of design and dimensions necessary for proper fitting and construction of the work as required by the Contract and for achieving the result and performance specified thereunder.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PROJECT MEETINGS

- A. Except as noted below for pre-construction conference, project meetings will be held on a bi-weekly basis, unless otherwise directed by the Ayer DPW. Coordinate as necessary to establish mutually acceptable schedule for meetings.
- B. Meetings will be held at the Ayer DPW office.
- C. **Pre-construction conference** will be scheduled within twenty days after the Effective Date of the Agreement, but before the Contractor starts any work at the site. Provide attendance by authorized representatives of the Contractor and all major subcontractors. The Engineer will advise other interested parties and request their attendance. Minimum agenda:
 - 1. Identification of key project personnel for Owner, Engineer, Contractor, funding/regulatory Agencies.
 - 2. Responsibilities of Owner, Engineer, Resident Project Representative, Contractor.
 - 3. Channels and procedures for communications.
 - 4. Construction schedule, including sequence of critical work including staged construction, and schedule of values for lump sum pay items.
 - 5. Easements, permits.
 - 6. Contract Documents, including distribution of required copies of original documents and revisions.
 - 7. Processing of Shop Drawings and other data submitted to the Engineer for review.
 - 8. Processing of field decisions and Change Orders.
 - 9. Rules and regulations governing performance of the Work, including funding/regulatory Agency requirements.
 - 10. Procedures for safety and first aid, security, quality control, housekeeping, and other related matters.

D. PROGRESS MEETINGS

- 1. Review, revise as necessary, and approved minutes of previous meeting.
- 2. Review progress of the Work since last meeting, including status of submittals for approval.
- 3. Review schedule of work to be accomplished prior to next meeting.
- 4. Discuss monthly partial payment request.
- 5. Review status of change order requests and Work Directive Changes.
- 6. Identify problems which impede planned progress.
- 7. Develop corrective measures and procedures to regain planned schedule.
- 8. Complete other current business.

3.2 QUALITY CONTROL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- C. Perform work by persons qualified to produce workmanship of specified quality.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.
- D. Comply with manufacturer's instructions in full detail, including each step-in sequence. Should instructions conflict with Contract Documents, request clarification from Engineer before proceeding. When required by individual Specifications Section, submit manufacturer's certificate that products meet or exceed specified requirements.
- E. When specified in respective Specification Sections, require supplier and/or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to make appropriate recommendations.
- F. Representative shall submit written report to Engineer listing observations and recommendations.

3.3 TESTING LABORATORY SERVICES

- A. Contractor will employ and pay for services of an Independent Testing Laboratory to perform inspections, tests, and other services wherever an Independent Testing Laboratory is required by individual specification sections listed in paragraph 1.2 above, or the specific sections, unless otherwise indicated.
- B. Services will be performed in accordance with requirements of governing authorities and with specified standards.
- C. Reports will present observations and test results and indicate compliance or non-compliance with specified standards and with Contract Documents. Independent Testing Laboratory will submit one copy of each report directly to each of the following: Owner, Engineer, Resident Project Representative, and Contractor. Reports will be mailed within 5 days of obtaining test results. If test results indicate deficiencies, Independent Testing Laboratory shall telephone or FAX results to Engineer and Contractor within 24 hours.
- D. Contractor shall cooperate with Independent Testing Laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.
- E. Contractor shall coordinate all testing work and shall notify Engineer and Independent Testing Laboratory at least 24 hours prior to performing work requiring testing services. If scheduled tests or sampling cannot be performed because the work is not ready as scheduled, testing costs associated with the delay will be determined by Engineer and invoiced to Contractor. If unpaid after 60 days, the invoice amount will be deducted from the Contract Price. If adequate notice is not provided, Contractor shall suspend work on that portion of the Project until testing can be performed. Such suspension will not be grounds for a claim against the Owner for delay, nor will it be an acceptable basis for an extension of time.

- F. Payment for Independent Testing Laboratory services shall be as follows:
1. General: Where testing is required by the Town or the Engineer, payment will be made as stated below unless other requirements are given in Specification Sections. Testing which is the responsibility of the Contractor will be considered an incidental item unless otherwise indicated in **Section 01150, Measurement and Payment**.
 2. Initial Testing: Contractor will pay for initial tests.
 3. Retesting: Costs of retesting due to non-compliance will be paid by Contractor.
 4. Contractor's Convenience Testing: Inspections and tests performed for Contractor's convenience will be paid for by Contractor.

END OF SECTION

SECTION 01570
TRAFFIC REGULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Work Included:
 - 1. Provide all materials and perform all work necessary to completely regulate traffic in the area of Work based on the TCP's shown within the plans.
 - 2. Perform all work in such a manner as to provide safe passage at all times for the public and with a minimum of obstruction to traffic.
 - 3. Do not close roads or streets to passage of the public without the permission of the proper authorities.
- B. The Ayer Police Department and/or the DPW will determine if safe passage is being maintained and shall have the authority to require the Contractor to take any additional steps necessary to maintain safe passage.
- C. Contractor may restrict traffic on West Main Street during working hours, as approved by the Ayer Police Department in association with the phased construction. The Contractor is responsible for providing proper detour / alternate route signage and police details as required by the Town. The Contractor shall maintain one-way traffic, with the assistance of the temporary signal and signage, at all times with limited exceptions including but not limited to relocating equipment, material deliveries / removal, and reconfiguration of work zone(s).
- D. Detour / Alternative Routes as shown within the contract documents. The Town will assist with public notification to local residents.
- E. Access to local residents and public safety vehicles must be maintained at all times.

1.2 TRAFFIC CONTROL PLAN

- A. The Contractor shall submit, at or before the Preconstruction Meeting, a Traffic Control Plan (TCP) based on the traffic management plans included as part of this contract, that provides the following information, as applicable to this project:
 - a. The name, telephone number, and other contact numbers (cell phone) of the Contractor's employee (the "Responsible Person") with overall responsibility for following the TCP, and who is empowered to immediately resolve any traffic control deficiencies or issues.
 - b. Proposed construction phasing or sequencing that reasonably minimizes traffic impacts.
 - c. A written narrative and/or plan explaining how traffic and pedestrians will be moved through the Project Limits, including transitions during the change from one phase of construction to the next, as applicable.
 - d. Temporary traffic control treatments at all intersections with roads, rail crossings, businesses, parking lots, pedestrian ways, bike paths, trails, residences, garages, farms, and other access points, as applicable.
 - d. A procedure for notifying the DPW, local emergency officials, and local residents whenever significant traffic impacts are anticipated or occur
 - g. A description of any detours including provisions for constructing, maintaining, signing, and removing the detour or detours, including all temporary bridges and accessory features and complete restoration of the impacted land.

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND BARRICADES

- A. Provide adequate warning signs, barricades, signal lights, watchmen and take other necessary precautions for the safety of the public.
- B. Provide and illuminate suitable warning signs to show where construction, barricades or detours exist.
- C. Provide barricades of substantial construction and painted with a finish that increases visibility at night.
- D. Keep signal lights illuminated at all barricades and obstructions from sunset to sunrise.
- E. Maintain all necessary signs, barricades, lights, watchmen and other safety precautions during authorized suspension of the Work, weekends, holidays or other times when the Work is not in progress.
- F. Traffic control signs, devices, etc., for construction work shall be located and of the size and type as outlined in Manual on Uniform Traffic Control Devices for Streets and Highways as published by U. S. Department of Transportation.

2.2 UNIFORMED POLICE OFFICER

- A. Arrange and schedule for the police details with the Ayer Police Department. The Contractor is responsible for proper scheduling and cancelling details. The Ayer DPW will pay for all scheduled details. If a detail is not cancelled and a cost is incurred, the Contractor will be responsible for paying for the detail.

PART 3 - EXECUTION

3.1 DETOURS

- A. Provide, identify and maintain suitable detours during the phased construction as outlined in the project plans.
- B. When the phased construction portion of the project is reopened, restore the detour area and any other disturbed areas to the original condition.

3.2 INCONVENIENCE TO RESIDENTS OF VICINITY

- A. Whenever a traveled way is closed or under temporary traffic control, perform the Work in such a manner that local travel and residents in the vicinity of the Work will be inconvenienced as little as possible.
- B. Allow access to residents and abutting landowners along the project to driveways and other normal outlets from their property.

END OF SECTION

SECTION 01575
HANDLING EXISTING FLOWS

PART 1 -GENERAL

1.01 WORK INCLUDED:

This Section covers all materials, equipment, and labor required to handle existing sanitary and combined sewage flows and installation and maintenance of all temporary connections, plugs, and bypass pumping. Upon completion of the rehabilitation or reconstruction, all temporary plugs and connections shall be removed, and flows returned to the system.

1.02 RELATED WORK:

Section 01330, SUBMITTALS

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS:

Submit the following: Electronic copies of complete checked shop drawings, showing equipment, method of bypassing, and the method of transferring flows from the existing system to a temporary system during construction and back to the existing system once construction is complete.

PART 2 -PRODUCTS

NOT USED

PART 3 -EXECUTION

3.01 MAINTAINING EXISTING FLOWS:

- A. The Contractor shall maintain all flows in the existing system until reconstruction or rehabilitation of the utility is complete and ready for safe operation.
- B. The Contractor shall protect against surcharging of the existing system upstream of the work area by installing adequate temporary by-pass pumping to handle dry weather and wet weather flows.
- C. The Contractor shall repair any damage that occurs to existing pipes and structures to the satisfaction of the Engineer. Work performed under this section shall be considered incidental and shall not be measured separately for payment.
- D. The Contractor shall not allow sanitary flow to discharge to any salt or fresh waterbody by means of overflow, by-pass pumping, or any other method that may contaminate these water areas.

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Keep accurate record documents for all additions, substitutions of material, variations in work, and any other additions or revisions to the Contract.

1.2 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Field Test Reports

B. Maintain documents in clean, dry, legible condition.

C. Make documents available at all times for inspection by the Engineer and Owner, and by the end of the project, transmit these documents to the Engineer.

1.3 RECORDING

A. Label each document "PROJECT RECORD" in large high printed letters.

B. Keep record documents current and do not permanently conceal any work until required information has been recorded.

C. General Field Recording Issues:

1. All ties should be taken from existing, permanent features such as utility poles, corners of houses and hydrants. Porches, sheds or other house additions should be avoided for they could be torn down. A minimum of two ties should be taken.
2. Stations should be recorded to the nearest foot.
3. Inverts should be recorded to the nearest hundredth of a foot.
4. Elevations should be recorded to the nearest hundredth of a foot.

D. Project Record Drawings - Legibly mark Contract Drawings to record existing utilities and actual construction of all work, including but not limited to the following (where applicable):

1. Existing Utilities

Water mains and services, water main gate valves, sewer mains and services, storm drains, culverts, steam lines, gas lines, tanks and other existing utilities encountered during construction must be accurately located and shown on the Drawings. In congested areas supplemental drawings or enlargements may be required.

a. Show any existing utilities encountered in plan and profile and properly labeled showing size, material and type of utility. Ties should be shown on plan. Utility should be drawn to scale in section (horizontally and vertically) and an elevation should be called out to the nearest hundredth of a foot.

b. When existing utility lines are broken and repaired, ties should be taken to these locations.

c. If existing water lines are replaced or relocated, document the area involved and pipe materials, size, etc. in a note, and with ties.

2. Manholes, Catch Basins and other structures.

- a. Renumber structure stationing to reflect changes.
 - b. Show ties to center of structure covers or hatches.
 - c. In general, show inverts at center of structures. However, for manholes with drop structures, or steep channels (greater than 0.2' change on slope), show inverts at face of manhole.
 - d. Show inverts for other structures at the face of the structure.
 - e. Draw any new structures that are added on plan and profile.
 - f. Show any field or office redesigns.
 - g. Redraw plan if the structure's location is moved more than 5 feet in any direction.
3. Water Mains
 - a. Show ties to the location of all valves, bends (horizontal and vertical), tees and other fittings. The use of thrust blocks should be recorded.
 - b. Revise elevations indicated on the Drawings to reflect actual construction.
 4. House Services
 - a. Draw all house services (even to empty lots) on plan, and show ties.
 - b. Show ties or distances to wyes from manhole.
 - c. Show chimneys heights in the profile.
 5. Ledge
 - a. Ledge profiles should be shown. Note whether the plotted ledge profile reflects undisturbed or expanded conditions.
 6. Yard Piping
 - a. Site piping should be drawn to reflect the installed locations, with ties and elevation of all bends (horizontal and vertical).

1.4 SUBMITTALS

- A. At the completion of the project, deliver record documents to the Engineer.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
 1. Date, project title and number.
 2. Contractor's name and address.
 3. Title and number of each record document with certification that each document is completed and accurate.
 4. Signature of Contractor, or his authorized representative.
- C. Failure to supply all information on the Project Record Drawings may result in additional retainage from monthly partial payment requests, and in non-approval of final payments of the Contract and/or if contract time has elapsed, this shall be grounds for the enactment of the liquidated damages as specified.

END OF SECTION

SPECIAL PROVISIONS

AYER

Project Number 25DPW14

West Main Street over Nonacoicus Brook Bridge Replacement

SCOPE OF WORK

All work under this contract shall be done in conformance with the *2024 Standard Specifications for Highways and Bridges*, the *Supplemental Specifications* contained in this book, the *2017 Construction Standard Details*, the *Traffic Management Plans and Detail Drawings*, *MassDOT Work Zone Safety Temporary Traffic Control*, the *1990 Standard Drawings for Signs and Supports*; the *2015 Overhead Signal Structure and Foundation Standard Drawings*, the *2009 Manual on Uniform Traffic Control Devices (MUTCD)* with Massachusetts Amendments; the *1968 Standard Drawings for Traffic Signals and Highway Lighting*; *The American Standard for Nursery Stock*; the Plans and these Special Provisions.

The work involves the staged replacement of the existing West Main Street bridge structure carrying traffic over the Nonacoicus Brook with a three-sided precast concrete rigid frame. The replacement bridge will have a clear span length of 28 feet. Subsequent to the replacement of the bridge structure, roadway infrastructure improvements extending approximately 250-feet along each West Main Street approach will include but not limited to full depth pavement reconstruction, cement concrete sidewalks and wheelchair ramps, driveway aprons, drainage system improvements, utility relocations, installation of guardrail, signing, pavement markings and related work as directed by the Ayer Department of Public Works. The Contractor shall be responsible for coordination with impacted utility companies for temporary and/or permanent relocations required as part of this project.

The work under this contract consists of furnishing all necessary labor, materials, equipment, as well as all other related work incidental to a project of this nature.

ENVIRONMENTAL PERMITTING

Refer to conditions outlined in the Ayer Conservation Commission Order of Conditions, the Army Corp. of Engineers (ACOE) Permit, MassDEP – Minor Modification Approval, MA Division of Fisheries & Wildlife – Negative Determination, and the Environmental Notification Form – Certificate, included as appendices to this Document. The Contractor is required to meet all the conditions and requirements of the respective permits. Refer to **Section 01110 Environmental Protection Provisions** related to the guidelines of the Invasive Plant Control Plan required as part of this Contract.

Topsoil from wetland fill area shall be stripped, stockpiled, and then used in the mitigation area as defined within Wetland Replication Plan. Regarding construction sequencing, the cut for the proposed mitigation area shall take place immediately following the fill of the wetlands as highlighted within the Wetland Replication Plan.

SAWCUTTING

The Contractor shall note well that sawcutting will be required for pipe trenches, curbing and at numerous other locations as shown on the Plans. The Contractor shall be aware that based on these Special Provisions and the MassDOT Standard Specifications, only specific locations will be measured for payment.

PROPERTY MARKERS

The Contractor shall attempt to maintain existing property markers within the limits of the project. If the property markers are disturbed during construction activities, the Contractor shall have a Massachusetts Registered Land Surveyor re-establish the property markers. This work shall be considered incidental to other contract items, and no specific compensation will be made.

DRAINAGE AND UTILITIES

All castings in milled areas shall be set to finished grade, as directed by the Engineer. Existing / proposed structures in full depth areas shall be adjusted to finish surface grade, as needed, prior to the placement of the pavement surface course.

The opening in existing structures to accommodate a new pipe, or larger pipe if applicable, shall be incidental to the cost of the pipe.

The relocation of existing utilities for the convenience of the Contractor to assist in completing project scope will be incidental to the scope being completed and no additional compensation will be due the Contractor.

RECORD OF EXISTING CONDITIONS

The contractor shall prepare a digital record of the existing conditions of from the curblines to ten feet outside the roadway layout to help in settling disputes with the abutters, the Town, and the utility companies. The record can be by digital photograph or video camera but needs to be thorough enough to record the existing conditions in detail from all angles as viewed from the sidewalk. At least four copies will be prepared with one copy retained by the contractor, two given to the Engineer, and one given to the Town.

ITEM 102.511 **TREE PROTECTION – ARMORING & PRUNING** **EACH**

GENERAL

The work under this item shall conform to the relevant provisions of Sections 771 and shall be for furnishing and installing temporary tree trunk protection and for limb pruning to prevent injury to the tree from construction equipment and activities.

Trunk armoring is for instances where construction activity (the use of heavy equipment) comes close enough to potentially damage the tree trunk or limbs. It is to be used where shown on the plans and as directed by the Engineer.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the latest edition of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance: Part 1-Pruning and Part 5-Construction Management Standard. Provision of reference shall be incidental to this item.

MATERIALS

Trunk armoring shall be such that it prevents damage to the trunk from construction equipment. Selected material shall be such that installation and removal will not damage the trunk.

Acceptable materials include 2x4 wood cladding with wire or metal strapping, or, for instances when duration of construction activities is less than three months, corrugated plastic pipe mounted with duct tape. Height of cladding shall be from base of tree (including root flare) to the bottom of the first branch or as recommended by the Arborist. Material and methods shall be approved by the Engineer.

Other materials or methods may be acceptable if approved by the Engineer, Tree Warden, Public Works Director, or an Arborist.

METHODS OF WORK

Prior to construction activities, the Engineer, the Contractor, Public Works Director, the Town Tree Warden, and the Arborist, if specified, shall review trees noted on the plans to be protected. Final decision as to trees armored and/or pruned shall be per the Engineer.

Care shall be taken to avoid damage to the bark during installation and removal of armoring. Trunk armoring shall be replaced and maintained such that it is effective for as long as required and shall be removed immediately upon completion of work activities adjacent to trees.

Pruning of limbs shall conform to the techniques and standards of the most recent ANSI A300 standards.

ITEM 102.511 (Continued)

DAMAGES & PENALTIES

In the event that trees designated for protection under this item are damaged, including root damage from unapproved trespassing onto the root zone, the Contractor shall, at his own expense obtain an Arborist. The Arborist shall be approved by the Town.

If, based on the recommendations of the Arborist, the Engineer determines that damages can be remedied by corrective measures, such as repairing trunk or limb injury, soil compaction remediation, pruning, and/or watering, the damage will be repaired as soon as possible within the appropriate season for such work and according to industry standards.

If the Engineer determines that damages are irreparable, the Contractor shall pay for the damages in the amount of \$500.00 per diameter inch at breast height (DBH) per tree.

Additionally, if the Engineer determines that the damages are such that the tree is sufficiently compromised as to pose a future safety hazard, the tree shall be removed. Tree removal will include clean up of all wood parts, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.511 will be measured and paid at the contract unit price per Each. This will include full compensation for all labor, equipment, materials, and incidentals for the satisfactory completion of the work and the subsequent removal and satisfactory disposal of the protective materials upon completion of the contract.

In the event of tree damage, the cost of Arborist services, of remediation measures, and/or tree removal will be borne by the Contractor.

Payment under this item will be scheduled throughout the length of contract:

- 40% of value shall be paid upon installation of trunk armoring and completion of pruning work, if required.
- 60% shall be paid at the end of construction operations that would damage the tree and after protection materials have been removed and properly disposed of by the Contractor. In the event of repairable damages, payment shall be made after the completion of remediation measures.

In the event of irreparable damage due to lack of proper protective measures being take there will be no compensation in addition to the \$500.00 per diameter inch penalty.

ITEM 102.521

TREE AND PLANT PROTECTION FENCE

FOOT

The work under this Item shall conform to the relevant provisions of Sections 644 and 771 of the Standard Specifications and the following:

GENERAL

Work under this item consists of furnishing, installing, removing and resetting, maintaining fence in a vertical and effective position at all times, and final removal of temporary fence.

The purpose of the fence is to prevent damage to tree roots, tree trunks, soil, and all other vegetation within a delineated Tree and Plant Protection Zone (TPPZ) as shown on the plans, as directed by the Engineer, and as described herein.

Protection shall be for the duration of the construction activities unless otherwise directed.

MATERIALS

Temporary Fence shall be such that it provides a minimum 48-inch tall barrier that remains vertical and effective (not sagging) for the duration of period required. Fence shall be plastic orange safety fence (recommended where high visibility is necessary), wooden snow fencing, or other approved material.

Per the Engineer, additional posts, deeper post depths, and/or additional attachments will be used if the fabric or fence sags, leans or otherwise shows signs of failing to create a sufficient barrier to access.

REFERENCES

If requested, the Contractor shall provide to the Engineer one copy of the American National Standards Institute (ANSI) A300 Standard Practices for Tree, Shrub, and Other Woody Plant Maintenance Part 1, Pruning and Part 5, Construction Management Standard. Provision of reference shall be incidental to this item.

ESTABLISHMENT OF TPPZ

Fencing shall be used for construction areas, staging areas, and stockpile areas as shown on the plans and as directed by the Engineer to establish the Tree and Plant Protection Zone (TPPZ).

Fence shall be located as close to the work zone limit and as far from the trunk as possible to maximize the area to be protected. Fence shall run parallel and adjacent to construction activity to create a barrier between the work zone and the root zone or designated limit of plants and soils to be protected. When construction activities surround (or have the potential to surround) trees or plants to be protected, a circular enclosure shall be used. In these instances, the TPPZ limit shall be the Drip Line of each tree or as close as possible to the Drip Line, as shown on the plans and details. The Drip Line is defined as the limit of tree canopy.

ITEM 102.521 (Continued)

The Contractor shall not engage in any construction activity within the TPPZ without the approval of the Engineer, including: operating, moving or storing equipment; storing supplies or materials; locating temporary facilities including trailers or portable toilets; and shall not permit employees to traverse the area to access adjacent areas of the project or use the area for lunch or any other work breaks.

METHOD OF WORK

Fence shall be installed prior to any construction work or staging activities and shall be installed and maintained in a vertical and effective position at all times.

Fence shall be repositioned where and as necessary for optimum effectiveness. Repositioning shall be incidental to this item. Fence shall not be moved without prior approval by the Engineer.

The TPPZ shall be protected at all times from compaction of the soil; damage of any kind to trunks, bark, branches, leaves, and roots of all plants; and contamination of the soil with construction materials, debris, silt, fuels, oils, and any chemicals substance. In the event of spills, compaction or damage, the Contractor shall take corrective action immediately using methods approved by the Engineer in coordination with an Arborist.

After construction activities are completed, or when directed by the Engineer, fence, stakes, and other materials shall be removed and disposed off-site by the Contractor.

REQUIRED WORK WITHIN THE TPPZ

In the event that grading, trenching, utility work, or storage is unavoidable within the TPPZ, the Engineer shall be notified. Measures may be required for tree protection and preservations, including the use of six-inch depth of wood chips or approved matting for root protection, pruning of branches, and/or trunk protection. These protection measures will be paid under applicable items.

Landscaping work specified within the TPPZ shall be accomplished by hand tools. Where hand work is not feasible, with permission of the Engineer, work shall be conducted with the smallest mechanized equipment necessary.

TREE AND PLANT DAMAGES OR LOSS

If the TPPZ is intruded upon, at the discretion of the Engineer, the Contractor will be required to provide a more durable barrier (e.g., Jersey Barriers) to secure the area. Cost of furnishing and installing additional or more durable barrier shall be borne by the Contractor.

If the Contractor intrudes into a TPPZ without approval, soil will be considered compacted and tree root damage will be assumed. Action will be taken as specified below.

ITEM 102.521 (Continued)

In the event that trees designated for protection under this item are damaged, including root damage from unapproved trespassing onto the root zone, the Contractor shall, at his own expense obtain an Arborist. The Arborist shall be approved by the Engineer and the Town of Ayer.

If, based on the recommendations of the Arborist, the Engineer determines that damages can be remedied by corrective measures, such as repairing trunk or limb injury, soil compaction remediation, pruning, and/or watering, the damage will be repaired as soon as possible within the appropriate season for such work and according to industry standards.

If the Engineer determines that damages are irreparable, the Contractor shall pay for the damages in the amount of \$500.00 per diameter inch at breast height (DBH) per tree.

Additionally, if the Engineer determines that the damages are such that the tree is sufficiently compromised as to pose a future safety hazard, the tree shall be removed. Tree removal will include clean up of all wood parts, grinding of the stump to a depth sufficient to plant a replacement tree or plant, removal of all chips from the stump site, and filling the resulting hole with topsoil.

Shrubs will be replaced with a plant of similar species and equal size or the largest size plants reasonably available. The Engineer will approve the size and quality of the replacement plant. Replacement will include a minimum of one year of watering and care.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 102.521 will be measured and paid for payment by the Foot of Tree and Plant Protection Fence, complete in place. This includes all labor, materials, equipment, maintenance, final removal and disposal of the protective materials, damages repair, and all incidental cost required to complete the work.

Payment of 40 percent of value will be made upon installation of Fence. The remaining 60 percent will be made when protection materials have been removed and disposed off-site.

No separate payment will be made for costs of remedial actions including, removing and resetting, adjusting, addition of more durable barriers, or arborist services, but all costs in connection therewith shall be included in the Contract unit price bid.

In the event of irreparable damage due to lack of proper protective measures being taken there will be no compensation in addition to the \$500.00 per diameter inch penalty.

ITEM 115.1 **DEMOLITION OF BRIDGE NO. A-19-014 (79A)** **LUMP SUM**

The work under this Item shall conform to the relevant provisions of Sections 112 of the Standard Specifications and the following:

GENERAL

The work to be done under this Item shall include furnishing all material, labor, equipment, and tools necessary to perform the complete removal and satisfactory disposal of the existing bridge in staged demolition, as designated on the Contract Plans. The demolition includes, but is not limited to, stone masonry substructure, concrete slab deck, steel railroad rail formwork, granite curb and sidewalk. Plans of the existing bridge are not available.

Excavation necessary for the removal of the existing abutments and wingwalls shall be included in Item 115.1.

The Contractor shall make adequate provisions for the protection of traffic, private property, and pedestrians from damage and injury during all phases of the demolition process.

The Contractor shall make his own investigation of the structure to be demolished including the materials that are part of, or may be stored in the structure. No increase will be made to the bid price due to the nature of the materials involved in the demolition. All costs for permits, dump fees, special handling of hazardous materials, etcetera, shall be included in the bid price of the demolition item.

All dimensions and details shown for the existing structure are not guaranteed. Plans and details are based on MassDOT Inspection and Load Rating reports with supplemental survey. The Contractor shall determine and establish all dimensions and details necessary for the completion of all work by field measurements and survey. The Contractor shall be responsible for the adequacy and accuracy thereof and shall not commence any work until the required measurements have been made on the actual structure.

It is the Contractor's responsibility to maintain the portions of the existing bridge which are necessary to maintain traffic on the bridge during the different stages of construction. Repairs to any portion of the structure which are necessary, due to damage by the Contractor's operations, shall be incidental to Item 115.1. Repairs shall be completed to the satisfaction of the Engineer and all repair costs shall be borne by the Contractor.

All materials removed in this demolition operation, except for any utility components, which may be directed to remain the property of the utility companies involved, shall become the property of the Contractor and shall be properly disposed of away from the jobsite in accordance with the Standard Specifications.

During the prosecution of this work, the Engineer may reject the use of any method or equipment that causes undue vibration or possible damage to the remaining structure or any part thereof during stage construction. The noise and dust created by demolition operations must be reduced to the maximum extent possible so as not to cause significant disturbance in the vicinity of the work site. Blasting will not be allowed without written permission from the Town.

ITEM 115.1 (Continued)

The Contractor shall take precautions to prevent debris caused from the demolition of the bridge to fall into the water. The Contractor shall be required to remove any debris which is generated by demolition from the site immediately and to restore portions of the site affected by the operation to their original undisturbed condition or better. Removal of debris generated by demolition will be performed at the Contractor's own expense. The Contractor shall be responsible for protecting the overhead and underground utility lines during his/her operations. If any utilities are damaged due to the Contractor's negligence, the Contractor shall make repairs at his/her own expense.

The Contractor shall be solely responsible for maintaining the stability of the existing structure at all times during the demolition and construction operations. The Contractor shall prepare and submit a plan indicating the proposed method of demolition, including equipment, tools, devices, equipment capacity and location, schedule of operations, disposal location, traffic management procedures, etc., to the Engineer for approval. The demolition procedure and any necessary calculations and drawings shall bear the stamp of a Professional Engineer Registered in the Commonwealth of Massachusetts certifying that all existing structural members are suitably braced and supported throughout the demolition process. Work shall not commence until the Engineer has given written approval of the method of demolition.

The proposed method of demolition plan shall also specify crane capacity, location, radii of movement, etc. to the Engineer for approval for all stages of demolition. The submittal shall include drawings and calculations of all loads and selection of crane and lifting hardware, as well as any effects to the existing abutments and structure, and shall be stamped by a Professional Engineer, having a structural discipline registered in the Commonwealth of Massachusetts.

No demolition work shall be started until the various utility companies involved have been notified (not less than seven (7) days prior to the start of demolition) and the Contractor has received approval from the Engineer as to the equipment, procedures and schedule of operation to be used during the demolition and reconstruction periods.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for the work to be done under this Item shall be at the contract lump sum bid price for Item 115.1 Demolition of Bridge No. A-19-014 (79A). The price shall include full compensation for all labor, materials, tools, equipment, and all incidental work that may be necessary to accomplish the specified work to the satisfaction of the Engineer.

The Town does not guarantee or represent that the bridge materials will coincide with any descriptions contained herein or represented on the plans. The Contractor shall be satisfied, by the Contractor's own investigation and research, regarding all conditions and materials affecting the work to be done. No additional compensation, other than the lump sum price bid for this Item, will be made if the materials or work prove to be different than that inferred or described herein, or shown on the Plans.

The Contractor shall submit in duplicate for approval, by the Engineer, a cost schedule for the Demolition of Bridge No. A-19-014 (79A). The approval of the cost schedule by the Engineer shall not be considered as a guarantee to the Contractor of the quantities assumed in developing any part of the submitted cost schedule. The schedule is only for the purpose of estimating partial payments, and it shall not affect the contract terms in any way.

ITEM 119.

RODENT CONTROL

LUMP SUM

The work under this item shall conform to the relevant provisions of Subsection 119 of the Standard Specifications and the following:

GENERAL

The work under this item shall include all work required to provide rodent control in the areas of proposed construction. Such rodent control shall include a pre-construction survey of surface rodent activity and sanitation deficiencies in and bordering the proposed work area. The Contractor is required to make all efforts to reduce the activity of rodents within the proposed work area prior, during and after construction has ceased, within the limits of work for the duration of this project to the satisfaction of the Engineer.

CONSTRUCTION METHODS & SUBMITTALS

Baiting will include a pre-construction baiting program followed by a maintenance-baiting program that lasts throughout the construction period, terminated once stage 3 of bridge construction is complete. All baiting will be done according to the rodenticide labeling as approved by the U.S. EPA and the Massachusetts Department of Food and Agriculture. All bait applications will be made by licensed pest control operators in the Commonwealth of Massachusetts and based upon activity levels and distribution of rodent control populations.

Records shall be maintained on baiting and survey results. A summary of determinable results of the control program must be submitted to the Engineer monthly. Baiting shall continue until after stage 3 of bridge construction been completed and reported to the Engineer. The summary must include the types of bait used, baiting locations, a description of rodent activity and sanitation conditions, and recommendations. Control shall include baiting of active rat burrows and the use of tamper-resistant bait stations, as appropriate. Control shall also be applied at all manholes and/or catch basins within the immediate contract area and to all catch basins and sewer manholes on adjoining streets within 300 feet of the Project Limits as defined by this Contract. The pest control operator must provide adequate liability insurance and be prepared to respond to changes in rodent populations and any rodent related complaints associated with construction activities.

Initial submittals (at the Pre-Construction Meeting):

1. Name, a copy of Massachusetts license, and qualifications of the pest control operator that will implement the Rodent Control Program.
2. Description of the Rodent Control Program.

BASIS OF PAYMENT

Item 119. will be paid for at the Contract price per Lump Sum, which price shall include all specified work required to accomplish the control of rodent populations during construction of this project within the limits specified. A payment of 50% of the price bid shall be made after the pre-construction survey has been completed and the necessary steps for the duration of the project have been initiated. The remaining 50% of each Item will be paid for at the conclusion of stage 3 of bridge construction or at a prior date as directed by the Engineer.

ITEM 120.1

UNCLASSIFIED EXCAVATION

CUBIC YARD

The work to be done under this Item shall conform to the relevant provisions of Section 120 of the Standard Specifications, and the following:

GENERAL

The work to be done under this Item shall consist of removing and disposing all the materials obstructing the execution of required work as shown on the plans and as directed, except material for which payment is made under the item of Class B Trench Excavation of this Contract, and except materials for which payment is made under other items of this Contract. The work under this Item shall include, but is not limited to, the satisfactory removal of hot mix asphalt and/or concrete sidewalks, concrete slabs, reinforced concrete, gutters, hot mix asphalt pavement, hot mix asphalt curb, concrete curb, brick, cobblestones, boulders, buried foundations, fencing, posts, drainage structures / pipes, and any other items required to be removed to complete the proposed construction.

Edges of excavation made in existing pavement shall be squared by sawcutting with power driven tools to provide a neat, clean edge for jointing new pavement as shown on the Plans. Ragged, uneven edges shall not be accepted. Pavement areas that have been broken or undermined shall be edged neatly with a minimum disturbance to the remaining pavement. Payment for sawcutting pavements shall be considered incidental to the pavement items, unless otherwise specified herein.

DISPOSAL OF SURPLUS MATERIALS

Surplus materials obtained from any type of excavation, and not needed for further use as determined by the Engineer, shall become the property of the Contractor and shall be removed from the site during construction period and disposed of legally. The removal, testing, and disposal of surplus material shall adhere to the regulations and requirements of local authorities governing the disposal of such materials, at no additional compensation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Measurement and Payment for Unclassified Excavation shall be at the Contract unit price bid per Cubic Yard of excavation complete in place or discarded which price shall constitute full payment for all labor, material and equipment, testing, legal disposal, fees, and transportation necessary to complete the Item to the satisfaction of the Engineer. No additional payment will be made for any soil testing, stockpiling, or disposal of surplus material.

ITEM 200.1 DRAINAGE & WATER SYSTEM AS-BUILT DRAWINGS LUMP SUM

GENERAL

Within 30 days of completion of the municipal drainage, sewer, and water system work, the Contractor shall mark and submit 3 copies of “as built” or corrected copies of the contract plans, showing in detail all construction changes, especially locations and depths of pipe, catch basins & manholes (locations and inverts), valves, fittings, services, corporations, curb stops, and crossing utilities. All “as built” drawings shall be dated with writing clearly legible.

Diameter and length (as appropriate) shall be noted for each water, sewer, and drain element.

At least 3 horizontal ties shall be provided to each catch basin, manhole, gutter inlet, fitting, gate, valve, corporation, water shutoff, and sewer manhole. Horizontal ties shall be made to nearby permanent, or semi-permanent, and highly visible ground level surface features such as hydrants or building corners.

The “as built” drawings shall be provided in both hard copy (24”x36” paper format) and electronic format as a PDF file. Both versions must be accurately scaled.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 200.1 shall be measured and paid for at the Contract unit price per Lump Sum which price shall include labor and materials required for furnishing, measuring, marking, and submitting the as-built drawings. This price shall include one set of revisions based on comments provided by the Town of Ayer Public Works Department and/or their representative. Payment shall be made at 75% of the bid price upon submittal of the draft “as-built” drawings. The remaining 25% of the bid price shall be paid upon satisfactory completion, and submission, of edits to the “as-built” drawing markups based on comments from the Town of Ayer Public Works Department and/or their representative for final approval / record purposes.

ITEM 210.1

**SANITARY SEWER MANHOLE
MUNICIPAL STANDARD**

EACH

The work to be done under these Items shall conform to the relevant provisions of Section 201 of the Standard Specifications, and the following:

GENERAL

Where noted on the plans and as required by the Engineer, the existing sanitary sewer system of sewer manholes and gravity sewer trunk lines shall be modified or reconstructed. This work includes all connections to existing sanitary sewers, all temporary bypass pumping and piping needed to maintain the existing sewer flows during construction.

New sewer manholes shall be provided at locations as noted on the plans to connect an existing system by using fitted compression couplings designed and sized to fit the existing pipes.

MATERIALS

Sanitary Sewer Manholes

All sanitary sewer manholes shall be constructed of pre-cast concrete only, no exceptions. All sanitary sewer manholes shall be pre-cast concrete and shall conform to ASTM C478 per AASHTO HS-20 loading.

Butyl resin section joints shall be manufactured in accordance with ASTM C443 specifications and shall be used in all joints between precast sections.

Manhole Steps shall not be required.

All manholes and structures shall be fully coated on the exterior surface with hot asphalt water proofing applied by the manufacturer.

All pipe connections to manholes shall be made by rubber boot cast into the opening of the precast base section. Pipes shall be connected to the manholes with stainless steel clamps fastened around the rubber boot. All straps and hardware shall be stainless steel.

ITEMS 210.1 (Continued)

Sanitary Sewer Manhole Connections

All pipe connections to manholes shall be watertight.

Connections made to existing sanitary sewers (based on the condition of the existing pipe and as approved by the DPW) shall be made with rubber couplings fitted with stainless steel strap clamps and designed to fit the new and existing pipe diameters and varying thicknesses. When all the existing pipe is directed to be removed, the Contractor shall provide a watertight connection.

Sanitary Sewer Fittings

Saddle fittings shall not be approved for use on this project.

Sanitary sewer fittings shall be molded or fabricated in accordance with ASTM D-3034, and F-1336. Fittings shall be manufactured of polyvinyl chloride meeting ASTM D1784 with a wall thickness meeting SDR-35. Sewer fittings shall be gasket type only. Gaskets for sewer fittings shall meet ASTM F-477.

CONSTRUCTION METHODS

All sanitary sewer manholes shall be placed on not less than 6 inches of crushed stone. Excavation shall be considered incidental to the cost of the sewer structures. The manhole base section shall be set at the proper invert grade and level in all directions.

Sanitary sewer manhole sections shall be connected with a continuous beam of butyl rubber compound or tape sufficient to completely seal the joint. All joints shall be watertight.

The contractor shall be required to maintain sewer flow to the existing system during construction. The contractor shall provide the DPW with the intended method to be used for approval prior to commencing with the work. The contractor's method of maintaining sanitary sewer flow shall be consistent with all state and local environmental policies and regulations. Discharge to ground or to drainage systems shall not be allowed.

Structure walls that are excavated for access, may be backfilled with suitable back fill from the excavation or gravel borrow type c provided that the excavation limits are not less than 18 inches outside the structure and the Contractor has the appropriate equipment to compact the backfill material to a 95% compaction in 12-inch lifts.

If the Contractor has not provided at least 18-inches of clearance for proper back fill and compaction as described herein then the structure shall be backfilled with Control Density Fill Type 2E at no additional cost.

New manholes shall be vacuum tested. The Ayer DPW must be notified 48 hours before tests take place so that a representative of the DPW can be present.

ITEMS 210.1 (Continued)

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 210.1 Sanitary Sewer Manhole Municipal Standard is based on the actual number of sewer manholes installed per Each. This payment shall include all boots and couplings needed to connect to the sewer pipes existing or proposed. Such payment shall be considered full compensation for all materials, labor, tools, and equipment needed to provide a complete installation as specified herein.

All excavation and backfill needed to install the manhole structure to the depth required to meet existing or proposed inverts and to install the crushed stone base shall be included in the cost of the item. No additional payment will be made for variations in depth. If a drop over manhole base is used, the cost of the cement concrete base shall be included in the unit price for the manhole installed. No separate payment will be made for Control Density Fill used to backfill manholes. Crushed stone bedding for sewer manholes shall be paid for under the contract unit price for Item 156. Crushed Stone per Ton.

Contractor shall note that no separate payment shall be made for the maintenance of sewer flow during the construction, connection, or modifications of the sewer system. The costs of maintaining sewer flow, including bypass piping, pumping, and any temporary connections shall be considered incidental to this item.

Frames and covers shall be paid for at the contract unit price for Item 222.3 Frame and Grate (or Cover) Municipal Standard per Each. Covers shall have the word "SEWER" cast into the top.

ITEM 220.6

SANITARY STRUCTURE REBUILT

FOOT

The work to be done under this Item shall conform to the relevant provisions of Section 220 of the Standard Specifications, and the following:

GENERAL

This work shall include the rebuilding of sanitary structures to the limits determined by the Engineer.

For sanitary structures which, in the opinion of the Engineer, need to be rebuilt, the casting and deteriorated masonry shall be removed until a clean, sound base is obtained upon which concrete blocks or brick may be set to rebuild the structure. New castings shall be set to the top of the milled surface grade in areas outside the limits of full depth reconstruction. In areas of full depth reconstruction, the castings shall be set to an intermediate elevation.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 220.6 will be measured and paid for at the Contract unit price per Foot, which price shall include all labor, equipment, materials, and all incidental costs required to complete the work.

ITEM 220.8

SANITARY STRUCTURE REMODELED

EACH

GENERAL

The work under this item shall conform to the relevant provisions of Section 220 and the following, including excavation, protection of the existing manhole, a masonry core, watertight sealing, backfilling, compaction and site restoration.

The Contractor shall take every precaution and care not to damage the structural condition of the existing sanitary structure. The Contractor will be fully responsible for any damage to the existing sanitary structure resulting from his work.

The brick for sanitary structures shall be sound, hard and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the Engineer. Brick shall comply with ASTM Standard Specifications for sewer brick (made from clay or shale), Designation C-32-63 or Grade SA, hard brick, except that the mean of five tests for absorption shall not exceed 8 percent by weight. Rejected brick shall be immediately removed from the work and brick satisfactory to the Engineer substituted.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 220.8 will be measured and paid for at the Contract unit price per Each which price shall include all labor, materials, equipment and incidental costs required to complete the work. Removing and resetting of the frame and cover to the proposed grade for structures designated to be adjusted or remodeled shall be separately measured for payment under Item 222.3. Payment will include the cost of excavation, protection of the existing manhole, backfilling, compaction and final grading.

ITEM 222.3 FRAME AND GRATE (OR COVER) MUNICIPAL STANDARD EACH

The work to be done under this Item shall conform to the relevant provisions of Section 201 and 220 of the Standard Specifications, and the following:

GENERAL

This work shall include furnishing new castings.

MATERIALS

MassDOT Standard Frame and Cover (Type A) 24-inch diameter shall be placed on new structures as specified or where existing frame and covers are determined by the Engineer to be broken or unacceptable. Covers supplied for drain manholes shall have the word "DRAIN" cast into the cover in 3-inch letters. Covers supplied for sewer manholes shall have the word "SEWER" cast into the cover in 3-inch letters.

Frame and grates shall conform to AASHTO-M105 Class 30. Catch basin frames shall be 3-flange when installed adjacent to a curb inlet. 4-flange frames shall be used on catch basins that are installed without a curb inlet. Grates shall have a two-directional or "grid pattern" type. Grates at low point locations must be able to accept flow from either direction. The Contractor shall confirm acceptable grate configuration with Ayer DPW prior to submitting shop drawings for approval.

The standard frame height shall be eight (8) inches. Four (4) inch frames will be allowed only at locations where shallow outlet pipes preclude the use of 8-inch frames.

Frame and Grate (or Cover) Municipal Standard shall be provided from an approved vendor listed on the MassDOT Qualified Construction Materials List

<https://www.mass.gov/info-details/ductile-iron-frame-and-grate-or-cover-m8030>

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 222.3 will be measured and paid for at the Contract unit price per Each, which price shall include all labor, materials, equipment and incidental costs required to complete this work. Each Frame and Grate or Frame and Cover is considered as a single unit.

The installation of these castings on new structures is considered incidental to Items 201., 202., 204., and 210.1. The installation of these castings on existing structures is considered incidental to Items 220., 220.2, 220.3, 220.5, 220.6, 220.7, and 220.8.

ITEM 250.10

**10 INCH POLYVINYL CHLORIDE
SANITARY SEWER PIPE**

LUMP SUM

GENERAL

The work to be done under this Item shall include all materials, labor and equipment necessary to install the new 10-inch sewer trunk line supported in the hydraulic opening of the replacement structure and laid between the sewer manholes within the bridge approaches, as shown on the Contract Plans and Specifications, or as directed by the Engineer. The work also includes maintenance of the existing sewer trunk line during staged construction and/or the installation, operation, and maintenance of a temporary sewer trunk line as necessary to remove the existing structure and install the replacement bridge. The Contractor's attention is drawn to the fact that work under this Item will include interfacing and coordinating with other utilities, impacted abutters, and/or the Town of Ayer Public Works Department.

The work included under this Item consists of completing the following work to the lines and grades shown on the Plans, or as directed by the Engineer, in accordance with the relevant provisions of Sections 200 and 300 of the Standard Specifications and the relevant regulations / standards of the Town of Ayer Public Works Department: removing the existing sewer piping; furnishing and installing new PVC pipe in the roadway approaches and mechanical joint cement-lined ductile iron (CLDI) sewer pipe within the bridge and through the abutment frame legs; furnishing and installing insulation and aluminum jacketing within the bridge opening; furnishing and installing a pipe support system comprised of rollers, hangers, couplings, and steel abutment penetration sleeves, including coordination with the precast concrete rigid frame fabricator for installation of embedded components, and; temporary support and/or bypass piping and pumping as required for the removal, installation, and testing of new sewer pipes and fittings of the size, type and class specified.

Temporary Support of Sewer

The Contractor shall be responsible for determining the level of temporary support of the existing sewer pipe and sleeve that is necessary during construction, which is dependent upon the Contractor's proposed means and methods. The existing 10-inch diameter trunk line spans between the abutments, within the hydraulic opening. The Contractor shall submit a plan detailing his proposed method of temporary support and/or bypass of the sewer to the Engineer and the Town for review and approval.

Maintenance of Sewer Service During Construction

The Contractor shall be responsible for developing and implementing a maintenance of sewer plan. Sewer flow must be maintained at all times during construction, including during manhole installation/replacement, removal of the existing 10-inch sewer pipe/sleeve, and installation of the new sewer pipe/sleeve on the bridge and in the roadway approaches. It shall be the Contractor's responsibility to handle the sewage in the existing pipes during the period of reconnection. Anticipated sewer flows shall be confirmed with the Ayer Department of Public Works as part of submittal process under Notice to Proceed.

ITEMS 250.10 (Continued)

The Contractor shall submit a bypass/service maintenance plan for approval by the Engineer and the Town of Ayer DPW Superintendent or his/her delegate prior to removal of any portion of the existing sanitary sewer system.

MATERIALS

All pipe lengths and fittings to be used on the project shall be clearly marked on the outside in bold type with the name of the manufacturer, pipe size, pipe material, pipe class and AWWA designation.

All pipe, fittings, and couplings shall be subject to the approval of the Engineer. For this purpose, the Contractor shall be required to submit to the Engineer copies of manufacturer's literature describing the pipe intended for use as outlined in **Section 01200 – Project Submittals, Meetings, and Quality Control**. Included in the manufacturer's information shall be recommendations on storage, handling, jointing and installation of the pipe and fittings proposed.

Each shipment of pipe and/or fittings shall include the manufacturer's certification indicating that the material was manufactured and tested in accordance with this specification, along with a copy of the test report to be furnished to the Engineer.

All pipe delivered to the job site shall be accompanied by independent testing laboratory reports certifying that the pipe and fittings conform to the above-mentioned specifications. In addition, the pipe shall be subject to thorough inspection and tests; the right being reserved for the Engineer to apply such of the tests specified as he may from time to time deem necessary.

Polyvinyl Chloride

Polyvinyl chloride (PVC) sewer pipe and fittings shall conform to the latest revision of ASTM Specification D3034. All PVC pipe shall have a minimum SDR ratio of 35. ASTM F 789 PVC gravity sewer pipe is not considered an acceptable "or equal" substitute.

Joints for PVC sewer pipe shall be bell and spigot sealed with rubber "o" ring gasket approved by the Engineer. Bells shall have the same strength rating as the pipe.

The maximum individual pipe length for PVC sewer main shall be 13-feet.

One pipe bell consisting of an integral wall section with a solid cross section rubber ring, factory assembled, shall be furnished with each standard, random and short length of pipe. Rubber rings shall be provided to the requirements of ASTM D3212.

The rubber ring shall be retained within the bell of the pipe by a precision formed groove or recess designed to resist fish-mouthing or creeping during assembly of joints.

ITEMS 250.10 (Continued)

Spigot pipe ends shall be supplied with bevels from the manufacturer to ensure proper insertion. Each spigot end shall have an “assembly stripe” imprinted thereon to which the bell end of the mated pipe will extend upon proper jointing of the two pipes. Pipe ends shall be such to permit checking of the rings with a feeler gauge to insure their proper location within the coupling grooves. PVC fittings shall be provided with bell and/or spigot configurations with rubber gasketed joints compatible with that of the pipe.

Cement Lined Ductile Iron Pipe and Mechanical Joint Fittings

Refer to the Materials section under Item 303.12 for Cement Lined Ductile Iron (CLDI) Pipe and Mechanical Joint Fitting product and performance requirements. CLDI pipe shall be used for the sewer trunk line within the bridge and through the abutment frame legs.

Steel Utility Sleeves

Utility sleeves through the abutments shall be steel pipe conforming to ASTM A-53, Type S, Grade B, standard weight, plan ends, hot-tip galvanized.

Insulation

Insulation shall conform to Materials Specification M9.11.0.

Polyurethane Expansive Foam Sealant

Polyurethane expansive foam sealant shall be a minimal-expanding, single component polyurethane foam sealant. The foam sealant shall cure quickly and have moisture-resistance skin.

CONSTRUCTION METHODS

All piping shall be adequately supported in accordance with the Contract Plans and as specified herein. The Contractor shall furnish all labor necessary to assist the Engineer in inspecting the pipe and fittings. The pipe and fittings shall be inspected upon delivery and any which does not conform to the above specifications shall be rejected and immediately removed from the site by the Contractor.

Sewer Pipes shall be laid at least 10-feet horizontally from any existing or proposed water mains. The distance shall be measured edge to edge. In cases where it is not practical, as directed by the Engineer, to maintain a 10-foot separation, it is permissible to install a sewer pipe closer to a water main. However, the sewer pipe must be laid in a separate trench or on an undisturbed earth shelf located on one side of the water main at such an elevation that the bottom of the water main is at least 18-inches above the top of the sewer. Sand bedding shall be included in the Contractor's Lump Sum price. No additional payment will be made for sand bedding and backfill material.

Reconnection of existing mains or house services to the proposed sanitary sewer is included under this item.

ITEMS 250.10 (Continued)

All repairs to pipes installed under this Contract shall be made by replacing the damaged sections with pipe of the same material and class. Repair sleeves approved by the Engineer shall only be used with the Engineer's specific permission.

All foundation and haunching shall be compacted to a minimum of 90% Standard Proctor Density.

Each pipe length shall be inspected before being laid to verify that it is not damaged. Pipe shall be laid to conform to the lines and grades indicated on the drawings or given by the Engineer. Each pipe shall be so laid as to form a close joint with the next adjoining pipe and bring the inverts continuously to the required grade.

The pipe shall not be driven down to grade by striking it with a shovel handle, timber, rammer, or other unyielding object. When each pipe has been properly bedded, enough of the backfill material shall be placed and compacted between the pipe and the sides of the trench to hold the pipe in correct alignment.

Before a joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that inverts are matched and conform to the required line and grade.

For pipe placed on crushed stone, immediately after the joint is made, the jointing area shall be filled with suitable materials so placed and compacted that the ends of either pipe will not settle under backfill load.

No pipe or fitting shall be permanently supported on saddles, blocking, or stones, except for pipe supported on roller supports within the hydraulic opening of the bridge.

Incidental to this contract item shall be the formulation of a bypass plan and bypass pumping of wastewater as required to maintain sanitary sewer flow for this active sewer trunk line at all times.

The construction methods for pipe insulation shall conform to Sub-section 301.60.

METHOD OF MEASUREMENT

Measurement will be at the contract unit price per Lump Sum for Item 250.10, 10 Inch Polyvinyl Chloride Sanitary Sewer Pipe, as specified above including all materials, tools, equipment and labor necessary to complete the installation of 10-inch sewer pipe and associated work between the sewer manholes on each bridge approach as described in this Special Provision and as shown on the Contract Plans and Details.

ITEMS 250.10 (Continued)

BASIS OF PAYMENT

Under Item 250.10 of the Contract, the Contractor will be paid the Contract Lump Sum price for 10 Inch Polyvinyl Chloride Sanitary Sewer Pipe, which price shall include full compensation for all labor, tools, equipment, materials and incidentals necessary for satisfactory completion of the work. Payment shall include, but is not limited to, complete installation of sewer trunk line between manholes on each bridge approach, 10 Inch Polyvinyl Chloride sanitary sewer pipe, CLDI pipe, insulation with jacket, hangers, spacers, rollers, couplings, abutment penetration sleeves, foam sealant, casing end seals, fittings, appurtenances, sewer manhole connections, temporary support of existing sewer, temporary maintenance of sewer service including bypass pumping, and removal of temporary measures necessary to complete the work under this Item.

Within ten (10) days after the award of the Contract, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of values of the components of work associated with Item 250.10 for the purpose of making partial payments. The total of all partial payments to the Contractor shall equal the Lump Sum contract price.

ITEM 303.12

**12 INCH DUCTILE IRON WATER PIPE
(MECHANICAL JOINT)**

LUMP SUM

GENERAL

The work to be done under this Item shall include all materials, labor, and equipment necessary to install the new 12-inch water line supported in the hydraulic opening of the replacement structure and between the existing water gates within the bridge approaches, as shown on the Contract Plans and Specifications, or as directed by the Engineer. The work also includes maintenance of the existing water main during staged construction and/or the installation, operation, and maintenance of temporary water main piping as necessary to remove the existing structure and install the replacement bridge. The Contractor's attention is drawn to the fact that work under this Item will include interfacing and coordinating with other utilities, impacted abutters, and/or the Town of Ayer Department of Public Works.

The work included under this Item consists of completing the following work as shown on the Plans, or as directed by the Engineer, in accordance with the relevant provisions of Section 300 of the Standard Specifications and the relevant regulations / standards of the Town of Ayer Public Works Department: removing the existing water pipe; furnishing and installing new mechanical joint cement-lined ductile iron (CLDI) water main within the roadway approaches and through the opening of the bridge; furnishing and installing insulation and aluminum jacketing within the bridge opening; furnishing and installing a pipe support system comprised of rollers, hangers, couplings, and steel abutment penetration sleeves, including coordination with the precast concrete rigid frame fabricator for installation of embedded components; disinfection, temporary support and/or temporary water main as required for removal and installation, and; testing ductile iron water pipes and fittings of the size, type and class specified.

Temporary Support of Water Pipe

The Contractor shall be responsible for determining the level of temporary support of the existing water pipe and sleeve that is necessary during construction, which is dependent upon the Contractor's proposed means and methods. The existing 12-inch diameter water pipe spans between the abutments, within the hydraulic opening. The Contractor shall submit a plan detailing his proposed method of temporary support and/or temporary water main to the Engineer and the Town for review and approval.

Maintenance of Water System During Construction

The Contractor shall be responsible for developing and implementing a temporary water main system. The temporary water main must be maintained at all times during construction associated with the replacement of the water main, including during removal of the existing 12-inch water pipe/sleeve, and installation of the new water pipe/sleeve on the bridge and in the roadway approaches, chlorination, and testing.

ITEMS 303.12 (Continued)

The Contractor shall submit a temporary water main plan / schedule for approval by the Engineer and the Town of Ayer DPW Superintendent or his/her delegate prior to exercising gate valves and / or removal of any portion of the existing water system. The design, implementation, testing, and removal of the temporary water main shall be considered incidental to this contract item.

MATERIALS

All pipe lengths and fittings to be used on the project shall be clearly marked on the outside in bold type with the name of the manufacturer, pipe size, pipe material, pipe class and AWWA designation.

All pipe, fittings, and couplings shall be subject to the approval of the Engineer. For this purpose, the Contractor shall be required to submit to the Engineer copies of manufacturer's literature describing the pipe intended for use as outlined in **Section 01200 – Project Submittals, Meetings, and Quality Control**. Included in the manufacturer's information shall be recommendations on storage, handling, jointing and installation of the pipe and fittings proposed.

Each shipment of pipe and/or fittings shall include the manufacturer's certification indicating that the material was manufactured and tested in accordance with this specification, along with a copy of the test report to be furnished to the Engineer.

All pipe delivered to the job site shall be accompanied by independent testing laboratory reports certifying that the pipe and fittings conform to the above-mentioned specifications. In addition, the pipe shall be subject to thorough inspection and tests; the right being reserved for the Engineer to apply such of the tests specified as he may from time to time deem necessary.

Ductile Iron Pipe

The Contractor shall use ductile iron pipe unless otherwise indicated on the. All ductile iron pipe shall be designed in accordance with AWWA C150 and shall be manufactured in accordance with AWWA C151. Unless otherwise indicated or specified, ductile iron pipe shall be Class 52.

The pipe shall be installed with a minimum of 5'-0" of cover, unless specifically indicated otherwise on the plans or required by the Engineer. Where pipe is installed at less than the required cover, the Contractor shall furnish and install insulation.

ITEMS 303.12 (Continued)

No defective pipe or fittings shall be laid or placed in the piping, and any piece discovered to be defective after having been laid or placed shall be removed and replaced by a sound and satisfactory piece. Each pipe and fitting shall be cleared of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work. Pipe and fittings shall be laid accurately to the lines and grades indicated on the drawings or as required. Care shall be taken to ensure good alignment both horizontally and vertically. In buried pipelines, each pipe shall have firm bearing along its entire length. Immediately prior to being set, castings shall be thoroughly cleaned of all rust, scale and other foreign material. Fittings shall not be used to clear beneath or above an existing structure or pipeline unless approved by the Engineer. The water main shall be brought to a depth sufficient to clear the structure or pipeline without the use of bends.

Lining & Coating

The inside of pipe and fittings shall be given a cement lining and asphaltic seal coat in accordance with AWWA C104. The thickness of the lining shall be double that specified in AWWA C104. The outside of pipe and fittings shall be coated with the standard asphaltic coating specified under the appropriate AWWA Standard Specification for pipe and fittings. Machined surfaces shall be cleaned and coated with a suitable rust preventative coating at the shop immediately after being machined.

Mechanical Joint Fittings

Mechanical thrust restraint is required at all bends, tees, and other fittings for water mains and components except for water service connections. Thrust restraint glands shall be constructed of ductile iron rings designed to fit the appropriate outside pipe diameters. Thrust restraint glands shall be manufactured with integral threaded lugs designed to lock directly to the outside of the pipe and fit directly to the mechanical joint fitting and to the gasket.

Where thrust restraint collars and harnesses are installed to add thrust restraint to a push on joint in the pipe run, the restraint collars and harnesses shall be sized to match the pipe sections being assembled. Pipe sections that require restraint shall be locked with an integral lug collar on the plain end of the pipe section and a harness on the bell end. These two fittings shall be through bolted directly together with the appropriate connecting rods or bolts to form a completely restrained joint. The connecting rods or bolts used to tie two pipe sections shall clear the pipe bells with minimum clearance. Field welding glands to the pipe sections is not acceptable. Collars formed from steel straps are not acceptable and shall not be used.

Bolts and nuts and rods used for mechanical fitting assemblies and thrust restraint assemblies shall be of domestic manufacture and made of low carbon steel conforming to ASTM A307, Grade B, or ductile iron. Bolts heads shall be supplied with torque limiting break off bolts. All thrust restraint assemblies shall be supplied from a single source.

ITEMS 303.12 (Continued)

Acceptable manufacturers of joint restraint collars include:

- Mega-Lug brand as manufactured by EBAA Iron, Inc., Eastland, Texas
- Uni-Flange Series 1400 as manufactured by Ford Meter Box Co., Inc.
- Romagrip Brand as manufactured by Romac Industries, Inc.
- TufGrip brand as manufactured by Tyler Pipe Co. and Union Foundry Co.

Solid Body Ductile Iron Couplings for Connection to Existing Water Pipes 4- to 16-Inches

Couplings shall be of domestic manufacture, multipurpose, mechanical couplings shall consist of a ductile iron sleeve, ductile iron follower rings, rubber gaskets, and corrosion-resistant bolts and hex nuts.

Couplings alone or couplings in combination with mechanical joint cement lined ductile iron long body reducers with plain ends shall be used to connect new pipe work to existing water lines at the work limits.

Mechanical couplings shall have a minimum pressure rating that will accommodate maximum pressures expected to be experienced during pressure and leakage testing. Couplings shall be designed to be connected to older cast iron pipe sizes as well as newer ductile iron pipe sizes. The couplings shall be provided with various gaskets in order to accommodate variations in the outside diameter of the existing pipe encountered in the field.

Couplings shall meet the following specifications:

- Follower and middle ring material shall be ASTM A-536, Grade 65-45-12 (Ductile Iron)
- Bolts shall be: AWWA C 111/ANSI A21.11
- Gaskets shall be approved for water use
- Coupling coating shall be: Fusion-Bonded Epoxy

Acceptable manufacturers of couplings shall include:

- Dresser Style 153, Romac Style 501, Ford Meter Box Co. style FC1 or FC2, Smith Blair Type CC441 or 443, or approved equal.

Steel Utility Sleeves

Utility sleeves through the abutments shall be steel pipe conforming to ASTM A-53, Type S, Grade B, standard weight, plan ends, hot-tip galvanized.

Insulation

Insulation shall conform to Materials Specification M9.11.0.

ITEMS 303.12 (Continued)

Polyurethane Expansive Foam Sealant

Polyurethane expansive foam sealant shall be a minimal-expanding, single component polyurethane foam sealant. The foam sealant shall cure quickly and have moisture-resistance skin.

CONSTRUCTION METHODS

The Contractor shall install and test all water piping in accordance with the relevant provisions of the Standard Specifications Section 300 Water Systems and as specified herein and meeting all Town of Ayer Department of Public Works Standards. In general, the Contractor is responsible for the sequence of the work progression, and the Contractor's sequence must ensure minimal disruption to the needs of the public, abutters, and the overall operation of the existing water supply. The Contractor shall coordinate all work and related operations with the Ayer DPW.

All piping shall be adequately supported in accordance with the Contract Plans and as specified herein. The Contractor shall furnish all labor necessary to assist the Engineer in inspecting the pipe and fittings. The pipe and fittings shall be inspected upon delivery and any which does not conform to the above specifications shall be rejected and immediately removed from the site by the Contractor.

Temporary and Bypass Water Service Requirements

The Contractor shall design the temporary water service system, or bypass system, as needed to maintain all domestic water services and firefighting capacity during the removal and installation of the proposed bridge crossing.

The minimum requirements for the temporary or bypass systems shall be as follows:

The Contractor shall design the bypass system and coordinate the work with the Ayer Fire Department, Ayer DPW, and the Engineer. The Contractor's proposed bypass system shall be subject to comments and changes requested by these entities before approval.

Minimum design pressure shall be not less than 200 psi static pressure and 260 psi intermittent.

All temporary pipes crossing roadways and driveways shall be set below pavement surfaces and either plated with steel plates or back filled with gravel and patched with hot mix asphalt.

Temporary piping and services shall not block or hinder the use of the sidewalk or present a tripping hazard in front lawns or pedestrian walkways.

All private services to houses, buildings and municipal offices shall be maintained in size. Except that the minimum pipe size for temporary house service piping shall be ¾" diameter.

The Contractor is required to communicate all changes to the temporary water system at least 72 hours before the change is planned. The Contractor is required to notify all residents affected by temporary shutdowns at least 48 hours in advance of the shutdown.

ITEMS 303.12 (Continued)

All portions of the temporary system, or bypass system, shall be leak tested, disinfected in accordance with these Special Provisions and approved before it is used as a part of the existing water service system. The Contractor shall notify the DPW of the proposed testing 72 hours before the test is planned. The Contractor shall conduct tests in accordance with Massachusetts DEP Standards and shall submit samples to an independent laboratory approved by the Ayer DPW. The Contractor shall provide copies of all disinfection tests conducted to the Ayer DPW for their records. The Contractor shall be responsible for the sterility and maintenance of the temporary water system before the system is implemented and during use of the system. The Ayer DPW and Fire Department has the right to conduct separate tests of the temporary water system at any time.

The Contractor shall provide all additional specialized valves, couplings, fittings, needed due to variations or changes in connection points created due to the implementation of the temporary service system or bypass designed by the contractor.

Disinfection of Temporary and Proposed Water Mains

All permanent and temporary water lines shall be disinfected and tested by the Contractor in accordance with ANSI/AWWA651-05 or the latest standard in place at the time the contract is bid. The Contractor's testing procedures shall comply with Massachusetts DEP 310 CMR 22.00: Drinking Water requirements. The actual disinfection additives used in to disinfect the temporary and permanent water mains shall be as approved for use by Massachusetts DEP.

All personnel conducting tests, sampling and transporting samples shall be certified in the State of Massachusetts for conducting water disinfection testing. The Ayer DPW has the right to request the certification documents of the Contractor's personnel at any time. The Contractor shall coordinate testing times with the Ayer DPW and provide 72 hours' notice to the Town prior to performing testing.

ITEMS 303.12 (Continued)

METHOD OF MEASUREMENT

Measurement will be at the contract unit price per Lump Sum for Item 303.12, 12 Inch Ductile Iron Water Pipe (Mechanical Joint), as specified above including all materials, tools, equipment and labor necessary to complete the installation of 12-inch water pipe and associated work between the existing gates valves on each bridge approach, through the hydraulic opening, as described in this Special Provision and as shown on the Contract Plans and Details.

BASIS OF PAYMENT

Under Item 303.12 of the Contract, the Contractor will be paid the Contract Lump Sum price for 12 Inch Ductile Iron Water Pipe (Mechanical Joint), which price shall include full compensation for all labor, tools, equipment, materials and incidentals necessary for satisfactory completion of the work. Payment shall include, but is not limited to, complete installation of the new watermain between the existing gates valves on each bridge approach as shown on the Contract Plans and Details, 12 inch ductile iron water pipe (mechanical joint), bedding, backfill, insulation with jacket, hangers, spacers, rollers, couplings, thrust blocks, bends, joint restraints, steel abutment penetration sleeves, foam sealant, casing end seals, fittings, appurtenances, connections to existing gate valves, chlorination, testing, temporary support of existing water pipe, temporary maintenance of water main including a temporary system, and removal of the existing main and temporary measures necessary to complete the work under this Item.

Within ten (10) days after the award of the Contract, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of values of the components of work associated with Item 303.12 for the purpose of making partial payments. The total of all partial payments to the Contractor shall equal the Lump Sum contract price.

ITEM 350.12
ITEM 381.

12 INCH GATE AND GATE BOX
SERVICE BOX

EACH
EACH

The work under these items shall conform to the relevant provisions of Section 300 of the Standard Specifications and the following:

GENERAL

The work shall include the furnishing and installation of all materials required to remove existing water system components and install new water system components as shown on the plans and outlined within these special provisions.

Approval of Materials

All shop drawings shall be submitted to the Engineer for review. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs including descriptive literature and complete characteristics and specifications, and code requirements. Shop drawings shall be submitted for the type of joint, fittings, couplings, filling rings, restrained joints, and lining and coating in accordance with specifications.

The manufacturer shall furnish as part of the shop drawing submittal the Engineer with an affidavit stating that valves conform to the applicable requirements of the applicable AWWA Standard and the Engineer's specifications, and that all tests specified therein have been performed and all test requirements have been met and the test date. A copy of the Affidavit of Compliance shall be delivered to the construction site attached to each valve furnished. The Affidavit shall be attached to the valve inside a waterproof pouch.

Any valve received without the required affidavit shall be removed from the project and replaced at no expense to the Owner. All materials shall be certified "NEW". No reconditioned or repaired materials are permitted. Any reconditioned or repaired materials furnished or installed shall be removed and replaced with new materials at no expense to the Owner.

MATERIALS

Resilient Seat Gate Valves

Resilient seat, wedge type gate valves shall be manufactured to meet all applicable requirements of AWWA C509 or AWWA C515. All valves shall be bubble-tight at 200 psi water working pressure, tested in both directions. Valve bodies shall be of cast or ductile iron and shall have non-rising threaded bronze stems acting through a bronze stem nut. Opening nuts shall be 2-inches square and shall open as specified above. All buried valves shall have mechanical joint ends. Valve wedges shall be of ductile iron with resilient seating surfaces permanently bonded to the wedges in strict accordance with ASTM D429 or attached to the face of the wedges with stainless steel screws. Each valve shall have a smooth, unobstructed water way free from sediment pockets. Valves shall have low friction, torque-reduction thrust bearings. All O-rings and gaskets shall be removable without taking the valves out of service.

ITEMS 350.12 & 381. (Continued)

An NSF 61-approved epoxy coating, which is safe for potable water, shall be applied to exterior and interior valve surfaces. Valves for horizontal applications shall have Delrin wedge covers and be specifically designed for horizontal installation.

Resilient seat gate valves shall be as manufactured by Clow Valve Co., Oskaloosa, IA; Mueller Co., Decatur, IL; American Valve and Hydrant; Birmingham, AL; Waterous Co., S. St. Paul, MN; MH Valve, Anniston, AL; Kennedy Valve, Elmira, NY; or approved equal.

Post indicating valve assemblies shall have a post and indicator as an integral part of the resilient seated gate valve assembly. The unit shall be provided with a detachable crank which OPENS the valve in a clockwise direction. Shafts shall be Type 304 stainless steel. Post indicators and valves shall be UL listed, FM approved.

Valves shall open right (clockwise).

All valves shall be carefully installed and supported in their respective positions free from distortion and strain. Care shall be taken to prevent damage or injury to the valves and appurtenances during handling and installation. All material shall be carefully inspected for defects in workmanship and all debris and foreign material cleaned out of valve openings and seats. All mechanisms shall be operated to check for proper functioning, and all nuts and bolts checked for tightness. Valves that do not operate easily or are otherwise defective shall be repaired or replaced at the Contractor's expense.

Valves shall be operational and accessible at all times during construction and warranty period. The Contractor shall verify proper operation of all valves in the presence of the Engineer and/or Owner following completion of the project and prior to the acceptance of Substantial Completion.

Valve Boxes & Extensions

Valve boxes shall be manufactured in North America. The minimum outside diameter of the boxes shall be 5½-inches and the lengths shall be as necessary to suit the ground elevation and the depth of each valve operator, regardless of the depth of cover. When there is more than 6 feet of cover, valve operators shall have non-rising extension stems which raise the operating nut to a depth of approximately 4 feet below grade. The extension stem shall have a centering support ring at the upper end. The lower socket shall be tapped with a set screw into the valve nut to prevent the extension stem from lifting off the valve nut. Each valve shall be provided with a box which has a close fitting 7-1/4-inch diameter cover and is substantially dirt-tight. The top of the cover shall be flush with the top of the box rim. The word "WATER" shall be cast in the top of the cover.

ITEMS 350.12 & 381. (Continued)

Valve boxes shall be cast iron and of the adjustable sliding, heavy pattern type. They shall be so designed and constructed as to prevent direct transmission of traffic loads to the pipe or valve. The upper or sliding section of the box shall be provided with a flange on the top of the section (not on the bottom) having sufficient bearing area to prevent undue settlement. The lower section of the box shall be designed to enclose the operating nut and stuffing box of the valve and to rest on the backfill. The boxes shall be adjustable through at least 6 inches vertically without reduction of lap between sections to less than 8-inches.

Valve boxes shall be set plumb, flush with the ground or paved surface, and centered directly over the operating nut of the valves. Earth fill shall be carefully tamped around the valve boxes to a distance of 4 feet on all sides of the boxes or to the undisturbed trench face, if less than 4 feet.

Service Boxes

The cast iron box shall be the sliding Buffalo type with Arch pattern base. Minimum inside diameter of the upper section shall be 1-1/2-inches. Curb box lid shall have brass pentagonal nut. Boxes shall be equipped with 30-inch stationary extension rods with pinned connections to the curb stop.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Unless otherwise noted, all earthworks shall be included under any item requiring excavation. Unless otherwise noted, each item specified or shown on the drawings shall be furnished and installed in accordance with the technical section whether a specific applicable payment item exists or not. The prices for those items which involve excavation shall include compensation for disposal of surplus excavated material, and installation of all necessary sheeting and bracing. In all items involving excavation, the price shall be based on doing the entire excavation in earth. Where rock is excavated, the price therefore shall be in addition to the cost of excavating the earth, and no deduction shall be made in the amount for earth excavation.

The price for all valves, gate boxes, and service boxes shall constitute full compensation for earth excavation, sheeting, dewatering, bedding, restraints, thrust blocks, furnishing, laying, jointing, testing pipe, and backfilling. The cost of making connections to existing water mains and abandoning existing water mains shall be considered incidental to the project.

Insulation for underground pipelines shall be considered incidental to pipeline replacement.

Valves and Service Boxes shall be measured and paid per Each. The cost of making connections to existing mains, and the cost of joint restraints, couplings and concrete backing shall be considered incidental to the cost of the project. The cost of removing abandoned valves and/or valve boxes shall be considered incidental to the project.

ITEM 450.99

TEMPORARY HOT MIX ASPHALT

TON

Work under these Items shall conform to the relevant provisions of Section 460 Hot Mix Asphalt Pavement for Local Streets of the Standard Specifications and the following:

GENERAL

Temporary Hot Mix Asphalt may be required during staged construction in Stages 1A to 1C where the existing sidewalk platform area, within the limits of the bridge structure, is utilized to shift traffic to the north, and for other stages of construction where determined to be necessary by the Contractor, as approved by the Engineer.

The Equivalent Single Axle Loads (ESALs) for the design travel lane over a 20-year period is **1.0 Million 18-kip (80-kn)** ESALs. The PGAB Grade selected for this Contract is **PG 64-28**.

Temporary Hot Mix Asphalt shall meet the requirements SUPERPAVE Bridge Surface Course – 12.5 (SSC-B-12.5).

Removal of the Temporary Hot Mix Asphalt will not be paid for under other items of the Contract but will be subsidiary.

ITEM 628.4

**TEMPORARY IMPACT ATTENUATOR
REMOVED AND RESET**

EACH

The work performed under this item shall conform to Section 628, Section 850, Traffic Controls for Construction and Maintenance Operations, Sections of the Standard Specifications and the following:

GENERAL

Temporary Impact Attenuators shall be installed as shown on the drawings and in accordance with the MUTCD and MassDOT Standard Details. The Contractor shall prepare shop drawings, install attenuators and install concrete foundations as required and in accordance with manufacturer's requirements. The contractor shall install, maintain, and remove the units at no additional cost to the Town of Ayer Department of Public Works. Attenuators damaged shall be repaired or replaced within 24 hours after damage has occurred.

MATERIALS

Temporary Traffic Attenuators for Shoulder, Incapable of Redirection shall conform to the requirements included under Item 628.31 of the Standard Specifications and the Supplemental Specifications. Temporary impact attenuator shall be listed on the MassDOT Qualified Traffic Control Equipment (QTCE) list.

<https://www.mass.gov/info-details/section-628-impact-attenuators>

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 628.4 shall be paid for at the contract unit price for Each location installed per the Traffic Management Plans included as part of the contract documents, which includes full compensation for all labor, equipment materials, foundation and anchorage, concrete transitions, and all incidental work necessary to complete the work specified. There shall be no separate payment to replace or repair damaged units, removal and resetting of attenuators for the construction activities, or instances in which the attenuators were removed and reset without prior approval from the Town of Ayer Department of Public Works or the Engineer.

ITEM 657.
ITEM 657.5

TEMPORARY FENCE
TEMPORARY FENCE REMOVED AND RESET

FOOT
FOOT

GENERAL

The work under these Items shall include furnishing, installing, maintaining, removing, resetting and final removal of 6-foot-high chain-link fence in the location(s) indicated on the Plans and/or as required by the Engineer. The fence shall be used to close off the construction area from adjacent private properties and for protection of pedestrians whose use may conflict with the construction activities.

Fencing shall conform to the relevant provisions of Section 644 of the Standard Specifications.

The Contractor will be responsible for providing the Engineer with an acceptable method for the installation of the Temporary Fence that will provide for the pedestrian and worker safety and security for which it is intended.

All posts, including end, corner and intermediate brace posts, and all gates and gateposts, shall be included in the per foot cost. The fencing height shall be 6 foot minimum. Materials need not be new, but shall be in good condition, shall not be deteriorated, nor in a condition which in any way may jeopardize the safety and security purposes intended. All fencing shall meet the approval of the Engineer. The Contractor shall be responsible for maintenance of the Temporary Fence and shall be responsible and cognizant that the work area remains secure and is inaccessible to the general public at all times. It may be necessary to remove sections of the Temporary Fence at times during construction. Any removing and resetting of the Temporary Fence by the Contractor to facilitate his/her construction operations shall be done at no additional cost. Fence fabric shall be placed on the top face of the post away from the work area. A top tension wire, rather than a pipe top rail, shall be used. The top edge of the fabric shall be finished with a “knuckled” salvage. The Temporary Fence shall not be removed until construction is completed, or until directed by the Engineer.

METHOD OF MEASUREMENT

Measurement for Item 657. Temporary Fence will be at the Contract Unit per Foot, and shall include all tools, equipment, materials and labor costs for a complete installation as described herein. Moving the temporary fence, if required for contractor convenience, shall be considered included in the unit bid price and no additional compensation allowed.

Removing and resetting temporary fence between construction stages shall be measured and paid under Item 657.5 Temporary Fence Removed and Reset per Foot of relocated fence. The final removal and proper disposal of the Temporary Fence, once construction is complete, shall be considered incidental to these items.

ITEMS 657. & 657.5 (Continued)

BASIS OF PAYMENT

Payment for Temporary Fence will be paid for at the contract unit price per Foot of fence, which price shall constitute full compensation for all labor, tools, equipment, materials, and other incidentals required for installation and maintenance as detailed on the Project Drawings and/or as directed by the Engineer.

Payment for Temporary Fence Removed and Reset will be paid for at the contract unit price per Foot of fence removed and reset limited to switching construction phases as detailed in the Traffic Management Plans included as part of the contract documents.

The Contractor shall replace and/or restore sections of fence damaged due to accidents, vandalism or in any other manner for the duration of the project. Damage due to construction activities or the Contractor's negligence shall be replaced at no additional cost. The final removal and proper disposal of the Temporary Fence, once construction is complete or is no longer needed, shall be considered incidental to these items.

ITEM 697.1

SILT SACK

EACH

Work under this item shall conform to the relevant provisions of Sections 227 and 670 of the Standard Specifications, and the following:

GENERAL

The work under this item includes the furnishing, installation, maintenance and removal of a reusable fabric sack to be installed in drainage structures for the protection of wetlands and other resource areas and the prevention of silt and sediment from the construction site from entering the storm water collection system. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

CONSTRUCTION

Silt sacks shall be installed in existing catch basins to be retained and proposed catch basins and gutter inlets within the project limits and as required by the Engineer.

The silt sack shall be as manufactured to fit the opening of the drainage structure under regular flow conditions and shall be mounted under the grate. The insert shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The filter material shall be installed and maintained in accordance with the manufacturer's written literature and as directed by the Engineer.

Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and dispose of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired or replaced immediately at no additional cost to the Town of Ayer Department of Public Works.

ITEM 697.1 (Continued)

When emptying the silt sack, the Contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractors expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

All curb openings shall be blocked to prevent stormwater from bypassing the device.

All debris accumulated in silt sacks shall be handled and disposed of as specified in Section 227 of the Standard Specifications.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 697.1 will be measured and paid at the Contract unit price per Each, complete in place, which price shall include all labor, materials, equipment and incidental costs required to complete the work. No separate payment will be made for removal and disposal of the sediment from the insert, but all costs in connection therewith shall be included in the Contract unit price bid.

ITEM 755.
ITEM 755.9

WETLAND REPLACEMENT AREA
PROFESSIONAL WETLAND SPECIALIST

SQUARE YARD
HOUR

The work to be done under this section includes excavating, fine grading and installation of wetland soil and seeding as shown on the plans and as directed by the Engineer. The work under this item shall conform to the relevant provisions of Sections 120, 770, 771, and the following:

GENERAL

The construction and re-vegetation of the replacement areas shall be in accordance with the Plans and Cross Sections and as directed by the Wetland Specialist. Limits of replacement shown on the plans are approximate and may require adjustment in the field to accommodate actual conditions.

The Contractor shall retain the services of a Wetland Scientist, Biologist, Botanist, or other individual (hereafter referred to as Wetland Specialist) with similar qualifications and a minimum of five years' experience in similar wetland replacements, and thoroughly versed in the Commonwealth of Massachusetts Wetlands Protection Act (MGL C.131, s.40) and all other relevant regulations of the Department of Environmental Protection and the U.S. Army Corps of Engineers, New England District.

Wetland Specialist

The Wetland Specialist shall be paid per hour under Item 755.9. Responsibilities of the Wetland Specialist shall pertain only to wetland replacement, mitigation, and restoration activities.

Wetland Specialist shall review environmental permits and evaluate impacted and proposed wetland sites, conditions and materials prior to construction. Wetland Specialist shall review siltation controls and monitor construction impacts to buffer zones and regulated wetland resources for wetland replacement activities. Wetland Specialist shall also be responsible for approving the following:

- final location of wetland area and limits
- final grading prior to planting and seeding
- limits of wetland and upland seeding prior to seeding
- monitoring for invasive species during establishment period and until final acceptance
- submitting wetland monitoring reports to the Construction Observer and regulatory agencies, as directed.

Wetland Specialist shall also be responsible for mitigation requirements specified in the Permits as they pertain to the wetland replacement, restoration or mitigation.

ITEMS 755. & 755.9 (Continued)

The definition of invasive species referred to herein shall be as defined by Massachusetts Invasive Plant Advisory Group (MIPAG): "non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems." In addition, invasive species shall include those listed by the U.S. Army Corps of Engineers, New England District.

Submittals

Wetland Specialist. Prior to beginning work, the Wetland Specialist shall furnish proof of qualifications to the Engineer for approval.

Soils. Contractor shall submit for approval all sources of loam and compost and all other soil amendments prior to ordering. Soils brought in from off-site shall be free of invasive species. Off-site source shall be identified and available for inspection by the Engineer prior to transport of soil to the site.

Photographic Documentation. Prior to any disturbance, clear and legible digital photographs shall be taken by the Contractor of the existing wetland to be impacted and of the proposed wetland replacement site. These shall be submitted to the Engineer.

Seed. At least 30 days prior to ordering, the Contractor shall submit to the Engineer seed packing certificates with source and date, as well as material specifications for all mulch materials. No material shall be ordered until submittals have been approved by the Engineer. Delivered materials shall match approved materials. All substitutions shall be approved by The Engineer and/or the Town of Ayer Department of Public Works.

Seed shall be brought to the site in unopened bags, whereupon Engineer shall collect certification from bag prior to opening bag and prior to any seeding activity. In addition, a manufacturer's Certificate of Compliance shall be submitted with each seed shipment. These Certificates shall include the guaranteed percentages of Pure Live Seed, based on purity and germination rates, as well as the net weight, harvest, and shipment dates.

Quantities specified are Pure Live Seed (PLS). Greater quantities of ordered seed may be required to achieve actual specified seeding rates. Pure Live Seed is defined as the fraction of pure seed species within the mix that, by standard seed testing practices, will germinate. This is determined by multiplying the percent of seed purity by the percent of seed germination.

ITEMS 755. & 755.9 (Continued)

MATERIALS

Wetland Soil

Compost shall be per the requirements of Section M.1.06.0 Organic Soil Additives.

Wetland soil for wetland restoration or replacement may be either soil excavated from impacted wetland area or manufactured hydric soil. If using soil from the impacted wetland area, soil shall not be compacted or grubbed. If the proposed mitigation site is in an area free of invasive species, wetland soil from the impacted wetland that is infested with invasive plant species shall not be used so as to avoid bringing invasive species to a new location. If the mitigation is adjacent to the infested area, wetland soils from the impacted site may be used as they will inevitably spread into the mitigation site. Manufactured wetland soil shall consist of on-site borrow from the proposed replacement site thoroughly mixed with compost to achieve a target organic content of 10-12% by weight. Where empirical data are lacking, compost to soil ratio shall be 1:2 by volume. Off-site borrow may be used for mixing if approved in advance by the Engineer per these Special Provisions.

No soil, compost, or other soil amendment imported to the work site shall contain seeds, roots, stems, or other viable parts of invasive plants. No soil or soil amendment shall be brought on site without prior approval of the material source. Soils used in the replacement area should be free of rocks greater than 4 inches in diameter.

Sediment Control Barriers

Sediment Control Barriers shall conform to the requirements of the Special Provision for Item 767.121.

Seeding

Seed Mix shall be as specified on the plans, and in the subsequent Special Provisions.

CONSTRUCTION METHODS

Site Preparation

All trees, stumps, brush and other removed vegetation shall become the property of the Contractor to be legally disposed of offsite or recycled for use.

The Contractor shall plan and execute operations in such a manner that the amount of excavated and exposed fill is minimized and foreign materials are prevented from being washed or otherwise carried into the replacement area or into nearby wetland resource areas.

ITEMS 755. & 755.9 (Continued)

Erosion and Sediment Control

Stake out replacement area boundaries in the field prior to excavation. Install sediment control barriers along the edge of the proposed replacement site. The siltation barrier shall begin and end in the surrounding upland and shall be placed so that no excavated material or disturbed soil can enter adjacent wetlands or waters. The siltation barrier shall act as a limit of work barrier for all heavy equipment. Siltation fencing needs to be entrenched in soil to prevent sediment transport.

Filter tubes shall be sized and filled to achieve at least 12 inches in height. Bags shall be tamped to ensure good contact with soil. The Contractor shall maintain the filter tubes in a functional condition at all times, including inspections after each rainfall and at least daily during prolonged rainfall and shall immediately correct all deficiencies.

Engineer shall inspect and approve erosion and sediment control measures prior to excavation work. Contractor shall remove sediment deposits as necessary to maintain the filters in working condition.

Suitable erosion and sedimentation control consisting of a filter berm, compost tube, or siltation fence shall be installed around the replacement to control the discharge of water draining into and from the replacement area.

Excavation

Final wetland replacement area shall be staked for approval prior to clearing and excavation. Environmental protection measures, including hay bales, silt fence, compost filter tubes or berms, shall be in place prior to any construction activities. Limits of replacement area shall be adjusted to protect root systems of existing trees: limits shall be a minimum of 6 feet from trunk of trees to the extent possible. However, the total area of wetland mitigation required by permit(s) shall not be reduced.

Unless otherwise directed, the contractor shall excavate the replacement area to a depth of 12 inches below finished grade.

If hydric soil from the impacted wetland is being used and the replacement area is not ready for placement, the soil may be temporarily segregated by horizon (topsoil, subsoil) and stored in a site approved by the Engineer. The stockpiled soil shall be placed in the proper order in the replacement area as soon as practicable and with a minimum of handling. The Contractor shall provide water to keep the soil moist, whether stockpiled or placed in the replacement area. All stockpiled soils shall be outside the resource area and at least 100 feet from the edge of resource areas and buffer zones. All material should be covered with plastic or a tarpaulin and watered as necessary to prevent desiccation. Stockpiled soil shall be surrounded by hay bales or filter tubes/berms to prevent migration of sediment. In the event there is excess borrow, it shall be disposed of in an upland area and stabilized without additional compensation.

ITEMS 755. & 755.9 (Continued)

Backfill and Grading

The Wetland Specialist and the Construction Observer will oversee all grading activities. The Contractor shall take measures necessary to ensure that the elevations of constructed replacement area blend without interruption with those of protected wetland areas.

Sequence and execution of work will ensure minimal compaction and that no heavy equipment travels over placed replacement soil.

Following excavation and grading of the site to sub-grade, and after the sub-grade elevations are approved by the Engineer, wetland soils shall be placed in two lifts over the replacement area as shown on the Plans and Cross Sections and/or as directed by the Wetland Specialist.

Contractor shall provide sufficient approved wetland soil to reach a depth not to exceed 12 inches. The finish elevations within the wetland replacement area shall be surveyed to ensure that the correct topography and hydrology are met. No breaks in elevation shall result upon removal of siltation barriers and other erosion- control devices. The finished grade shall be at an elevation that will provide a hydrologic connection between the replacement area and adjacent wetlands or water source. The Contractor shall verify that this elevation is not at a level that could dewater an adjacent wetland. The hydrologic connection should be in keeping with restoring the intended function of the replacement wetland.

After placement of soil is complete, the soil surface shall be raked to a relatively even, but roughened planting surface, except for topography changes around any trees that are selected to remain. If area has been dewatered, natural water levels shall be restored.

Upon completion of the excavating, filling and grading of the replacement area, filter berms, filter tubes or a hay bale barrier shall be placed around the entire perimeter to protect it until completion of project construction. The erosion-control devices shall be removed after plants are established and in accordance with performance standards from the applicable permits. The ground under the siltation barriers shall be reseeded with the wetland mix when the barriers are removed.

PLANTING & SEEDING

Once soils have been placed, no heavy equipment shall travel across replacement or restoration areas.

All seeding will take place under the supervision of the Wetland Specialist. At least 75 percent of the replacement surface area shall be reestablished with wetland plant species within two growing seasons of planting in accordance with the Massachusetts DEP Wetlands Protection Act Regulations, Corps of Engineers mitigation guidance, and applicable permit conditions.

ITEMS 755. & 755.9 (Continued)

Seeding

NE Wet Mix shall be applied after the soil has been raked and before mulch has been applied. Seed shall be sown by hand or by small mechanical lawn seeder unless otherwise approved by the Engineer. No fertilizers are necessary unless otherwise directed by the Wetland Specialist.

Water seeded areas within same day. Spray of water shall not disturb seed on the soil surface. Any seeded area disturbed by watering or other construction activity shall be re-seeded at no additional cost. Watering shall continue as necessary for germination and establishment of seed.

Compost Mulch

Upon completion of seeding and/or planting, all disturbed areas up to the limit of the replacement area shall be lightly mulched with 1-2 inches of compost and seeded.

Removal of Erosion Protection Measures

Upon completion of all construction and once soils are stabilized with a uniform cover of vegetation, sediment control barriers shall be removed and disposed of off-site. Contractor shall rake out filter berms so that filter material is no greater than 3 inches in depth on soil substrate. If filter has been wrapped in fabric or fabric bags, all bag material shall be cut and removed and disposed of off-site by the Contractor, at no additional cost to the project. Filter material shall then be raked out.

MAINTENANCE AND REPLACEMENTS

Monitoring will be performed in order to ensure satisfactory establishment and compliance with the performance standards for Bordering Vegetated Wetland from the Massachusetts Wetlands Protection Act Regulations at 310 CMR 10.55 (4)(b) or with any other requirements of the Department of Environmental Protection, Corps of Engineers, and applicable permits.

At the end of each of the growing seasons, the Wetland Specialist shall complete and submit a progress report detailing the relative success or failure of the replacement efforts.

Replication area shall be monitored for invasive species. All invasive species shall be removed as specified by the Wetland Specialist.

Completion Inspection

Area shall be inspected to document that it has been constructed such that it meets the intent of the design with regard to soils, grading, hydrologic connection, erosion control, and seeding. A written report must be submitted to the Engineer which documents construction of the mitigation area, materials, final grades, final total area of mitigation, and digital photographs showing final conditions.

ITEMS 755. & 755.9 (Continued)

First Inspection

Wetland Specialist will conduct an inspection at the end of the first full growing season or 180 growing season days after seeding, whichever comes first. A written report must be submitted to the Engineer documenting viability of the mitigation area, hydrology, condition of vegetation, evidence of invasive plant species, and any other information required by permits, DEP and Corps of Engineers regulations and requirements.

Seeding shall have seventy-five percent (75%) uniform cover by wetland species to be accepted as having satisfactory evidence of growth. Any areas that are unsatisfactory shall be reseeded. All reseeded, together with necessary re-grading, soil amendment and erosion control, shall be done at the expense of the Contractor.

Second Inspection

The Wetland Specialist shall make a second inspection at the end of the second growing season. All written reports shall be provided to the Engineer as described under First Inspection.

Seeding shall have ninety percent (90%) uniform cover by wetland species to be accepted as having satisfactory evidence of growth. Any areas that are unsatisfactory shall be reseeded. All reseeded, together with necessary re-grading, soil amendment and erosion control, shall be done at the expense of the Contractor.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Wetland replacement area shall be measured as per Square Yard of wetland replacement completed and shall be paid for as such. Cost shall be full compensation for the work described above, surveying of areas and existing conditions, evaluation of presence of satisfactory existing wetland (hydric) soils for reuse in the replacement area, excavation, provision and placement of suitable wetland soil materials, grading, and protection of the work and all inspections and reports. The cost shall also be full compensation for wetland soil, seeding, fertilizers, watering, treatment of invasive species, inspections, and all incidental costs for the satisfactory establishment of the wetland replacement area.

Professional Wetland Specialist shall be paid per hour under Item 755.9. Contractor shall submit a breakdown of costs for all activities. Contract quantity is based on estimate of work appropriate for this contract.

ITEM 756. NPDES STORMWATER POLLUTION PREVENTION PLAN LUMP SUM

This Item addresses the preparation and implementation of a Storm Water Pollution Prevention Plan required by the National Pollutant Discharge Elimination System (NPDES) and applicable Construction General Permit.

GENERAL

Pursuant to the Federal Clean Water Act, effective March 10, 2003, construction activities which disturb 1-acre, or more are required to apply to the U.S. Environmental Protection Agency (EPA) for coverage under the NPDES General Permit for Storm Water Discharges from Construction Activities. On July 1, 2003 (68 FR 39087), EPA published the final NPDES construction general permit for construction activity. On August 4, 2003 (68 FR 45817), EPA reissued the General Permit for the Commonwealth of Massachusetts and included state specific requirements.

The roadway drainage system operating within the limits of this project is part of the Nashua River watershed. The contractor shall conduct all operations pursuant to the construction of this project such that pollutants including sediment and debris are minimized. All work within the drainage system shall be performed in a manner that will minimize sediment and other debris from being discharged into the drainage system. Drainage manhole remodels, adjustments and rebuilds shall be done in the dry and the inverts shall be cleaned out before water is allowed to pass through the system. Cement materials shall also be removed from the inverts after the work is complete or before a major storm event which would require that the system be used.

MATERIALS

The contractor shall have on site at all times a separate container or toolbox which shall have a minimum of two oil spill kits on site at all times consisting of the following items:

- 20 Pads, Heavy Wt.
- 4 Socks, 3"x48"
- 2 Socks, 3"x8'
- 2 Pillows, 18"x18"
- 2 Bag Ultrasorb, 5 lbs.
- 6 Temp Disposal Bags
- 6 Plastic Zip Ties
- 6 Pr Nitrile Gloves
- 6 Pr Safety Goggles
- Instruction Sheets and personnel trained in the use of the equipment.
- Provide additional socks as needed to mitigate silts from pumping operations

The box shall be visible and locked and labeled with the contractor's name and "Emergency Spill Kit". The contractor shall have a key to the box on site at all times and a second key shall be provided to the DPW Superintendent.

ITEM 756. (Continued)

CONSTRUCTION METHODS

The equipment box or container shall be mobile and shall be kept within 300 feet of any heavy equipment activities. The contractor shall make all subcontractors aware of the location of the box on site.

Concrete or Controlled Density Fill cleanouts shall be done in utility and or earth trenches to prevent cement residues from entering the drainage system.

Pumping systems designed and established by the contractor for the purposes of bypass pumping drainage shall be subject to these requirements. The contractor shall provide siltation control devices to mitigate silts that may be developed by the pumping operations.

Silt sacks shall be installed as specified in Item 697.1 Silt Sack.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Payment for this item shall be as follows. An initial payment equal to 50% of the Contract Lump Sum price shall be paid only after the container and materials have been delivered to the site and approved by the Engineer. The remaining 50% of the Lump Sum shall be paid at the contract close-out.

Item 756. will be measured and paid at the Contract unit price per Lump Sum. Such payment shall be considered full compensation for all materials, tools and equipment needed to provide the materials noted herein. Any oil, chemical or petroleum spills on site shall be cleaned up by the contractor as required and the material used shall be disposed of in accordance with MassDEP requirements for disposal. All materials used shall be replaced immediately. All costs associated with cleaning up oil, chemical or petroleum spills and maintaining all materials shall be considered part of the cost of this item.

ITEM 765.

SEEDING

SQUARE YARD

The work under these items shall conform to the relevant provisions of Section 765 of the Standard Specifications and the following:

GENERAL

Seeding for impacts related to abutting residential properties outside of the regulatory areas shown on the Wetland Replication Plan shall conform to the *Grass Seed Requirements for Lawn Grass Areas* outlined in Section M6.03.0.

Seeding locations within the regulatory areas shall be *New England Roadside Wet Mix or New England Roadside Upland Seed Mix* outlined by the boundaries shown on the Wetland Replication Plan included as part of the contract documents, unless otherwise directed by the Engineer or the Town of Ayer.

METHOD OF MEASUREMENT

The quantity of seeding shall be the number of Square Yards based on actual measurements made over the general contour of the areas seeded, complete in place, and accepted.

BASIS OF PAYMENT

Payment will be made based on the provisions defined in Section 765 of the Standard Specifications.

ITEM 767.121

SEDIMENT CONTROL BARRIER

FOOT

The work under this item shall conform to the relevant provisions of Sections 751 and 767 of the Standard Specifications and Section 670 of the Standard Supplemental Specifications and shall include the furnishing and placement of a sediment control barrier. Sediment control barrier shall be installed prior to disturbing upslope soil.

GENERAL

The purpose of the sediment control barrier is to slow runoff velocity and filter suspended sediments from storm water flow. Sediment barrier may be used to contain stockpile sediments, to break slope length, and to slow or prevent upgradient water or water off road surfaces from flowing into a work zone. Contractor shall be responsible for ensuring that barriers fulfill the intent of adequately controlling siltation and runoff.

Twelve-inch diameter (after installation) compost filter tubes are intended to be the primary sedimentation control barrier.

For small areas of disturbance with minimal slope and slope length, the Engineer may approve the following sediment control methods:

- Straw tubes/wattles which shall be trenched
- Straw bales which shall be trenched

Additional barriers (adding depth or height) shall be used at specific locations of concentrated flow such as gully points, steep slopes, or identified failure points in the sediment capture line.

Where specified or required by permits, silt fence shall be used in addition to compost filter tubes or straw bales and shall be incidental to the item.

MATERIALS AND CONSTRUCTION

Prior to initial placement of barriers, the Contractor and the Engineer shall review locations specified on the plans to ensure that the placement will provide maximum effectiveness.

Barriers shall be staked, trenched and/or wedged as specified herein and shall be securely in contact with existing soil such that there is no flow beneath the barrier.

Compost Filter Tube

Compost material inside the filter tube shall meet M1.06.0, except for the following: no manure or bio-solids shall be used; no kiln-dried wood or construction debris shall be allowed; material shall pass through a 2-inch sieve; and the C:N ratio shall be disregarded.

Outer tube fabric shall be a knitted mesh with 1/8 - 3/8" openings and made of 100% biodegradable materials (i.e., cotton, hemp or jute).

ITEM 767.121 (Continued)

Compost filter tubes shall be a minimum of 12 inches in diameter installed. Tubes shall be placed, filled, and staked in place as required to ensure stability against water flows. All tubes shall be tamped, but not trenched, to ensure good contact with soil.

Where reinforcement is necessary, additional tubes shall be installed as shown on the plans.

Straw Bales

Straw bales shall conform to the requirements of Section M6.04.3 of the Standard Specifications and the following:

Bales should be a minimum size of 12 x 16 x 36 inches and shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.

The bales shall be trenched and backfilled. The trench shall be excavated the width of the bale and the length of the proposed barrier to a depth of 4 inches. After the bales are staked the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier.

Straw Wattle

Straw wattle shall be a minimum of 12 inches in diameter. Straw filling shall conform to the requirements of Section M6.04.3, shall be encased in durable netting, and shall have a density of 3 lb/foot.

Straw wattle shall be trenched in 3 inches deep and staked according to the plans. The wattles shall be sufficiently secure on the upstream side to prevent water flowing underneath the wattle.

Silt Fence

Materials and Installation shall be per Section 670.40 of the Standard Supplemental Specifications and the following:

Silt fence shall be used when specified by Orders of Condition or other permitting.

When used with compost filter tubes, the tube shall be placed on a minimum of 8 inches of folded fabric on the upslope side of the fence. Fabric does not need to be trenched.

When used with straw bales, an 8-inch deep and 4-inch wide trench or V-trench shall be dug on the upslope side of the fence line. One foot of fabric shall be placed in the bottom of the trench followed by backfilling with compacted earth or gravel. Stakes shall be driven 16 inches into the ground on the down slope side of the trench and shall be spaced such that the fence remains vertical and effective.

Width of fabric shall be sufficient to provide a 36-inch high barrier after fabric is folded or trenched. Sagging fabric will require additional staking or other anchoring.

ITEM 767.121 (Continued)

Stakes

Stakes for anchoring Compost Filter Tubes, Straw Wattles, and Straw Bales shall be as shown on the plans and shall be a minimum of 1x1 inch diameter x 4 feet hardwood stakes.

When used with Silt Fence, stakes for Compost Filter Tubes shall be driven 12 inches into the ground, Stakes for Straw Bales shall be driven 16 inches into the ground.

Stakes of other material of equivalent strength may be used if approved by the Engineer.

MAINTENANCE

Maintenance of Sediment Control Barriers shall be per Section 670.40 of the Standard Supplemental Specifications or per the Stormwater Pollution Prevention Plan (SWPPP).

The contractor shall inspect the sediment barrier after each rain event and as specified in relevant permits to ensure that they are working effectively and as intended. Contractor shall be responsible for ensuring that an effective barrier is in place for all phases of the contract.

Barriers that decompose naturally due to weatherization over time such that they no longer provide the function required shall be repaired or replaced as directed. If the resulting berm of compost within the fabric tube is sufficiently intact and continues to provide water and sediment control, barrier does not necessarily require replacement.

DISMANTLING & REMOVING

Barriers shall be dismantled and/or removed when construction work is complete and when site conditions are sufficiently stable to prevent surface erosion and after receiving permission to do so from the Engineer.

For all instances, all nonbiodegradable material, including photo-biodegradable fabric, plastic netting, nylon twine, and silt fence, shall be removed and disposed off-site by the Contractor regardless of site context.

For naturalized areas, biodegradable, natural fabric and material may be left in place to decompose on-site. Compost filter tubes may be left as they are with stakes removed. Straw bales shall be broken down and spread evenly. All nylon or nonbiodegradable twine shall be removed along with silt fence. Wooden stakes may be left on site, placed neatly and discretely.

ITEM 767.121 (Continued)

In urban, residential, and other locations where aesthetics is a concern, the following shall apply:

- Filter tube fabric shall be cut and removed, and compost shall be raked to blend evenly (similar to a soil amendment or mulch). Not more than a 2-inch depth shall be left on soil substrate.
- Straw bales shall be removed and disposed off-site by the Contractor. Areas of trenching shall be raked smooth and disturbed soils stabilized with a seed mix matching adjacent grasses (i.e., lawn or native grass mix).
- Silt fence, stakes, and other debris shall be removed and disposed off-site. Site shall look neat and clean upon completion.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 767.121 will be measured and paid for at the contract unit price per Foot of sediment control barrier which price shall include all labor, equipment, materials, maintenance, dismantling, removal, restoration of soil, and all incidental costs required to complete the work.

Silt fence, when used in conjunction with compost filter tubes or straw bales, will be incidental to this item.

Additional barriers, such as double or triple stacking of compost filter tubes, shall be paid for per foot of tube installed.

Barriers that have been driven over or otherwise damaged by construction activities shall be repaired or replaced as directed by the Engineer at the Contractor's expense.

ITEM 767.9

MATTING FOR EROSION CONTROL

SQUARE YARD

Work under this item shall conform to the plans and the relevant provisions of Section 767 and the following:

GENERAL

The work shall include the furnishing and placement of permanent erosion control matting for slope protection and stabilization as shown on the plans and as directed by the Engineer, after the placement of Loam Borrow and seed. Matting shall be placed on all slope's steeper than 1 vertical foot to 3 horizontal feet.

MATERIALS

Furnish material that is clean, sound and free of rips or tears. Staples shall be U-shaped with eight (8) inch legs and one (1) inch crowns from 6 gauge or larger wire. Erosion control mats shall be undyed, untreated, biodegradable, jute, coconut coir, or other approved yarn woven into a plain weave mesh with approximately 0.65 to one (1) inch square openings.

Jute mesh shall be a uniform open plain weave fabricated from jute yarn that does not vary in thickness by more than 1/2 from its normal diameter. The mesh shall not exceed one (1) by one (1) inch in size and with an average weight of 0.5 kg/cm +/- 5% when tested in a standard atmospheric condition according to ASTM D 1776.

CONSTRUCTION REQUIREMENTS

Install according to the manufacture's recommendations. Install mats to soil surfaces that are at final grade, stable, firm, and free of rocks or other obstructions. Spread mats evenly and smoothly, without stretching, to ensure direct contact with the soil at all points. Unroll fabric parallel to the drainage flow direction. Drive all staples flush with soil surface. Repair damage areas immediately. Restore the soil in damaged areas to finished grade, re-fertilize, and re-seed.

Place upslope mat end in a vertical, six (6) inch deep slots. Staple the mat end along the bottom of the slot at twelve (12) inch intervals. Backfill the slot and compact. Staple the outer edges at six (6) foot intervals. Overlap the abutting edges by four (4) inches. Staple the overlap at three (3) foot intervals. Overlap the roll ends by eighteen (18) inches with the upslope end on top. Staple the overlap at twelve (12) inch intervals. Turn the downslope mat end under six (6) inches of mat and staple along the fold at twelve (12) inch intervals. Staple throughout the mat at staggered two (2) foot intervals.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Matting for erosion control will be measured for payment by the Square Yard, complete in place. Overlapped matting will not be measured for payment. Contract unit price shall include all labor, materials, equipment, and incidental costs required to complete the work.

ITEM 816.81

TEMPORARY TRAFFIC CONTROL SIGNAL

LUMP SUM

GENERAL

The temporary traffic control signal is a temporary system for controlling the flow of traffic in single lane two-way traffic locations and at residential driveways and shall be cancelled upon completion of the construction project. The system shall have no less than two (2) individual Portable Traffic Signals (PTS), and three (3) individual Portable Driveway Assistance Devices (PDAD) linked together through either radio controlled or microwave communications to comprise the system. The temporary traffic control signal (TTCS) system shall comply with the requirements of the MUTCD and shall be installed and utilized as designated by this Special Provision, the MassDOT Standard Specifications for Highways and Bridges, the Plans, and the Engineer.

1. Portable Traffic Signals shall be trailer-mounted. Each trailer shall be self-contained and consist of two signal heads. One signal head shall be mounted on a mast arm capable of extending over the travel lane. The other signal head shall be mounted on a vertical upright.
2. Portable Driveway Assistance Devices shall consist of 1 – signal trailer with 1 – retractable signal head per trailer. Signal heads shall be mounted in the horizontal position.
3. The Contractor shall be responsible to install and maintain the PTS and PDAD as required for this contract. The Contractor shall furnish the Engineer with names and phone numbers of persons to be contacted in case of a malfunction. The Contractor shall keep a signal log in the cabinet to track all maintenance work they complete on the PTS and PDAD. This log shall be placed within a plastic cover and shall at least include the description of the trouble call, corrective action taken, date, time, and personnel who completed the work.
4. Any changes to the PTS and/or PDAD location, signal timing and phasing shall be approved by Ayer DPW and the Engineer.

MATERIALS

PTS Trailer

The trailer and all mounted equipment shall conform to the wind load requirements as described in the 2001 AASHTO Standard Specifications for Highway Signs, Luminaries and Traffic Signals 4th edition. The PTS trailer shall be equipped in such a manner as to provide legal transport on the public highway system. Each trailer shall be equipped to minimize overturning from wind and various terrain conditions when in the operating position. No additional ballast shall be used to meet the requirements of the AASHTO Standard Specifications. Each PTS trailer shall be equipped with four stabilizing/leveling jacks, one on each corner of the trailer. The PTS trailer shall have adequate structural integrity to facilitate lifting and placing the PTS trailer as required. Two people shall be able to maneuver the PTS when in the collapsed position and set-up the unit to its fully extended position.

ITEM 816.81 (Continued)

PDAD Trailer Requirements

Physical Requirements

Overall Length	74 in.
Overall Width	56 in.
Operational Height	108 in.
Ground Clearance	13 in.
Coupler (Class III)	2 in. ball style
Axle / Suspension	Torq-Flex Independent

The PDAD Trailer shall be painted highway safety orange. Each PDAD Trailer shall be clearly identified with the manufacturer, serial number and emergency phone number.

Signal Heads/Display Requirements

PTS Signal Heads/Display Requirements

The PTS shall meet the physical display and operational requirements of conventional traffic signals as specified in Part IV of the current addition of the Manual on Uniform Traffic Control Devices (MUTCD). Signal Heads shall have three 12-inch LED indications, conforming to ITE Specification “Vehicle Traffic Control Signal Heads” and NEMA Standards TS1 and TS2. Signal heads shall be equipped with visors, which extend beyond the signal head a minimum of 10 inches. The signal heads shall have 5” louvered back plates and have the ability to rotate horizontally 180°. The overhead signal shall have a minimum clearance height of 16 feet measured from the bottom of the housing to the road surface. The top of the signal head shall not exceed 25.5 feet above the road surface. The lower signal head shall be mounted to a vertical upright at a minimum height of 8 feet measured from the bottom of the housing to the road surface.

PTS Pedestrian Display

The pedestrian signal system includes MUTCD-compliant indications intended for controlling pedestrian traffic. The pedestrian signal indications shall consist of a countdown pedestrian type display, APS pedestrian pushbutton, sign, and saddle. The pedestrian indications shall be furnished on a standalone cart. Communications shall be accomplished via a wireless radio link.

ITEM 816.81 (Continued)

PDAD Signal Heads/Display Requirements

The PDAD Trailer shall be equipped with one signal head containing one 12” circular LED module, with two 8-inch diameter Red Arrow LED modules mounted on either side of the circular module. Signal Heads shall be mounted on a retractable vertical upright and equipped with a manual hand crank.

LED modules shall conform to “Vehicle Traffic Control Signal Heads.” Signal heads shall be equipped with visors which extend beyond the signal head a minimum of 10 inches. The signal heads shall have the ability to accommodate back plates. The signal head shall be mounted to a vertical upright at a minimum height of 9’ measured from the bottom of the green indication to the road surface.

Signage for PDAD Requirements

The trailer shall be able to accommodate a minimum of two rigid signs. One sign shall be a 24” x 30” and display “No Turn on Red” (SHS R10-11). The second sign shall be 36” x 36” and display “Yield In Direction of Flashing Red Arrow After Stop” (SHS R10-27(Mod.)). Other sign legends may be used as directed by the Engineer.

Operational Requirements

Each PTS system shall be equipped with an operating system having the following capabilities:

- A conflict monitoring system conforming to NEMA Standards.
- The capability of being operated in a fixed time, traffic actuated or manual control mode.
- Fixed time mode operation option must include the ability to provide a minimum of five automatic signal timing changes within a 24-hour period.
- The operating system shall have the ability to control a minimum of 7 traffic phases.
- Programmable green times from 3 second to 250 seconds and red times from 1 second to 250 seconds in 1 second increments shall be a required.
- The ability to facilitate minimum / maximum green time programming in the traffic actuation mode in a manner that will extend the green times in predetermined programmable segments as required.
- The operating system shall have the capability of facilitating standby modes of red, red flash and yellow flash mode.
- The operating system shall be capable of accommodating a pre-emption system with optical activation which provides a priority green phase in the direction of appropriately equipped approaching emergency vehicles.
- During manual operation, ensure the system provides a means of informing the operator of indications, such as a light on the back of each signal head that illuminates when the signal displays a red indication.
- The PTS shall have a temperature operating range of –30F to 120F.

ITEM 816.81 (Continued)

Controller

The controller shall be an electronic unit housed in a weatherproof, rust resistant box, with a keyed lock and a light for night operation. The housing shall have a jack that will allow direct communication between the on-board controller and a computer. This controller shall have an LCD display screen that will allow the operator to review the status of the system.

The controller shall be capable of controlling a fully activated intersection and shall meet or exceed NEMA TS 2 Standards for fully activated traffic control units. The controller shall have internal communication capability with direct access to the data memory. The controller shall be capable of processing controller, intersection, and system detection data and provide all required intersection control functions. The required controller pre-emption functions shall be internal in the timing unit.

Pre-Emption Emitters

The Contractor shall supply the Town of Ayer Department of Public Works with 12 dash mounted pre-emption emitters for their use. Emitters shall be pre-programmed for compatibility with pre-emption receivers on Portable Traffic Signal System. Emitters shall be returned to the contractor at the completion of the project.

Pre-Emption Confirmation Strobe (White)

The visual signaling beacon shall be a replaceable single-flash xenon strobe lamp. The beacon shall have a universal mount base and clear lens. Light intensity is to be a minimum 400 effective candlepower. Strobe light shall be designed to accept a dome guard and mounting bracket.

CONSTRUCTION REQUIREMENTS

Actuation Requirements

The PTS system shall be actuated on the West Main Street approaches. Acceptable traffic actuation systems include microwave motion sensors, video detection and in pavement loop detection. Acceptable PTS systems shall have the capability of being operated with both a motion and true presence actuation system.

ITEM 816.81 (Continued)

Power Requirements

PTS Power Requirements

The PTS shall operate at an optimal voltage of 12 VDC. The system shall obtain the electrical power necessary for operation from the battery system, a 12 VDC power source supplied by solar power. The charging system shall include 450 watts (minimum) of solar collection capability and an onboard battery charger capable of being used with a 110-volt power source. The system shall also include an onboard monitoring system capable of regulating and providing a visual display of the battery voltage and solar input. Batteries shall be capable of a minimum of 20 days of continuous operation at 22° C (72° F) without charging. **Utilizing a portable generator for a power source is prohibited.**

PDAD Power Requirements

Each PDAD trailer shall be equipped with 8-deep cycle batteries and a 110-volt charger in a lockable weather proof compartment. Batteries shall be capable of a minimum of 20 days of continuous operation at 22° C (72° F) without charging. The PDAD shall also be equipped with a solar charging system to facilitate continuous operating for a minimum of 30 days in temperatures of 10° C (50° F).

Communication Requirements

The communication between PTS and PDAD units shall be Radio –Link, hardware interconnect or microwave communication system. If the hardware communication is utilized the communication cable shall be deployed in a manner that will not intrude in the direct work area of the project or obstruct vehicular and pedestrian traffic. Communications must be effective up to a distance of at least 2500 feet. If the radio link communication option is utilized clear line of sight must be maintained between PTS and PDAD units and the radio system shall conform to the applicable Federal Communication Commission requirements and all applicable state and local requirements.

Malfunction Requirements

The system shall be equipped with diagnostic capabilities in the event of a system default. The system shall have the capability of identifying the default, capable of recording the last 3 signal errors and shall include failure, power loss, low power and changes in programming. Upon detecting a malfunction, PTS system shall revert to a flashing red condition, the PDAD shall revert to a solid red condition, and the Contractor shall be notified by a reliable means approved by the Engineer. The PTS and PDAD system repairs shall be the responsibility of the contractor and shall be rendered in a manner that will return the PTS and PDAD to full operation condition in the most expeditious manner.

ITEM 816.81 (Continued)

METHOD OF MEASUREMENT

Item 816.81, Temporary Traffic Control Signals will be measured as a Lump Sum. The Lump Sum shall consist of all PTS, PDAD, and Pre-Emption Emitters as described in this Special Provision.

BASIS OF PAYMENT

Compensation for Item 816.81 Temporary Traffic Control Signals will be paid for at the Lump Sum price complete in place. Payment shall include furnishing all labor, hardware, equipment, tools, incidentals, and any miscellaneous items necessary for installing, operating, maintaining, moving, relocating, and subsequent removal of the system during the phased construction. Signage for the PDAD Trailers will be paid for under Item 852 – Safety Signing for Traffic Management. 50% of the payment will be authorized once the signal equipment is approved and Phase 1 of the traffic management plan is operational. The remaining 50% of the item will be paid once the temporary signal is deactivated and removed from the project site at the conclusion of staged construction requiring the temporary signal.

ITEM 852.12

TEMPORARY PEDESTRIAN CURB RAMP

EACH

GENERAL

Work under this item shall consist of furnishing, deploying, maintaining in proper operating conditions, and removing temporary pedestrian ramps as part of a Temporary Traffic Control Plans in order to guide pedestrians around a fully- or partially closed sidewalk.

MATERIALS

The Temporary Pedestrian Curb Ramp shall provide a 48-inch minimum width, with a firm, stable, and non-slip surface. Protective edging with a two (2) inch minimum height shall be installed when the curb ramp or landing platform has a vertical drop of six (6) inches or greater.

The Temporary Pedestrian Curb Ramp walkway and landing area surface shall be of a solid, continuous, contrasting color abutting up to the existing sidewalk.

If a Temporary Pedestrian Curb Ramp leads to a crosswalk, a detectable warning pad must be used at the base of the ramp; if it leads to a protected path that does not conflict with vehicular traffic then a detectable pad shall not be used.

CONSTRUCTION METHODS

Turning areas shall be 60 inches by 60 inches minimum.

Lateral joints between any surfaces shall not exceed 0.5 inches. Lateral edges may be vertical up to 0.25 inches high and shall be beveled at 1V:2H between 0.25 inches and 0.5 inches.

The temporary ramps shall be kept clear of debris, snow, and ice and shall not obstruct drainage.

Removal and/or resetting of Temporary Pedestrian Curb Ramps shall be considered incidental.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 852.12 shall be measured and paid for at the Contract price per Each unit installed in place, including all incidental items. This price shall include the cost of furnishing, installing, resetting, removal, and maintaining in good working condition.

ITEM 853.33 **TEMPORARY BARRIER – LIMITED DEFLECTION (TL-3)** **FOOT**

All costs related to providing products or work in conformance with the supplemental requirements of that section shall be considered incidental to the Bid Item.

GENERAL

Work under this item shall consist of furnishing, installing, maintaining and final removal of limited deflection TL-3 temporary barrier systems for channelization of traffic and/or work zone protection. Limited deflection temporary barrier systems shall have a maximum dynamic deflection of 24 inches or less and shall be used in areas where the available clear area behind the barrier system is 12 inches or more.

MATERIALS

The following limited deflection temporary barrier systems are acceptable for use:

1. BarrierGuard 800; Highway Care International.
http://www.highwaycareint.com/product_info/44/barrierguard800
2. J-J Hooks F-Shape Temporary Concrete Barrier; Easi-Set Industries. <http://jjhooks.com/>
3. ZoneGuard; Hill & Smith, Inc. <http://www.hillandsmith.com/zoneguard/>
4. Texas DOT X-Bolt F-Shaped Concrete Safety Barrier

The Contractor may submit alternate materials to the Engineer for approval if the limited deflection temporary barrier system meets the following criteria:

1. The system has been tested by an independent laboratory that is accredited by FHWA to crash test roadside hardware;
2. The system meets the minimum requirements of the AASHTO *Manual on Assessing Safety Hardware* (MASH) at Test Level (TL) 3 or higher; and
3. The system has a federal-aid eligibility letter from FHWA.

Copies of the testing results and the federal-aid eligibility letter shall be submitted and approved by the Engineer prior to procurement of an alternate temporary barrier system.

The Contractor shall supply shop drawings to confirm the available clear area behind the barrier equals or exceeds the maximum dynamic deflection of MASH Test 3-11 during testing procedures taken at an independent laboratory that is accredited by FHWA to crash test roadside hardware.

Delineators shall be installed on all limited deflection temporary barrier systems in conformance with the relevant provisions of Section 850.69 and shall be incidental to the temporary barrier systems.

Temporary impact attenuators (Item 628.31) that are listed on the Qualified Traffic Control Equipment List shall be used whenever a blunt end of the limited deflection temporary barrier system is facing traffic within the clear zone unless it is protected by a second barrier system or secured to a separate barrier system or bridge railing by a method approved by the manufacturer.

ITEM 855.33 (Continued)

CONSTRUCTION METHODS

Limited deflection temporary barrier systems shall be placed in line with the drawings. Installation shall be per the manufacturer's specifications, details, and the approved shop drawings.

The Contractor shall not place any breaks in the limited deflection temporary barrier system that will result in sections that are shorter than the stated minimum length-of-need (LON) under MASH Test 3-11. Exceptions shall be allowed for gate systems or changeable length segments placed over expansion joints if those barrier segment types have been tested and meet the minimum requirements of MASH Test 3-11 with the adjoining limited deflection barrier system.

Within the LON section, limited deflection temporary barrier systems shall only be placed on paved surfaces unless otherwise tested and certified under MASH TL-3 for those conditions.

Damage to the pavement surface caused by the limited deflection temporary barrier during installation, while in service, and/or during removal shall be repaired as directed by the Engineer at the Contractor's expense

Limited deflection temporary barrier systems that require anchorage systems shall conform with the relevant provisions of Section 850.70.

METHOD OF MEASUREMENT

Item 853.33 Temporary Barrier – Limited Deflection (TL-3) will be measured per Foot, in place.

BASIS OF PAYMENT

Compensation for Item 853.33 Temporary Barrier – Limited Deflection (TL-3) will be made at the contract price per Foot for limited deflection temporary barrier installed in place, including all incidental items under Stage 1 identified as part of the Temporary Traffic Control Plans. This price shall include the cost of furnishing, installing, maintaining and final removal of all limited deflection temporary barrier systems.

For limited deflection temporary barrier systems that require anchorage systems, the cost of furnishing and installing the anchorage and hardware and the restoration of pavement surfaces or adjacent permanent barrier systems to facilitate anchorage shall be considered incidental to the cost of the item.

Payment for limited deflection temporary barrier removed and reset as part of subsequent construction stages outlined in the Temporary Traffic Control Plans will be made under Item 853.331 Temporary Barrier – Limited Deflection (TL-3) Removed and Reset.

ITEM 853.331 **TEMPORARY BARRIER – LIMITED DEFLECTION (TL-3)** **FOOT**
REMOVED AND RESET

GENERAL

Work under this item shall consist of removing, transporting and resetting temporary barrier systems and limited deflection temporary barrier systems from alignments established along the roadway to new alignments in accordance with the details shown on the plans, as required by the construction and staged construction operations, and as required by the Engineer for the channelization of traffic and/or work zone protection.

The work shall also include furnishing and installing all hardware and associated materials per the details and/or manufacturer's specifications for anchored or restrained temporary barrier systems.

The work shall also include necessary patches and repairs caused by the temporary barrier system to damaged pavement surfaces or any adjacent longitudinal barrier once the system has been removed.

CONSTRUCTION METHODS

Limited deflection temporary barrier systems shall be removed from existing locations and reset in accordance with the Construction Methods stated in Item 853.33.

Damage to the pavement surface or adjacent permanent barriers caused by removing or resetting temporary barrier shall be repaired as directed by the Engineer at the Contractor's expense.

METHOD OF MEASUREMENT

ITEM 853.331 Temporary Barrier Removed and Reset will be measured by the Foot, in place.

BASIS OF PAYMENT

Compensation for Item 853.331 Temporary Barrier Removed and Reset will be made at the contract price per Foot, which shall provide full compensation for removing, relocating, resetting, realigning, maintaining and transporting the limited deflection temporary barrier system. The Contractor will be paid for this item each time the barrier is relocated either to a new work zone as detailed in the Temporary Traffic Control Plans. The Contractor will not be separately compensated for any work necessary to maintain or re-align units or replace damaged units. No payment will be made for removing and resetting barriers for the purpose of gaining access to the construction work zone. No payment will be made for removing, relocating and resetting any barriers moved for the convenience of the Contractor.

For temporary barrier systems that require anchorage systems, the cost of furnishing, installing and removing the anchorage and hardware and the restoration of pavement surfaces or adjacent permanent barrier systems to facilitate anchorage shall be considered incidental to the cost of the item.

ITEM 874.41 **TRAFFIC SIGN REMOVED AND DISCARDED** **EACH**

Work under this item includes the dismantling, removal, and disposal of any existing signs and supports (including their foundations) not to be used under this contract, as directed by the Engineer.

GENERAL

The Signs and Supports shall become the property of the Contractor and disposed of by the Contractor.

The work shall include removing and disposal of the signs and supports, excavation of the existing foundations to a depth of at least 4” below compacted gravel and the restoration or replacement, in kind, of the areas resulting from the excavation.

The existing signs shall not be removed until the new signs and structures replacing them are ready to be installed or as directed by the Engineer.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Items 874.41 will be measured and paid for at the Contract unit price per Each, which price shall include all labor, tools, equipment and materials necessary for dismantling, removing and disposing of the signs and supports as designated above, the excavation and disposal of the existing foundations, the supplying and replacing of compacted gravel backfill, and the restoration or replacement, in kind, of the area where foundations and post are removed, and any other incidental items necessary for the satisfactory completion of this work as specified.

ITEM 950.1

TEMPORARY SHORING

LUMP SUM

The work to be done under this Item shall conform to the applicable provisions of Sections 140 and the relevant sections of Section 900 of the Standard Specifications, amended as follows:

GENERAL

The Contractor shall design, furnish, install, maintain and remove Temporary Shoring as required based upon the actual site conditions to support a portion of the existing superstructure required to remain during Stage 1 of the stage construction operations to maintain one lane of two-way alternating traffic. The Temporary Shoring is to be installed in the general location as shown on the Plans and shall provide the required lane width specified during stage construction operations on West Main Street.

The Temporary Shoring width shall be such that the remaining structure maintains one 11'-0" travel lane and two braced portable concrete barriers; as shown on the Plans. The average height from existing channel to the low chord of the existing structure is approximately 11'-0".

Design

The Temporary Shoring at the location shown on the plans shall be fully designed by the Contractor. The Temporary Shoring shall be designed for an HL-93 design loading in accordance with the AASHTO LRFD Bridge Design Specifications and MassDOT LRFD Bridge Manual with all interims published as of the bid opening date. The Contractor is responsible for determining all geotechnical criteria associated with the temporary shoring.

Submission of Design Calculations and Drawings

Complete Temporary Shoring designs and plans shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts. Prior to installation, the plans and calculations shall be submitted to the Engineer for his review, acceptance, and as evidence that the requirements of these provisions have been fulfilled. Furnishing such plans and calculations shall not relieve the Contractor of sole responsibility for safety of the public, personnel, equipment, and structures, as well as successful project completion.

The design documents prepared by the Contractor shall show the horizontal and vertical extents of the temporary shoring system, the sizes, dimensions and arrangement of the components of the system, construction notes, and any other necessary measures required to allow for the proposed construction. Submittals shall also include an erection plan describing the method of erection proposed and the amount and character of equipment proposed. The Temporary Shoring shall not be installed until the Contractor's design has been reviewed and approved by the Engineer.

ITEM 950.1 (Continued)

MATERIALS

All materials shall conform to all applicable specifications of Section 900. Steel bearing piles shall conform to Section 940 and shall meet the material requirements of Subsection M8.05.1; Structural steel shall conform to Section 960 and shall meet the material requirements of Subsection M8.05.0; and structural timber shall conform to Section 955 and shall meet the material requirements of Subsection M9.05.6. All materials used for Temporary Shoring shall be new (or used but in like-new condition), sound and free from strength-impairing defects and subject to the Engineer's approval. Any materials removed after the proposed construction is in place shall be salvaged to the Contractor.

CONSTRUCTION METHODS

Temporary Shoring shall be installed prior to beginning existing bridge removal operations. The Contractor shall maintain the Temporary Shoring until removal. The maintenance shall consist of weekly joint inspections by the Engineer and the Contractor as to the condition of the shoring. Any repairs deemed necessary by the Engineer shall be completed at the expense of the Contractor.

All welding and the preparations and assembly of material for welding shall conform to the MassDOT Standard Specifications for Highways and Bridges, the Current Supplemental Specifications, the AASHTO Standard Specifications for Highway Bridges and the AASHTO/AWS Bridge Welding Code ANSI/AASHTO/AWS D1.5 and interim revisions published by AASHTO as of the bid opening date.

The Contractor shall accurately locate all utility lines and structures to ensure that the proposed Temporary Shoring will not interfere with any existing utilities and structures. The presence of existing gas facilities requires that vibration be limited during construction. Refer to the Special Provision for Item 1000.2 Gas Main Accommodations for further information regarding the requirements for working around existing gas infrastructure, including but not limited to the need for vibration monitoring as well as specialized excavation and sheet pile installation procedures to adhere to the construction requirements of National Grid Gas.

When the Temporary Shoring is no longer required to maintain traffic on the existing structure, it shall be completely removed and the area restored to its original condition or as shown on the Plans, or as directed.

ITEM 950.1 (Continued)

METHOD OF MEASUREMENT

Temporary Shoring under Item 950.1 will be measured and paid at the contract Lump Sum price, which price shall include full compensation for the Contractor's design and plans; all material, labor, tools and equipment furnished; and driving, coring, drilling, bracing, cutting, removal, and all other work and incidentals necessary for the proper completion of the work specified, as approved, regardless of the type of system the Contractor installs.

BASIS OF PARTIAL PAYMENT

1. The first payment will be made at eighty percent (80%) of the contract Lump Sum bid price of this Item and will be paid upon completion of the shoring installation, to the satisfaction and approval of the Engineer.
2. The second payment will be made for the remaining twenty percent (20%) of the contract Lump Sum bid price for this Item and will be paid upon completion of all work for this Item, including complete removal and satisfactory disposal of the shoring from the project.

ITEM 953.

PERMANENT STEEL SHEETING

FOOT

The work to be done under this Item shall conform to the applicable provisions of Sections 140 and 950 of the Standard Specifications, amended as follows:

GENERAL

The Contractor shall design, furnish, install, and maintain Permanent Steel Sheeting as required based upon the actual site conditions for the protection of the existing structure to remain open to traffic during excavation and construction of the proposed substructure. The intent of the Permanent Steel Sheeting installed at the Stage 1 limit is to allow partial removal of the existing structure during staged construction such that the existing masonry stone abutments remain stable to maintain one-way of alternating traffic. The intent of the Permanent Steel Sheeting installed along the face of the rigid frame and precast wingwall footing toes is to provide permanent scour protection for the structure.

DESIGN

The Permanent Steel Sheeting shall be fully designed by the Contractor for its use in the temporary condition, as well as for scour protection in the final condition. All earth support shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications and MassDOT LRFD Bridge Manual with all interims published as of the bid opening date.

The Contractor is responsible for determining all geotechnical criteria, lateral earth pressures, and hydrostatic pressures associated with the Permanent Steel Sheeting in the temporary condition. Additional lateral earth pressures due to surcharges caused by equipment operation and/or material storage near the top of the excavation shall be considered and incorporated into the design but shall not be less than 250 lb/ft².

The Permanent Steel Sheeting installed at the stage construction joint shall also be designed to resist surcharge pressures from HL-93 loading. The assumed maximum height of retained earth along the stage construction joint is approximately 4' measured from the channel elevation.

The Permanent Steel Sheeting installed at the face of the footing toes shall be designed for scour from the 50-year return frequency storm event. The scour depth for the 50-year event is estimated at 8.5', or to elevation of 197.5' for scour starting at the existing streambed elevation of 206', resulting in a height of retained earth of approximately 11.5'. If adjustments are made to the final streambed elevation during construction, the embedment depth of the Permanent Steel Sheeting shall be adjusted accordingly to provide scour protection to a depth of 8.5' as measured from the final streambed elevation.

ITEM 953. (Continued)

Submission of Design Calculations and Drawings:

Complete Permanent Steel Sheeting designs and plans shall be prepared and stamped by a Professional Engineer registered in the Commonwealth of Massachusetts. Prior to installation, the plans and calculations shall be submitted to the Engineer for review, acceptance, and as evidence that the requirements of these provisions have been fulfilled. Furnishing such plans and calculations shall not relieve the Contractor of sole responsibility for safety of the public, personnel, equipment, and structures, as well as successful project completion.

The design documents prepared by the Contractor shall show the horizontal and vertical extents of the excavation support, the sizes and dimensions of the components of the system, its proposed installation procedure and documentation of constructability, proposed method of bracing, if necessary, construction notes, and any other necessary measures required to allow for the proposed construction. The Permanent Steel Sheeting shall not be installed until the Contractor's design has been reviewed and approved by the Engineer. Any work done, or materials ordered for the work involved prior to approval of the design calculations, plans, and detailed drawings shall be at the Contractor's own risk. The Contractor's steel sheeting design should be submitted to the Engineer for review prior to installation.

MATERIALS

Steel sheeting shall conform to all applicable specifications of Section 950 and shall meet the material requirements of Subsection M8.05.4. All materials used for Permanent Steel Sheeting shall be new (or used but in like-new condition), sound and free from strength-impairing defects and subject to the Engineer's approval.

The Contractor shall furnish the manufacturer's sworn statement, in lieu of mill inspection, for the material furnished and in full accordance with Section 6.00

Shear connectors shall conform to all applicable specifications of Section 960 and shall meet the material requirements of Subsection M8.04.1.

ITEM 953. (Continued)

CONSTRUCTION METHODS

Permanent Steel Sheeting installed at the stage construction joint shall be cut off at the bottom of the concrete footing. Permanent Steel Sheeting installed at the footing toe shall be cut off a minimum of 6" below proposed grade. All steel sheeting cut-offs will become the property of the Contractor and shall be removed by the Contractor from the site. At the option of the Contractor, and approval of the Engineer, the steel sheeting cut-offs may be used as part of the Excavation Support System (Item 953.3). The length of Permanent Steel Sheeting below the specified cut off elevation will be the minimum embedment length required on the approved Permanent Steel Sheeting design drawings.

All welding and the preparations and assembly of material for welding shall conform to the MassDOT Standard Specifications for Highways and Bridges, the Current Supplemental Specifications, the AASHTO Standard Specifications for Highway Bridges and the AASHTO/AWS Bridge Welding Code ANSI/AASHTO/AWS D1.5 and interim revisions published by AASHTO as of the bid opening date

Any portion of the Permanent Steel Sheeting that becomes tilted or damaged shall be repaired, or if in the opinion of the Engineer it cannot properly be adjusted, the Contractor shall replace it at no additional cost.

The Contractor shall accurately locate all utility lines and structures to ensure that the steel sheeting will not interfere with any existing utilities or structures. The presence of existing gas facilities requires that vibration be limited during construction. Refer to the Special Provision for Item 1000.2 Gas Main Accommodations for further information regarding the requirements for working around existing gas infrastructure, including but not limited to the need for vibration monitoring as well as specialized excavation and sheet pile installation procedures to adhere to the construction requirements of National Grid Gas.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Permanent Steel Sheeting will be measured and paid at the contract Unit bid price for the number of linear feet of Permanent Steel Sheeting installed as indicated on the Construction Drawings. The number of linear feet will be the horizontal length measured along a projection of the sheeting on a plane parallel to and midway between the front and rear face of the sheeting wall. The unit bid price shall include full compensation for the Contractor's design and plans; all material, labor, tools and equipment furnished; and driving, bracing, shear connectors, cutting, removal, and all other work and incidentals necessary for the proper completion of the work specified, as approved, regardless of the type of system the Contractor installs.

Payment shall be made based upon the following percentages:

1. 10% of the anticipated total quantity upon approval of design
2. 80% of the measured quantity upon complete installation
3. 10% of the measured quantity upon sheeting being cut to required elevation

ITEM 953.3

EXCAVATION SUPPORT SYSTEM

SQUARE YARD

The work to be done under this Item shall conform to the applicable provisions of Sections 140 and 950 of the Standard Specifications, amended as follows:

GENERAL

The Contractor shall design, furnish, install, maintain and remove Excavation Support System as required based upon the actual site conditions for the maintenance of traffic and support of excavation during the partial demolition of existing substructure, and excavation for and construction of the proposed structure. The Excavation Support System shall be designed by the Contractor and shall be configured to serve the intended purpose during all stages of construction without the need for reinstallation or major modifications.

The Excavation Support System shall consist of sheet piling with or without tiebacks, soldier piling and lagging, braced excavation, or any other system that satisfies the design criteria contained herein. The Excavation Support System must be capable of supporting all loads applied during all stages of construction. The assumed maximum height of retained earth along West Main Street is approximately 18 feet. At all locations, the temporary earth support shall extend longitudinally such that the maximum slope of the excavated (or proposed) surface does not exceed 1 vertical to 2 horizontal. A minimum slope of 1 vertical to 3 horizontal is the shallowest slope assumed to be necessary for transitioning between existing ground and the excavation inside the Excavation Support System. The Contractor may utilize an Excavation Support System that accommodates a flatter transition than 3:1 however, no additional payment will be made for portions of the Excavation Support System necessary to accommodate the flatter slope.

The lowest bottom of sheeting elevation, for measurement and payment purposes, shall be 2' below the bottom of footing. The Contractor may excavate to a lower elevation, but no additional payment will be made if the deeper excavation is made for the Contractor's convenience, or due to Contractor's construction means and methods. If unsuitable material is encountered and the excavation support system and excavation limits must be adjusted for removal of unsuitable materials, the cost of sheeting will be paid for at the contract unit price.

DESIGN

The Excavation Support System shall be fully designed by the Contractor. All earth support shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications and MassDOT LRFD Bridge Manual with all interims published as of the bid opening date. The Contractor is responsible for determining all geotechnical criteria, lateral earth pressures, and hydrostatic pressures associated with the Excavation Support System. Additional lateral earth pressures due to surcharges caused by equipment operation and/or material storage near the top of the excavation shall be considered and incorporated into the design, but not less than 250 lb/ft². The Excavation Support System shall also be designed to resist surcharge pressures from HL-93 loading. If the Excavation Support System is located within the maximum dynamic deflection of the portable concrete barrier-braced, it shall also be designed for forces transferred from a vehicular impact to the portable concrete barrier-braced. Loads transferred from a vehicular impact shall be in accordance with MassDOT Bridge Manual Section 3.3.2.4.

ITEM 953.3 (Continued)

Excavation Support System design shall consider the batter of the back face of existing masonry stone abutments and wingwalls. Adequate embedment for the Excavation Support System is not likely achievable at the interface between the excavation support and the abutment because of existing substructure geometry. If steel sheeting is used, it is likely to require tie-backs, or temporary attachment to the existing masonry stone substructure(s).

Submission of Design Calculations and Drawings:

Complete Excavation Support System designs and plans shall be prepared and stamped by a Professional Engineer registered in Commonwealth of Massachusetts. Prior to installation, the plans and calculations shall be submitted to the Engineer for review, acceptance, and as evidence that the requirements of these provisions have been fulfilled. Furnishing such plans and calculations shall not relieve the Contractor of sole responsibility for safety of the public, personnel, equipment, and structures, as well as successful project completion.

The design documents prepared by the Contractor shall show the horizontal and vertical extents of the excavation support, the sizes and dimensions of the components of the system, its proposed installation procedure and documentation of constructability, proposed method of bracing, method of attachment to the existing substructure, if necessary, construction notes, and any other necessary measures required to allow for the proposed construction. The Excavation Support System shall not be installed until the Contractor's design has been reviewed and approved by the Engineer. Any work done or materials ordered for the work involved prior to approval of the design calculations, plans, and detailed drawings shall be at the Contractor's own risk. The Contractor's excavation support system should be submitted to the Geotechnical section for review before being installed.

MATERIALS

Steel sheeting shall conform to all applicable specifications of Section 950 and shall meet the material requirements of Subsection M8.05.4; structural steel shapes for soldier piles shall conform to M8.05.1; and other structural steel components shall conform to M8.05.0. All materials used for Excavation Support System shall be new (or used but in like-new condition), sound and free from strength-impairing defects and subject to the Engineer's approval. Any materials removed after the proposed construction is in place shall be salvaged to the Contractor.

Fabricated sections and corners shall be bolted and satisfactory for the use intended.

High strength steel may be used at the Contractor's option at no additional cost.

The Contractor shall furnish the manufacturer's sworn statement, in lieu of mill inspection, for the material furnished and in full accordance with Section 6.00.

ITEM 953.3 (Continued)

CONSTRUCTION METHODS

Any portion of the Excavation Support System that becomes tilted or damaged shall be repaired, or if in the opinion of the Engineer it cannot properly be adjusted, the Contractor shall replace it at no additional cost.

All welding and the preparations and assembly of material for welding shall conform to the MassDOT Standard Specifications for Highways and Bridges, the Current Supplemental Specifications, the AASHTO Standard Specifications for Highway Bridges and the AASHTO/AWS Bridge Welding Code ANSI/AASHTO/AWS D1.5 and interim revisions published by AASHTO as of the bid opening date. The Contractor shall accurately locate all utility lines and structures to ensure that the proposed temporary earth support systems will not interfere with any existing utilities and structures.

All damage to the adjacent pavement or ground caused by the use of the chosen Excavation Support System (e.g. voids beneath the pavement or shoulder, pavement or shoulder cracking or subsidence, ground settlement) shall be repaired to the satisfaction of the Engineer at no additional cost. Severe damage which directly affects the safety of the public shall be immediately repaired to the satisfaction of the Engineer. The operation shall be halted until a satisfactory prevention method is instituted.

The presence of existing gas facilities requires that vibration be limited during construction. Refer to the Special Provision for Item 1000.2 Gas Main Accommodations for further information regarding the requirements for working around existing gas infrastructure, including but not limited to the need for vibration monitoring as well as specialized excavation and sheet pile installation procedures to adhere to the construction requirements of National Grid Gas.

Upon completion of the substructure improvements and sufficient backfilling to maintain the stability of the adjacent roadway, the Excavation Support System shall be entirely removed from the job site.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Excavation Support System will be measured and paid at the contract Unit bid price for the number of square yards of Excavation Support System installed as indicated on the Construction Drawings. The number of square yards will be obtained by multiplying the vertical length measured between the original ground surface at the site at the time the work commences and the bottom of the excavation immediately adjacent to the Excavation Support System by the actual length of protection system installed measured as shown on the Construction Drawings.

The unit bid price shall include full compensation for the Contractor's design and plans; all material, labor, tools and equipment furnished; and driving, coring, drilling, bracing, mechanical connection to existing substructure, cutting, removal, repair of existing substructure upon removal, and all other work and incidentals necessary for the proper completion of the work specified, as approved, regardless of the type of system the Contractor installs. When the support system is used in staged construction, the quantity of Excavation Support System shall be measured for payment for each stage the Excavation Support System is installed.

ITEM 953.3 (Continued)

In addition to the locations indicated on the Plans, other locations may require excavation support system. If the Contractor elects to install such excavation support, no additional measurement or payment will be made under this Item and will be considered incidental work necessary for the satisfactory completion of the work being completed. No direct payment will be made for any Excavation Support System not indicated on the Plans or in these Special Provisions to be specifically utilized for demolition or construction of the bridge.

Payment shall be made based upon the following percentages:

1. 10% of the anticipated total quantity for all stages of construction upon approval of design
2. 60% upon complete installation of the measured quantity for each stage of construction
3. 30% upon removal of the measured quantity for each stage of construction.

ITEM 983.03

PARTIALLY GROUTED RIPRAP

CUBIC YARD

The work to be done under this item shall conform to the relevant provisions of Section 983 of the Standard Specifications and the following:

GENERAL

This work shall consist of furnishing and installing Partially Grouted Riprap as specified herein and as shown on the Plans or as directed by the Engineer. This scour countermeasure is referenced in FHWA HEC-23, Design Guideline 12, and consists of placing and grouting smaller size stone together to provide resistance to channel bed erosion around a bridge foundation structure. The intent is to “partially” fill the gaps or voids between the stones with grout and bond them together.

Contractor shall demonstrate knowledge of proper placement of riprap and grout to the satisfaction of the Engineer by performing a small sample installation within the work limits as approved by the Engineer.

MATERIAL

A. Riprap

The riprap shall consist of clean, sound, and durable stones and rock fragments. The riprap shall have a nominal median diameter (d_{50}) of 12”, with the required gradation as shown below:

Riprap 12 inch (24” average total layer thickness)	% Smaller Than Given Size By Weight	Sieve Size (Inches)	d_{50} (Inches)
	100	15	
	40	12	12
	0	9	

A riprap sample of 2 cubic yards shall be provided and is subject to Engineer approval, onsite or at the material stockpile location, prior to placement.

ITEM 983.03 (Continued)

B. Grout

The grout shall be a fine Portland cement grout conforming to the following:

Material	Quantity by weight for one cubic yard	MassDOT Standard Specification
Portland Cement Type II	740 to 760 lb	Section M4.01.0
Fine Aggregate (sand), dry	1,180 to 1,200 lb	Section M4.02.02
1/4" to 3/8" crusher chips (very fine gravel), dry	1,180 to 1,200 lb	Section M2.01.6
Water	420 to 450 lb	Section M4.02.04
Air entrained	5% to 7%	Section M4.02.05

Contractor may submit an alternate design to the Engineer for approval. The mix shall result in a wet grout density ranging from 120 to 140 lb/ft³ with a minimum compressive strength of 2000psi. The final amount of water shall be added on site to achieve the desired consistency.

CONSTRUCTION

The Contractor shall notify the Engineer at least 2 working days prior to the first placement of Partially Grouted Riprap.

A. Ground Preparation

The Partially Grouted Riprap shall be installed on the cast-in-place concrete footing for the rigid frame and precast wingwall system and ground preparation should not be necessary. However, should Partially Grouted Riprap be required in other areas, the following shall apply. The subgrade of the Partially Grouted Riprap area shall be clear of all deformities such as roots, grade stakes and large stones. The entire area shall be smooth so that intimate contact with the filter can be achieved. To obtain required streambed elevations, clean borrow meeting the requirements of MassDOT Standard Specifications Section, M2.01.4, 3/4" Crushed Stone, may be used as a leveling base. Minor excavation and shaping shall be performed to the extent required to remove obstructions, to prepare an optimal contact surface for the filter, and to place the top of the Partially Grouted Riprap in a way that conforms with the established streambed elevations.

B. Riprap Placement

- a. The rock for riprap shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks.

ITEM 983.03 (Continued)

- b. Riprap placement shall be by hand with the aid of equipment. It shall be placed in a manner to prevent damage to structures and extra care shall be taken as to not damage the concrete footings or precast elements. Dumping riprap from any height is unacceptable.

Riprap shall be placed as shown on the Plans or as directed by the Engineer. The design thickness of the riprap shall be a minimum of 24” (2 times the stone diameter); due to the nature of the substrate, the minimum thickness may not be achievable in some areas and a shallower thickness may be necessary. See Plans for placement limits of the riprap in the channel and the bank areas.

- c. Placed riprap shall be washed clean after placement but before grouting commences.

C. Grout Placement

- a. Material testing shall be performed onsite, including, but not limited to, air content, compressive strength cylinders, and flow tests. The grout mix shall be subjected to a flow table tap test or slump flow test and the final amount of water in the mix shall be adjusted as necessary to meet the allowable criteria below:

Flow Table Tap Test:

- The flow table shall have a grip, a hinge, and be approximately 28in x 28in.
- The upside-down funnel for the specimen shall be open at the top and the bottom, be 8 in high, and have 5 in top diameter and an 8 in base diameter.

<u>Number of taps</u>	<u>Allowable range of grout diameter</u>
0	13 to 15 in
15	19 to 21 in

Slump Flow Test:

- The test shall be in conformance with ASTM Spec C1611 with a Visual Stability Index of 0 or 1.
- b. Truckloads of no more than 4 CY and a small trailer-mounted grout pump, with a discharge hose diameter of no greater than 3”, shall be used to control the rate of grout placement. Optimal grout flow rate is no more than 10 gal/min to allow for a manageable and uniform rate of placement on the riprap slope. The rate of grout placement shall be as follows in order to partially fill approximately $\frac{1}{3}$ to $\frac{1}{2}$ of the total voids between the stones:

For 12-inch d_{50} riprap, grout shall be placed at a rate of 2.7 to 3.2 cubic feet per square yard of riprap surface area.

ITEM 983.03 (Continued)

D. Conveying and placing

The grout mix shall be delivered to the site and placed within 1.5 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to accelerated stiffening of the concrete, the time between the introduction of the cement to the aggregates and complete discharge of the grout batch shall be a maximum of 45 minutes. The engineer may allow a longer time provided the setting time of the grout is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case concrete shall be conveyed from the mixer to the final placement as rapidly as practicable by methods that prevent segregation of the aggregates, loss of mortar, displacement of the rock riprap, or a combination of these.

Grout mix shall not be allowed to free fall more than 5 feet unless suitable equipment is used to prevent segregation.

The grout mix shall not be placed until the rock riprap has been inspected and approved by the engineer for the placement of grout.

Rock to be grouted shall be kept moist for a minimum of 2 hours before grouting.

The rock riprap shall be flushed with water before placing the grout to remove the fines from the rock surfaces. The rock shall be kept moist before the grouting and without placing in standing or flowing water. Grout placed on inverts or other nearly level areas may be placed in one operation. On slopes, the grout shall be placed in two nearly equal applications consisting of successive lateral strips about 10 feet in width starting at the toe of the slope and progressing upward. The grout shall be delivered to the place of final deposit by approved methods and discharged directly on the surface of the rock. A metal or wood splash plate is used to prevent displacement of the rock directly under the grout discharge. The flow of grout shall be directed with brooms, spades, or baffles to prevent grout from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be conducted to loosen tight pockets of rock and otherwise aid in the penetration of grout to ensure the grout fully penetrates the total thickness of the rock blanket. All brooming on slopes shall be uphill. After the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing. The surface finish, following the completion of grout installation, shall consist of one-third of the rock extended above the level of grout. The exposed rock shall not have a plastered appearance.

After completion of any strip or panel, no individual(s) or equipment shall be permitted on the grouted surface for 24 hours. The grouted surface shall be protected from injurious action by the sun, rain, flowing water, mechanical injury, or other potential damaging activity.

ITEM 983.03 (Continued)

E. Curing and protection

The completed finished surface shall be prevented from drying for a minimum curing period of 7 days following placement. Exposed surfaces shall be maintained in a moist condition continuously for the 7-day curing period or until curing compound has been applied as specified in this section. Moisture shall be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand, or other approved material. Water or moist covering shall be used to protect the grout during the curing process without causing damage to the grout surface by erosion or other mechanisms that may cause physical damage.

The grouted rock may be coated with an approved curing compound as an alternative method to maintaining a continuous moisture condition during the curing period. The compound shall be sprayed on the moist grout surface as soon as free water has disappeared and all surface finishing has been completed. The compound shall be applied at a minimum uniform rate of 1 gallon per 175 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed grout and/or concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified for the original treatment.

Grout mix shall not be placed when the daily minimum temperature is less than 40 degrees Fahrenheit unless facilities are provided to ensure that the temperature of the material is maintained at a minimum temperature of 50 degrees Fahrenheit and not more than 90 degrees Fahrenheit during placement and the curing period. Grout mix shall not be placed on a frozen surface. When freezing conditions prevail, rock to be grouted must be covered and heated to within a range of 50 to 90 degrees Fahrenheit for a minimum of 24 hours before placing grouting material.

F. Dewatering

Riprap placement and grouting shall be completed in the dry.

Dewatering shall be maintained for a minimum of 2 hours after all grouting has been completed.

All water pumped from the excavation area shall be pumped to a water containment area for processing prior to releasing back to the stream, and shall conform to either the NPDES Stormwater Pollution and Prevention Plan (Item 756) or the following, whichever is stricter:

The water containment area shall be large enough to allow for proper sediment removal, and dilution of the effluent during grouting to a pH level lower than 9.0 prior to being returned to the stream. Separate basins may be used. The Contractor shall use as many basins as necessary to achieve proper treatment. The released effluent shall then be passed through a silt-fence barrier before re-entering the stream. Grouting operations shall be adjusted as necessary to maintain water quality standards.

ITEM 983.03 (Continued)

METHOD OF MEASUREMENT

The measurement for payment of Partially Grouted Riprap will be the total number of Cubic Yards of in place Partially Grouted Riprap installed as specified on the Plans or as approved by the Engineer.

The work shall include supplying, transporting, stockpiling, and placing all riprap and grout, along with all other related and necessary materials, work, equipment and testing in accordance with the Plans and specifications, including but not limited to excavating, and shaping the subgrade.

The demonstration of the Contractor's experience with Partially Grouted Riprap installation shall not be measured and shall be considered incidental to the work.

BASIS OF PAYMENT

The accepted quantity of Partially Grouted Riprap will be paid for at the contract unit price per cubic yard as measured in place.

The bid price shall include all costs for supplying, transporting, stockpiling, and placing all riprap and grout, along with all other related and necessary materials, work, equipment and testing in accordance with the Plans and specifications, including, but not limited to, excavation and ground preparation, water containment areas for water treatment during grouting, and curing boxes.

The demonstration of the Contractor's experience with Partially Grouted Riprap installation shall not be paid for separately but shall be considered incidental to the work.

If filter material is required, it shall conform to MassDOT Standard Specifications Section M9.50.0: Geotextile Fabrics, but the cost of the filter material shall be considered incidental to the work.

ITEM 983.4

NATURAL STREAMBED MATERIAL

CUBIC YARD

The work to be done under this item shall conform to the relevant provisions of Section 983 of the Standard Specifications and the following:

GENERAL

This work shall consist of furnishing and placing natural streambed material on the channel bed and bank as well as inside, upstream and/or downstream of, a structure to set a desired channel profile, maintain a natural bed appearance, and maintain aquatic organism passage. The ultimate product will, to the extent possible, replicate the function and appearance of the existing brook. The natural streambed material is an important element to comply with environmental permits issued for the project.

MATERIAL

The natural streambed material is to be installed as depicted on the plans.

Natural streambed material is a mixture of streambed stone, gravel, fine sand, and organic material with the approximate gradation, composition, and appearance of the existing streambed.

Granular material excavated on-site with similar composition to the existing streambed material may be used as natural streambed material with the approval of the Engineer. Soil that must be imported from offsite to use as natural streambed material shall be locally sourced.

CONSTRUCTION

The Contractor shall notify the Engineer at least 2 working days prior to the first placement of natural streambed material.

Natural streambed material shall be placed as shown on the Plans, in layers not more than 12 inches in depth. After placement of each layer, natural streambed material shall be washed into the in-place native streambed material until voids are filled and sealed, so that water ponds on the surface. Fill voids by hand tamping with metal tamping rods, by shaking stone with the teeth of an excavator bucket, and/or by spraying water to settle fines between large stones. Plate compactors shall not be used. The purpose for filling the voids is to prevent subsurface flow where water disappears into the voids that may exist between stones below the channel bed surface.

Prior to removing the control of water and returning normal stream flow, the finished streambed, including apron areas, shall be thoroughly saturated. Any remaining voids shall be filled by washing in natural streambed material until the surface is sealed and water ponds on the surface. After the Contractor has received approval for the placement of the natural streambed material, the Contractor shall remove the water diversion structures in such a way to minimize the initial sediment pulse. Every attempt shall be made to minimize the downstream movement of sediment.

ITEM 983.4 (Continued)

Loam and Seeding (Item 765.) shall be placed over the natural streambed material above the limits of the mean annual high-water level (MAHWL) prior to removing the water diversion structures.

METHOD OF MEASUREMENT

The quantity of natural streambed material to be measured for payment will be the number of Cubic Yards natural streambed material imported to the site and installed in the complete and accepted work, measured within the limits shown on the Plans or as directed by the Engineer.

When it is impractical to measure natural streambed material in place, it may be measured in vehicles at the point of delivery. When measured in vehicles, the quantity for payment shall be 80% of the quantity shown on delivery slips. Material washed in to fill voids or seal the surface shall not be measured separately but will be considered incidental.

BASIS OF PAYMENT

The accepted quantity natural streambed material will be paid for at the Contract unit price per Cubic Yard. Payment will be full compensation for furnishing, transporting, and placing the material specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work, including washing in natural streambed material to seal the surface.

ITEM 991.1

**CONTROL OF WATER
STRUCTURE NO. A-19-014 (C1R)**

LUMP SUM

The work to be done under this Item shall conform to the relevant provisions of Section 140 and consists of the work required for the control of water to construct the proposed bridge foundation and partially grouted riprap in the dry as shown on the plans, and as directed by the Engineer, and as specified herein.

The Contractor shall follow the guidelines of this specification for which dewatering is to be accomplished. However, except for payment, all work shall conform to the relevant requirements of Section 140.

GENERAL

The Contractor shall install and maintain any required dewatering systems such that all work shall be done in dry conditions. The Contractor shall construct and maintain all necessary protective works, shall furnish all materials required and shall furnish, install, maintain, and operate all necessary equipment for the removal of water and control of water in the work area as required.

It is the responsibility of the Contractor to design the water control structures to be used as part of the dewatering placed in front of the structure as shown in the Corps of Engineers Permit, which is included herein. Additionally, as part of the work under this Item, it is the responsibility of the Contractor to determine the need for and extent of sand bags, sedimentation basins, dewatering techniques, sedimentation controls, system maintenance, and other water diversion features to control water and sediment at the site. Construction operations shall be conducted in such a manner as to minimize siltation and prevent contamination of the waterway.

The water control structures shall be fully designed by the Contractor. All earth support shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications and MassDOT LRFD Bridge Manual with all interims published as of the bid opening date.

The Contractor is responsible for determining all geotechnical criteria, lateral earth pressures, and hydrostatic pressures associated with the water control structures. Additional lateral earth pressures due to surcharges caused by equipment operation and/or material storage near the water control structures shall be considered and incorporated into the design.

Prior to the start of work, the Contractor shall submit a water control plan to the Engineer for approval. This shall include the actual process of executing the excavation operations including equipment and methods of dewatering and sedimentation controls.

The Contractor shall submit complete working drawings and computations of the proposed dewatering system with supporting data as necessary to the Engineer for approval in accordance with Subsection 5.02 and the Special Provisions. These drawings shall be accompanied by design calculations. Both shall be certified by a Professional Engineer registered in the Commonwealth of Massachusetts.

ITEM 991.1 (Continued)

The Contractor shall make their own evaluation of existing conditions and water flow, and of the effects of their proposed temporary works and construction methods, and shall provide in their design for all loads and construction conditions necessary to permit construction of the specified structures while maintaining public safety and protecting complete work and all third party property from damage resulting from their operation. Hydraulic analysis information prepared during the design phase of this project is provided for informational purposes and is located in Appendix L.

Measures to control the discharge of pollutants into water resource areas shall include, but not be limited to, the following:

- Rigorous management of construction operations involving potentially hazardous materials, such as, refueling and maintenance of construction equipment.
- Formulation of contingency plans to control accidental spillage from potentially hazardous materials.
- Siting of construction staging areas outside of the buffer zones on relatively flat ground.
- Scheduling of work within the resource areas to avoid periods of high flood (e.g., spring floods) and inclement weather.
- Installation and continuous maintenance of staked hay bales and filter fences to prevent sediment migration into adjacent downstream resource areas. Placement of erosion controls shall be as shown on the plans, as specified herein, or as directed by the Engineer, so as to accomplish maximum control of project related sediment mobilization. Additional erosion control measures shall be employed as necessary to prevent erosion and sedimentation of the streambed. These measures shall be maintained for the duration of the contract.
- All discharge resulting from dewatering activities shall be directed to temporary sedimentation/retention basins located as necessary to control turbidity. At no time shall said discharge be directly released into adjacent resource areas.

The Contractor shall provide temporary steel sheeting, water barriers, sandbags, filtering fabrics, silt fencing, sedimentation/retention basins and/or other effective procedures or structures together with all labor, materials, and equipment necessary for controlling water in the foundation and riprap areas. Such work shall be subject to the approval of the Engineer, but such approval will not relieve the Contractor of responsibility for the adequacy of construction, maintenance, operation and safety of the water control system. Also included shall be all necessary permits that may be required in performing the work under this item. Upon completion of the work, all temporary steel sheeting, water barriers and/or sandbags, etc., shall be removed from the site except for permanent steel sheeting that shall remain around the bridge.

METHOD OF MEASUREMENT AND PAYMENT

Under Item 991.1 of the Contract, the Contractor will be paid the Contract Lump Sum Price for Control of Water, which price shall include full compensation for all labor, tools, equipment, materials, installation, maintenance, and removal of any temporary water barriers such as concrete barriers, sandbags, or other diverting systems or material, all filter fences, sedimentation/retention basins, and all incidental work necessary to complete the work under this item to construct proposed Bridge No. A-19-014.

ITEM 995.01

**BRIDGE STRUCTURE,
BRIDGE NO. A-19-014 (C1R)**

LUMP SUM

GENERAL

The work under this Item shall conform to the applicable provisions of Section 995 of the Standard Specifications and the specific requirements stipulated below for component parts of this Item. For those component parts where no specific requirement is stipulated, the Standard Specifications shall apply except for payment.

Work under this Item shall include all materials, equipment and labor needed to construct all elements of the bridge, including but not limited to the following:

- Cast-in-Place Concrete Pedestal Walls and Footings
- Cast-in-Place HP Concrete Overlay and Sidewalks
- Precast Concrete Rigid Frame
- Membrane Waterproofing
- Bituminous Damp-Proofing
- S3-TL4 Bridge Railing
- Precast Concrete Retaining Wall

The work does not include any items listed separately in the proposal. Payment for materials shown on the Plans as being part of this bridge structure or which may be incidental to its construction and are not specifically included for payment under another Item shall be considered incidental to the work performed under this Item and shall be included in the unit price of the component of which they are a part.

Utility Coordination

The Contractor shall coordinate with the Town of Ayer Department of Public Works regarding the temporary and permanent relocation of the 10” diameter sewer main and 12” diameter water main. The Contractor shall install the utility supports, steel sleeves through the abutments, hangers, insulation, and sleeve caps for the permanent sewer main and water main locations, as shown on the Plans. All costs associated with the temporary location and permanent installation (including sleeves through the rigid frame legs, sleeve caps and utility supports) shall be included in Items 250.10 and 303.12.

The Contractor shall coordinate with National Grid (Gas) regarding the existing 8” diameter critical gas transmission main and the existing 4” diameter gas distribution main. Both the 8” gas transmission and 4” gas distribution mains will be relocated to the south fascia of the replacement bridge as part of this project. The Contractor’s role and responsibilities related to the gas main work are paid for under Item 1000.2 Gas Main Accommodations; refer to the applicable Special Provisions for more detailed information.

ITEM 995.01 (Continued)

The Contractor shall coordinate with Verizon regarding the 12-4” PVC telecom ducts within the structure. The telecom ducts will remain in service during construction and will be temporarily supported. The Contractor’s role and responsibilities related to temporary and permanent work for Verizon’s telecom ducts are paid for under Item 1000.1 Data Conduit Accommodations; refer to the applicable Special Provisions for more detailed information.

The Contractor shall coordinate with National Grid (Electric) regarding the relocation of utility poles and overhead wires associated with the removal of the existing structure / installation of precast elements / sheet piling. National Grid Electric shall be responsible for all costs related to utility pole / overhead wire relocations.

4000 PSI, 3/4 INCH, 585 HP CEMENT CONCRETE

The work under this heading shall be used to construct the cast-in-place concrete overlay, headwalls and sidewalks and shall conform to requirements and application provisions of Section 901 of the Standard Specifications. The concrete shall conform to all material requirements contained in Subsection M4.06.1 of the Supplemental Specifications, with the exception of the cementitious content, which shall be limited to a maximum of 585 pounds per cubic yard.

The construction joint between the headwall and sidewalk shall be sealed with high molecular weight methacrylate crack sealer, which is considered to be incidental to this work. The Contractor shall submit to the Engineer product data for the high molecular weight methacrylate crack sealer and obtains approval before work commences. Methacrylate crack sealing shall be performed in accordance with the manufacturer’s instructions within the allowable ambient temperature range. The cracks shall be v-notched to a minimum depth of ½” (12 mm) and shall be cleaned with compressed air. The notch shall then be inspected to confirm that the crack was intercepted. If the crack was not intercepted, the notch shall be expanded to intercept the crack and shall then be re-cleaned with compressed air. Methacrylate shall then be poured into the crack. The crack shall then be observed for seepage of methacrylate and shall be refilled as necessary to ensure the crack is completely filled. If large quantities of methacrylate are used and the crack is not getting filled, the crack should be filled with pre-bagged dried silica sand filler and the crack shall then be re-filled with methacrylate. Methacrylate crack sealer shall consist of a high molecular weight low viscosity methacrylate monomer that when catalyzed will produce a crack-healer/penetrating-sealer that is a rapid-curing, modified-methacrylate resin. The methacrylate material shall, as a minimum, provide the following as applied properties:

PROPERTY	VALUE	TEST
Viscosity	< 25 cps	ASTM D2393
Bond Strength	> 1500 psi	ASTM C882
Tensile Elongation	> 3%	ASTM D638

ITEM 995.01 (Continued)

STEEL REINFORCEMENT FOR STRUCTURES

The work under this heading shall conform to the applicable provisions of Section 901 of the Standard Specifications and the following:

The work under this heading does not include any items listed separately. Mechanical reinforcing bar splicers shall be considered as incidental to the work involved in the furnishing and placing of reinforcing steel. All mechanical reinforcing bar splicers shall be chosen from the MassDOT QCML and submitted to the Engineer for approval.

PRECAST CONCRETE RIGID FRAME

All costs related to providing products or work in conformance with the supplemental requirements of that section shall be considered incidental to the Bid Item.

This work shall consist of designing, fabricating, and installing a precast three-sided concrete rigid frame and appurtenances. The frame sections shall conform to the dimensions (span and rise) and geometry shown on the Plans. Headwall reinforcement and/or mechanical splicers for the headwall reinforcing shall be cast into the exterior sections as shown on the plans.

Included in the scope of the Precast Concrete Rigid Frame construction are the precast concrete headwalls, steel reinforcement for the frame and headwalls, sealants, miscellaneous steel, hardware, segmental unit erection, and miscellaneous items necessary for a complete installation.

The Contractor shall confirm the sewer main and water main penetrations through the rigid frame leg and coordinate the locations and sizes with the Precast Concrete Rigid Frame manufacturer prior to preparing shop drawings. The contractor shall also coordinate with National Grid Gas and the precast concrete rigid frame manufacturer regarding measures necessary for the permanent relocation of the gas transmission and distribution mains to the south bridge fascia (including penetrations through the precast concrete wingwalls); refer to the Special Provision for Item 1000.2 Gas Main Accommodations for further information.

QUALITY ASSURANCE

The contractor installing the Precast Concrete Rigid Frame shall have demonstrated experience constructing Precast Concrete Rigid Frame and shall use personnel having demonstrated experience in the installation procedures as specified herein.

ITEM 995.01 (Continued)

MATERIALS

The Contractor shall be responsible for the purchase or manufacture of the precast concrete rigid frame, panel/reinforcement connections, joint filler, and all other necessary components. The Contractor shall furnish to the Engineer the appropriate Certificates of Compliance certifying that the applicable frame materials meet the requirements of the project specifications. All materials used in the construction of the Precast Concrete Rigid frame shall meet the requirements specified in the following subsections of Division III, Materials Specifications of the MassDOT Standard Specifications and the latest supplemental specifications, and as specified herein.

Materials not conforming to this section of the specifications or from sources not listed in the contract documents shall not be used without written consent from the Engineer.

Precast Concrete Rigid Frame

The frame units shall be fabricated in accordance with Section M4 and Section 901, with the following exceptions and additions:

- A. Precast Concrete Rigid Frame units shall be manufactured of 5000 psi, $\frac{3}{4}$ ", 685 HP cement concrete.
- B. Reinforcing steel for precast panels shall be coated reinforcing bars in accordance with Section M8.

Grout

Grout used for the joints between frame elements and lifting and erection anchor recesses shall be high-strength non-shrink listed on MassDOT's "Qualified Construction Materials List" and shall be in accordance with Section M4.04.0. Additional aggregates shall not be added to the material during field mixing, unless otherwise recommended by the grout manufacturer. The grout when thoroughly mixed shall be readily pourable so that it completely fills the shape of the shear key joint.

Flexible Watertight Gaskets

Flexible watertight gaskets between the sections shall meet the physical requirements of ASTM C-990 and AASHTO M-198.

Acceptance of Material

The Contractor shall furnish to the Engineer a Certificate of Compliance certifying that the above materials comply with the applicable contract specifications. A copy of all test results performed by the Contractor necessary to ensure contract compliance shall also be furnished to the Engineer. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

ITEM 995.01 (Continued)

SUBMITTALS

- A. Design computations demonstrating compliance with the criteria specified herein and shown on the Plans, prepared and signed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts. The design calculations shall include:
1. Statement of all assumptions made, and copies of all references used in the calculations.
 2. Analyses demonstrating compliance with all applicable earth, water, surcharges, seismic, or other loads, as specified herein and required by AASHTO.
 3. The designers shall provide all corrosion protection devices necessary for the rigid frame to have a minimum service life of 75 years in the proposed location and environment
- B. A detailed resume of the frame designer listing similar projects and demonstrating necessary experience to perform the rigid frame design, including a brief description of each project that is similar in scope. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.
- C. A detailed listing of precast rigid frames that the contractor has constructed, including a brief description of each project and a listing of personnel who will construct the frames, demonstrating their experience in construction of precast concrete rigid frames. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address, and current phone number.

ITEM 995.01 (Continued)

- D. Shop Drawings showing the configuration and all details, dimensions, quantities, and cross-sections necessary to construct the precast concrete rigid frame, including but not limited to the following:
1. Fully and accurately dimensioned plan and elevation views showing the geometry of the sections including all projections, recesses, notches, openings, blockouts, etc.
 2. A typical cross section, which include details for the proposed methods for connecting to proposed conditions.
 3. General notes pertaining to design criteria and wall construction.
 4. A listing of the summary of material quantities for each rigid frame section.
 5. Details and bending schedules of steel reinforcing showing clearly the size, spacing and location including any special reinforcing required. Reinforcing or ties provided under lifting devices shall be shown in detail.
 6. Details of sleeves, pipes, utility attachments and other embedded items to be cast into the members, whether detailed on the Contract drawings or provided for the Contractor's convenience (such as inserts, lifting devices, etc.).
 7. Drainage design detail and design scheme.
 8. Location of utilities.
 9. Sequence and schedule of construction, including overall construction schedule.
 10. Method of monitoring plumbness and deviation of rigid frame sections.
 11. Any acceptance testing and frequency.
 12. Details and location of all necessary construction and expansion joints.
- E. Assembly and Erection Plans prior to erecting the precast units. At the Contractor's option, assembly and erection plans may be submitted as one plan set.
1. Assembly Plans:
 - i. Include a timeline and descriptions of Quality Control activities throughout construction.
 - ii. Include detailed sequence of construction and a timeline for all operations including installation of shims/leveling devices and installation of grout within shear keys.
 - iii. Include leveling bolt assembly details and design calculations, if required.
 - iv. Include methods and procedures for controlling tolerance limits both horizontally and vertically.
 2. Erection Plans:
 - i. 1. Preparation and submission of the erection procedures, including the information and calculations to be provided, shall be in accordance with the applicable requirements of Section 960.61, D.

Prior to performing any work under this Section, the Contractor shall have received approval for all submittals for the precast concrete rigid frame. The Contractor shall bear full responsibility and costs for all materials ordered or work performed prior to approval of the submittals or written authorization from the Engineer.

ITEM 995.01 (Continued)

Design Requirements

The precast concrete rigid frame shall be as specified herein and as shown on the Plans and be designed in accordance with AASHTO LRFD Standard Specification for Highway Bridges 8th Edition and the 2013 MassDOT LRFD Bridge Design Manual for HL-93 live loading. Where conflicting requirements occur, the more stringent shall govern. The design computations shall consider all loadings as are appropriate for each stage of fabrication, shipment, construction and upon completion. The utilities carried by the frame should be considered in the design.

The precast concrete headwalls shall be designed to resist traffic impact loads in accordance with the AASHTO LRFD Bridge Design Specification for Highway Bridge for a minimum load of HL-93 test level 4 (TL-4).

CONSTRUCTION

Precast Concrete Rigid Frame

The frame units shall be fabricated in accordance with Section M4 and Section 901, with the following exceptions and additions:

- A. Inspection and Rejection: The quality of materials, process of manufacture, and finished units shall be subject to inspection by the Engineer prior to shipment. Precast units may be subject to rejection on account of failure to conform to this specification. Individual units may be rejected because of any of the following:
 1. Variations in the exposed face that substantially deviate from the approved architectural model as to color, texture, relief, and reveals in accordance with precast concrete industry standards.
 2. Dimensions not conforming to the following tolerances:
 - i. Position of panel connection devices within 1", except for coil and loop imbeds which shall be 3/16". All other dimensions within 3/16".
 - ii. Panel squareness as determined by the difference between the two diagonals shall not exceed 1/2".
 - iii. Surface defects on smooth-formed surfaces measured over a length of five feet shall not exceed 1/8". Surface defects on textured-finished surfaces measured over a length of 5' shall not exceed 5/16".
 3. Defects indicating honeycombed or open texture.
 4. Defects which would affect the structural integrity of the unit including cracked or severely chipped wall units.
- B. Unless otherwise indicated on the plans, the concrete surfaces shall be finished in accordance with Section 901.68 and as modified herein. The wall units shall be cast on a flat area. The coil embeds, tie strip guide, and other galvanized devices shall not contact or be attached to the face panel reinforcement steel.

ITEM 995.01 (Continued)

- C. The date of manufacture, production lot number, and the piece mark shall be clearly scribed on an unexposed face of each panel.
- D. All units shall be handled, stored, and shipped in such a manner as to eliminate the dangers of chipping, discoloration, cracks, fractures, and excessive bending stresses. Wall units in storage shall be supported in firm blocking to protect the panel connection devices and the exposed exterior finish.
- E. The joints between the units shall be made watertight utilizing flexible rubber or plastic gaskets. Mechanical device shall be used as shown on the plans to connect individual sections together.

Delivery, Storage, and Handling

The precast concrete rigid frame shall be as specified herein and as shown on the Plans and be designed in accordance with AASHTO LRFD Standard Specification for Highway Bridges 8th Edition and the 2013 MassDOT LRFD Bridge Design Manual for HL-93 live loading. Where conflicting requirements occur, the more stringent shall govern. The design computations shall consider all loadings as are appropriate for each stage of fabrication, shipment, construction and upon completion. The utilities carried by the frame should be considered in the design.

The precast concrete headwalls shall be designed to resist traffic impact loads in accordance with the AASHTO LRFD Bridge Design Specification for Highway Bridge for a minimum load of HL-93 test level 4 (TL-4).

Field Construction

- A. General: Precast concrete bridge elements shall be installed to the line and grade shown on the plans in accordance with the Contractor's approved erection procedures and in accordance with relevant provisions of these Standard Specifications. Prior to installation, the Contractor shall confirm that Compressive Strength Results have achieved Design Strength, $f'c$.
- B. Erection: The Contractor shall supply competent workmen and equipment sufficient to install the precast concrete elements in a safe, accurate, workmanlike manner. Erection shall be performed in accordance with the approved erection procedure, as described in Section 960.61, Erection. The precast concrete elements shall be lifted only by the lifting hooks, and the utmost care shall be taken to prevent distortion of the elements during handling, transportation or storage. The design of the lifting hooks shall be the responsibility of the Fabricator. The lifting hooks shall be designed to meet the requirements for lifting devices as specified under Section 960.61, Erection.

ITEM 995.01 (Continued)

- C. Filling of Shear Keys: Non-shrink grout, approved by the Engineer, shall be placed as shown on the plans and in strict accordance with the specifications and manufacturer's recommendations and instructions. As required by the approved shop drawings, joints shall be filled flush to the top with non-shrink grout, and any vertical misalignment between adjacent elements shall be feathered out on a slope of 1 to 12.

Curing of grout or concrete shall be performed in strict accordance with the specifications and manufacturer's recommendations. Filling shall not be completed in cold weather when either the ambient temperature or the precast member's temperature is below the manufacturer's recommendation. No localized heating of either the precast members or of the air surrounding the element will be permitted in an attempt to reach application temperatures.

If the joints or voids are not filled within five days after the precast elements are erected, the Contractor shall cover and protect the openings from weather and debris until they are filled. Fill all lifting and erection anchor recesses with grout.

- D. Backfilling: Backfilling operations shall not begin until the following checks have been made:
1. The joints between the rigid frame units and wingwall stems are complete as shown on the plans.
 2. All joint seals are properly placed.
 3. Bituminous Damp-proofing has been applied.

ITEM 995.01 (Continued)

Backfill shall be paid for under separate items. The backfilling procedures shall be in accordance with Sections 120, 150, and 170 of the Standard Specifications and Supplemental Specifications, with the following modifications:

1. Fill shall be placed and compacted in layers not exceeding one foot in depth
2. Dumping of fill shall not be allowed any nearer to the structure than 3.25 feet from a vertical plane extending from the back of the footing
3. Backfill shall be placed as symmetrically as possible around the structure with differential depths of backfill on each side of the structure not exceeding 1.5 feet with respect to each other
4. Compaction shall be achieved using hand compaction equipment for all fill within one foot of the structure
5. The bare structure shall not be crossed by any equipment heavier than that specified by the frame manufacturer. All damage resulting from equipment damage shall be rectified to the satisfaction of the Engineer at no cost to the Town
6. Construction equipment will not be permitted atop an uncompleted structure of in contact with the membrane waterproofing
7. Construction equipment whose weight exceeds the design capacity shall not be permitted atop the completed structure under any circumstances

Drainage

Weep holes shall be provided through the legs of the rigid frame units along the wall system and can be shop fabricated or field cored.

MEMBRANE WATERPROOFING FOR BRIDGE DECKS – SPRAY APPLIED

The work under this Item shall conform to applicable sections of Section 965 of the Standard Specifications and the following:

The work to be performed shall consist of the furnishing and application of an approved cold liquid spray applied, seamless methyl methacrylate or polyurea membrane system and all concrete surface preparation work necessary to install the membrane system. The membrane system shall consist of the primer, the membrane, aggregated keycoat layer, and polymer modified tack coat.

GENERAL

Membrane waterproofing application shall be in accordance with the manufacturer's instructions. The Manufacturer's representative shall be present during the entire application and shall oversee surface preparation, installation and quality control testing. The handling, mixing, and addition of membrane components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations. All open flames and spark producing equipment shall be removed from the work area prior to commencement of application in accordance with the Manufacturer's recommendations. No smoking signs shall be posted at the entrances to the work. The Applicator shall be responsible for the protection of equipment and adjacent areas from overspray or other contamination.

ITEM 995.01 (Continued)

Product approval shall require the demonstration, by the Manufacturer, that the membrane system meets the material specifications and that the entire membrane system is designed and tested as waterproofing for use on bridge deck applications. The Contractor and the Applicator shall agree upon a schedule for coordination between trades working in the areas that are to receive the membrane waterproofing system.

SUBMITTALS

The Contractor shall submit to the Engineer for approval the following documents:

1. Initial submission:
 - a. The membrane system material specifications including product performance data.
 - b. Certified independent test reports demonstrating conformance to Table 965.2-1.
 - i. The independent lab shall be recognized by the National Cooperation for Laboratory Accreditation (NACLA) in Construction Materials Engineering and Testing (CMET) or an equal program approved by the Engineer.
 - All testing shall be performed by one independent lab unless approved by the Engineer.
 - ii. Independent testing reports must be dated within two (2) years from the anticipated start of membrane installation.
 - Samples for all required testing shall be fabricated at the same time. Test reports shall denote the lot of material as well as the sample fabrication and testing dates.
 - c. Safety data sheets (SDS) for all components.
2. At the pre-application meeting:
 - a. Manufacturer's written approval of the Applicator's qualifications
 - b. List of personnel performing the installation and the Manufacturer's representative performing the inspection and testing.
 - c. Installation procedure including storage and protection instructions as well as handling and mixing instructions.
 - d. List of application equipment to be used.
 - e. Manufacturer's written approval of the proposed polymer modified tack coat and the application rate that it shall be applied at.
3. A minimum of 48 hours prior to installation:
 - a. A certificate of analysis for the proposed polymer modified tack coat shall be submitted by the supplier of the tack coat to the Engineer for approval.

ITEM 995.01 (Continued)

4. Upon completion of installation:
 - a. All QC installation test results for the tests specified in the materials section, including the name, address and contact person of the laboratory that performed the tests and the date of the tests.
 - b. A Certificate of Compliance certifying that the membrane waterproofing system materials and installation meet the requirements of the Manufacturer and the contract specifications.

MATERIALS

Only products pre-approved by the MassDOT Research and Materials section will be accepted for use. The membrane waterproofing system shall consist of:

- primer
- one or two coat rapid curing cold liquid spray applied seamless methyl methacrylate, polyurea, or polyurethane methyl methacrylate membrane
- aggregated keycoat layer
- polymer modified tack coat

The total minimum base thickness for the membrane shall be 80 mils measured over peaks. The membrane shall easily accommodate the need for day joints and patch repairs. The membrane shall be able to bridge live cracks up to 1/8 inch in width and meet the criteria specified in Table 965.2-1.

The membrane waterproofing system shall be asbestos-free. The primer shall promote adhesion of the membrane to the concrete surface. The chemical composition of the primer, membrane, aggregate keycoat and tack coat that make up the membrane waterproofing system shall conform to the Manufacturer's specifications for the material. All components shall be approved by the Manufacturer as being compatible for use with the specified membrane. Cleaning solvents shall also be approved by the Manufacturer for use with the membrane.

APPLICATOR QUALIFICATION

The waterproofing system shall be applied by an Applicator who is approved by the membrane waterproofing system Manufacturer. The Applicator shall be certified by the membrane waterproofing Manufacturer and have at least 2 years of experience in membrane installation. The Engineer shall receive the Manufacturer's written approval of the Applicator's qualifications at least fourteen (14) days prior to the application of any system component. This approval shall apply only to the named individuals performing the application.

ITEM 995.01 (Continued)

MATERIAL DELIVERY AND STORAGE

All components of the membrane system shall be delivered to the site in the Manufacturer's original packaging, clearly identified with the products type and batch number. The Contractor shall provide the Applicator with a storage area for all components. The area shall be cool, dry, out of direct sunlight and comply with relevant health and safety regulations. Copies of material safety data sheets for all components shall be kept on site at the Contractor's field office.

PRE-APPLICATION MEETING

A minimum of fourteen (14) days before the anticipated start of membrane application, the Contractor shall schedule and conduct a pre-application meeting at the site to review the approved submittals, and other pertinent matters related to the application including the schedule for coordination between trades. At a minimum, the Contractor, the Applicator, the Manufacturer's field representative and the Engineer shall be present at the meeting.

Spray Applied Waterproofing Membrane Material Properties

PROPERTY	TEST	REQUIREMENTS
Solids Content		100%
Stability	ASTM C836	≥ 6 months
Crack Bridging (Neat Material + Aggregated Keycoat)	ASTM C1305*	Pass, no cracking
Extensibility after Heat Aging	ASTM C1522	For information only
Percent Elongation at Break	ASTM D638	≥ 130%
Tensile Strength	ASTM D638 Type IV @ 2 in/min	> 1,100 psi
Shore Hardness	ASTM D2240	≥ 40 D
Minimum Thickness (Membrane only)	ASTM D6132 or other approved method	≥ 80 mils minimum measured over peaks or ≥ thickness used to pass ASTM C1305 (Whichever thickness is greater)
Membrane Waterproofing System Adhesion to Concrete	ASTM D7234	≥ 100 psi minimum and failure in concrete
Water Vapor Transmission – Permeance	ASTM E96 Water Method Procedure B	≤ 1.0 perms [grains / (hr·ft ² ·in. Hg)]

Notes:

* ASTM C1305 shall be modified to 25 cycles at -15°F no failure at 1/8 inch per hour.

ITEM 995.01 (Continued)

APPLICATION PROCEDURE

The installation procedure shall consist of preparation of the concrete surface and application of primer, membrane, aggregated keycoat layer, and polymer modified tack coat. Special attention shall be paid to the bridge deck surface preparation prior to the membrane waterproofing system application. A representative from the membrane manufacturing company shall be present for the entire duration of the membrane system application and shall have the responsibility to ensure that the membrane system is installed in accordance with the Manufacturer's requirements. The Manufacturer's representative shall be also responsible for the field testing including but not limited to adhesion bond testing, deck moisture content measurement, and all other required documentation and reporting.

The membrane waterproofing system shall not be applied in either wet, damp or foggy weather, or when the ambient temperature is 40°F or below or is forecast to fall below 40°F during the application period. The temperature of the concrete deck surface shall also exceed the dew point by at least 5°F.

The membrane waterproofing on bridge decks shall not be placed until the Contractor is ready to follow within 24 hours with the first layer of hot mix asphalt pavement; a longer period of time will be allowed only with prior written approval from the Engineer.

Where the areas to be waterproofed are bound by a vertical surface including, but not limited to, a curb or a wall, the membrane waterproofing system shall be continued up the vertical as necessary. A neat finish with well-defined boundaries and straight edges shall be provided.

1. CONCRETE SURFACE PREPARATION

Concrete surfaces which are to be waterproofed shall be screeded to the true cross section and sounded. All spalls and depressions shall be repaired prior to the application of the primer. Depressions shall be filled to a smooth flush surface with 1:2 mortar (1-part cement to two parts sand) or an approved rapid setting patching mortar that is compatible with the membrane waterproofing system. Other surfaces shall be trimmed free of rough spots, projections, or other defects which might cause puncture of the membrane so that the surface profile of the prepared concrete surface shall not exceed a ¼ inch amplitude, peak to valley.

The use of resin or wax-based deck curing membranes is not acceptable. Unless otherwise approved by the Engineer the concrete shall be cured for a minimum of seven (7) days and aged a minimum of 28 days including curing time, before application of the membrane waterproofing system. For precast, high early strength, or rapid setting concrete mixtures for closure pours the Engineer may consider a curing period less than 7 days. This consideration will be subject to the approval of the Manufacturer and the Engineer and may require a mockup simulating the anticipated construction schedule. If an expedited schedule is approved then results of moisture testing and adhesion testing performed on the actual bridge deck and closure pours by the Manufacturer's representative in accordance with these specifications must be performed and all results shall be submitted to the Engineer for approval prior to primer placement.

ITEM 995.01 (Continued)

Immediately prior to the application of the primer, the concrete to which the membrane is to be applied shall be cleaned of all existing bond inhibiting materials in accordance with ASTM D4259 or as required by the Manufacturer. Dust or loose particles shall be removed using clean, dry, oil-free compressed air or industrial vacuums. The surface preparation shall produce a clean dry surface and ensure that the concrete surface is free of bituminous product, surface laitance, oil staining, soiling, and dust.

Any exposed steel components to receive membrane waterproofing shall be blast cleaned in accordance with SSPC SP6 or as required by the Manufacturer and coated with the membrane waterproofing system within the same work shift.

2. APPLYING PRIMER

The primer shall only be applied when the temperature of the concrete deck surface exceeds the dew point by at least 5°F and when the concrete deck surface has a moisture content of 5% or less as confirmed by a portable electronic surface moisture meter supplied by the Contractor.

The primer shall be applied in a manner to ensure full coverage. The primer shall consist of one coat with an overall coverage rate of 125-175 ft²/gal unless otherwise recommended in the Manufacturer's written instructions. All components shall be measured and mixed in accordance with the Manufacturer's recommendations. The primer shall be spray applied using a single or multiple component spray system approved for use by the Manufacturer. If required by site conditions, brush or roller application shall be allowed. The primer shall be allowed to cure tack-free for a minimum of 30 minutes or as required by the Manufacturer's instructions, whichever time is greater, prior to application of the first lift of waterproofing membrane.

A second coat of primer shall be required if the first coat is absorbed by the concrete. The membrane shall be applied within the primer re-coat drying time allowed by the Manufacturer but in no case shall it exceed 24 hours. Beyond this period, the surface shall be prepared again and re-primed following the Manufacturer's recommendations prior to membrane application.

3. APPLYING MEMBRANE

The waterproofing membrane shall be applied in a methodical manner. The Applicator shall follow the approved mixing and application procedure. Unless approved by the Engineer, the membrane shall be spray applied, with the mixing of the two components taking place at the nozzle and shall be applied to the primed deck in accordance with the Manufacturer's instructions. The spray equipment shall be controlled so that the quantities applied may be monitored and shall allow for coverage rates to be checked.

Following the application of the membrane waterproofing system, the cured surface shall be visually inspected. If any defects or pinholes are found, an appropriate quantity of membrane material shall be mixed and repaired in accordance with Section 7 Repairs below.

ITEM 995.01 (Continued)

In all cases, the thickness of the repair shall be sufficient to bring the area up to the specified thickness. The thickness of the repair patch shall be a minimum of 80 mils, measured over peaks, or the thickness used to pass the ASTM C1305 Crack Bridging Test.

4. APPLYING AGGREGATED KEYCOAT

Following the membrane application, an additional layer of membrane or resin, compatible with the membrane, shall be spray applied to a thickness of 30 to 40 mils into which an aggregate approved by the membrane Manufacturer shall be broadcast ensuring a minimum coverage of 95%. The coverage rate shall be designated by the Manufacturer. The broadcast aggregate shall be durable and provide the required shear resistant to prevent the hot mix asphalt (HMA) from shoving. Aggregate shall have a minimum Mohs hardness rating of seven (7). Loose aggregate shall be removed with brooms or oil/moisture-free compressed air before applying the tack coat.

5. APPLYING POLYMER MODIFIED TACK COAT

The polymer modified tack coat shall be applied in accordance with the membrane Manufacturer's recommendations after a minimum of three hours from initial membrane application. The tack coat shall consist of either a polymer modified asphalt emulsion, or a polymer modified asphalt binder approved for use by the membrane waterproofing Manufacturer and the Engineer. The tack coat shall be allowed to cool for a minimum of 1 hour prior to the application of the hot mix asphalt. The tack coat application rate shall be in accordance with the Manufacturer's recommendation. The application rate shall be monitored by the Quality Control personnel from the paving contractor in accordance with MassDOT approved procedures and shall be verified by the Engineer.

6. PAVING OVER MEMBRANE

Placement of the HMA surface shall be in conformance with Section 450.58 and the contract specifications. During paving, a light soap spray should be applied to the paving equipment wheels to prevent removal of the tack coat.

7. REPAIRS

If an area of membrane requires repair or if the membrane becomes damaged, a patch repair shall be carried out to restore the integrity of the membrane waterproofing system. The damaged area shall be cut back to sound materials and wiped with a solvent up to a width of at least 6 inches beyond the periphery of the damaged area, removing contaminants. The concrete shall be primed as necessary, followed by the application of the membrane. A continuous layer shall be obtained over the concrete with a 6-inch overlap onto the existing membrane. The solvent shall be as approved by the membrane waterproofing manufacturer. Repairs shall comply with the Manufacturer's guidelines for any over-coating times.

ITEM 995.01 (Continued)

Where the membrane is to be joined to existing cured material and at day joints, the new application shall overlap the existing membrane/day joint by at least 4 inches. The existing membrane/day joint shall be cleaned of all contamination including tack coat material or dirt to an edge distance of a least 6 inches and wiped with a solvent as approved by the membrane waterproofing manufacturer.

8. MOCKUP TO VALIDATE BOND STRENGTH

A mockup shall be performed for those projects where the available concrete cure time may adversely affect the required bond strength of the spray applied membrane waterproofing system. A mockup using the approved spray applied waterproofing membrane shall be required before and as close as possible to the intended date of the deck slab waterproofing placement to emulate actual placement conditions. The mockup shall take place offsite and be representative of the specified final bridge placement and shall include placement and surface preparation of the concrete, installation of membrane waterproofing system, and placement of HMA pavement. The intent is to validate the adhesion tensile bond strength in accordance with ASTM D7234 using the membrane Manufacture's primer and membrane.

Testing shall be performed as directed by the Engineer. Testing shall verify the adhesion bond strength and the moisture content on the deck. The moisture content shall be in accordance with Table 965.2-2. The mockup shall simulate the actual job conditions in all respects including air temperature, transit equipment, travel conditions, admixtures, forming, placement equipment, and personnel. If there are problems, the Engineer may require the Contractor to conduct more trial placements.

If weather conditions change between completion of trial testing and actual placement, adhesion bond testing and deck moisture testing shall be repeated as directed by the Engineer. Removal of the mockup concrete from the job site is the responsibility of the Contractor. In addition to the requirements contained herein, all weather and concrete temperature requirements contained in Subsection 901.64 shall be satisfied.

Acceptance of the mockup shall be the responsibility of the Engineer.

PROTECTION OF EXPOSED SURFACES

The Contractor shall exercise care in the application of the waterproofing materials to prevent surfaces not receiving treatment from being spattered or marred. Particular reference is made to the face of curbs, copings, finished surfaces, substructure exposed surfaces, and outside faces of the bridge. Any material that spatters on these surfaces shall be removed and the surfaces cleaned to the satisfaction of the Engineer.

ITEM 995.01 (Continued)

CONTRACTOR QUALITY CONTROL

The following tests shall be conducted by the Manufacturer's representative and recorded on a test report form to be submitted to the Engineer. All test reports shall be submitted to the Engineer within 72 hours of the test completion. Testing shall be in accordance with Table 965.2-2.

- a. Deck moisture: The concrete deck surface moisture content shall be measured by the Manufacturer's representative. The representative shall determine if the deck moisture is suitable to allow for installation to proceed.
- b. Primer Adhesion: Random tests for adequate tensile bond strength shall be conducted in accordance with ASTM D7234 using the membrane Manufacturer's primer. Minimum bond strength of 100 psi and failure in the concrete will be required for acceptance.

Testing shall be at a frequency of 1 test per 5,000 square feet with a minimum of 3 tests per day. Areas smaller than 5,000 square feet shall receive a minimum of 3 tests.

- c. Film Thickness:
 1. Wet film thickness shall be checked every 300 square feet in accordance with ASTM D4414 using a gauge pin or standard comb type thickness gauge or a magnetic gauge. Film thickness checks shall be carried throughout the application process.
 2. Dry Film Thickness: If the membrane waterproofing system cures too quickly to perform wet film thickness testing, dry film thickness shall be checked every 300 square feet in accordance with ASTM D6132 using magnetic or ultrasonic gauges, or using a destructive method. If a destructive method is used, areas shall be repaired in accordance with Section 10 Repairs.
 3. During the Final Review, the cured membrane film thickness shall be checked by a dial thickness gauge.
- d. Pin Hole/Holidays: The entire surface of the membrane shall be inspected for pin holes and/or holidays by the Manufacturer's representative. All pin hole/holidays shall be located, marked for repair, documented, and repaired in accordance with a repair procedure developed by the Manufacturer and approved by the Engineer.
- e. Membrane Adhesion: Random tests for adequate tensile bond strength shall be conducted in accordance with ASTM D7234 using the membrane Manufacturer's primer and membrane. The portion of the membrane to be tested shall be separated from the rest of the membrane prior to performing the test so that only the portion under the dolly receives the tensile force. A minimum bond strength of 100 psi and failure in the concrete will be required for acceptance. Testing shall be at a frequency of 1 test per 5,000 square feet with a minimum of 3 tests per day. Areas smaller than 5,000 square feet shall receive a minimum of 3 tests.
- f. Coverage Rates: Rates for all layers shall be monitored by checking quantity of material used against the area covered.

ITEM 995.01 (Continued)

- g. Visual inspections shall be conducted throughout the application process. The Manufacturer's field representative shall take progress photos for incorporation with his final review report to the Engineer.

Installation Quality Control Testing and Inspection Requirements

PROPERTY	TEST	FREQUENCY	REQUIREMENTS
Deck Concrete Moisture	Manufacturer's recommendation	1 per 5,000 ft ² and minimum of 3 tests	Manufacturer's recommendation
Primer Adhesion to Concrete	ASTM D7234	1 per 5,000 ft ² and minimum of 3 tests	≥ 100 psi minimum and failure in concrete
Film Thickness	Wet: ASTM D4414 Dry: ASTM D6132 or other approved method	1 per 300 ft ² and minimum of 3 tests	≥ 80 mils minimum measured over peaks or ≥ thickness used to pass ASTM C1305 (Whichever thickness is greater)
Pin Holes	Visual Inspection	Entire surface	No visible defects
Membrane Adhesion to Concrete	ASTM D7234	1 per 5,000 ft ² and minimum of 3 tests	≥ 100 psi minimum and failure in concrete

The Engineer shall perform visual inspection of the application and Quality Control during the installation of the membrane system.

Verification Testing

PROPERTY	TEST	REQUIREMENTS
Minimum Thickness (Membrane only)	ASTM D6132 or other approved method	≥ 80 mils minimum measured over peaks or ≥ thickness used to pass ASTM C1305 (Whichever thickness is greater)
Percent Elongation at Break	ASTM D638	≥ 130%
Tensile Strength	ASTM D638 Type IV @ 2 in/min	> 1,100 psi
Shore Hardness	ASTM D2240	≥ 40 D

ITEM 995.01 (Continued)

FINAL REVIEW

The final review and visual inspection shall be conducted jointly by the Applicator, Contractor, Manufacturer's field representative and Engineer. Irregularities or other items that do not meet the requirements of the special provisions and the plans shall be addressed/repared at this time, at no additional cost to the Town.

PRECAST CONCRETE MODULAR WALL

All costs related to providing products or work in conformance with the supplemental requirements of that section shall be considered incidental to the Bid Item.

This work shall consist of designing, fabricating, and installing prefabricated modular reinforced concrete walls at the locations specified in the contract drawings in accordance with these specifications and in reasonably close conformance with the lines and grades shown on the Contract Drawings or established by the Engineer. Included in the scope of the Precast Concrete Modular Wall construction are all grading necessary for wall construction, excavation, support of excavation, bituminous damp-proofing, backfill material, construction of leveling pads, segmental unit erection, steel reinforcement for the walls, miscellaneous steel, hardware and miscellaneous items necessary for a complete installation.

The Precast Concrete Modular Wall shall be designed by the Contractor and shall follow the general dimensions of the wall envelopes shown in the contract plans. Depending on location, the wall may require an opening for drain pipes, cross culverts, or other utilities, which openings and connection design shall be considered incidental to this item. At least two storm drain pipe penetrations are known to be necessary in the northern wingwall systems, and four main gas penetrations in the southern wingwall system; refer to the Special Provision for Item 1000.2 for further information regarding the main gas penetrations. The top of the leveling pad shall be located at or below the theoretical leveling pad elevation. The minimum wall embedment shall be at or below the elevation shown on the plans. The top of the wall units shall be at or above the top of wall elevation shown on the plans. All wall elements shall be within the right-of-way limits shown on the Plans.

The Contractor shall require the design-supplier to supply an on-site, qualified experienced technical representative to advise the Contractor concerning proper installation procedures. The technical representative shall be on-site during initial stages of installation and thereafter shall remain available for consultation as necessary for the Contractor or as required by the Engineer. The cost associated with the representative is incidental to this item.

Approved Prefabricated Concrete Modular Wall systems are:

- T-wall Retaining Wall ® by Concrete Systems, Inc.
- Redi Rock Retaining Wall ™ by Michie Corporation/Capital Concrete Products
- Stone Strong Retaining Wall by MBO Precast

ITEM 995.01 (Continued)

QUALITY ASSURANCE

The contractor installing the Prefabricated Concrete Modular Walls shall have demonstrated experience constructing Prefabricated Concrete Modular Walls and shall use personnel having demonstrated experience in the installation procedures recommended by the manufacturers and as specified herein.

MATERIALS

The Contractor shall be responsible for the purchase or manufacture of the precast concrete modular blocks, geotextile filters, panel/reinforcement connections, bearing pads, joint filler, and all other necessary components. The Contractor shall furnish to the Engineer the appropriate Certificates of Compliance certifying that the applicable wall materials meet the requirements of the project specifications. All materials used in the construction of the Precast Concrete Modular Wall shall meet the requirements specified in the following subsections of Division III, Materials Specifications of the MassDOT Standard Specifications and the latest supplemental specifications, and as specified herein.

Materials not conforming to this section of the specifications or from sources not listed in the contract documents shall not be used without written consent from the Engineer.

Prefabricated Concrete Modular Wall System

The wall units shall be fabricated in accordance with Section M4 and Section 901, with the following exceptions and additions:

- C. Precast Concrete Modular wall system shall be manufactured of 5000 psi, ¾", 685 HP cement concrete.
- D. Reinforcing steel for precast panels shall be coated reinforcing bars in accordance with Section M8.

Joint Materials

Cover all joints between wall units on the back side of the wall with a geotextile fabric. The geotextile fabric shall conform to the requirements of Section M9.50.0, Type II. Slit film and multifilament woven and resin bonded non-woven geotextile fabrics are not allowed for this application. The minimum width of the fabric shall be 12 inches. Lap fabric at least 4 inches where splices are required.

ITEM 995.01 (Continued)

Backfill Material

All backfill materials used in the concrete modular block wall volume shall conform to Gravel Borrow M1.03.0, Type A, and the following additional requirements:

- A. Soundness - The material shall be substantially free of shale or other soft, poor durability particles. The materials shall have a magnesium sulfate soundness loss, as determined by AASHTO T104 (ASTM C88), of less than 30 percent after four cycles.

Leveling Pad

The leveling pad shall be constructed of 2500 psi, 1-1/2 inch, 425-pound cement concrete as specified in Section M4. Leveling pad shall have minimum dimensions of 8 inches thickness and 12 inches width and be placed at the design elevation shown on the plans within a 1/8 inch tolerance.

Acceptance of Material

The Contractor shall furnish to the Engineer a Certificate of Compliance certifying that the above materials comply with the applicable contract specifications. A copy of all test results performed by the Contractor necessary to ensure contract compliance shall also be furnished to the Engineer. Acceptance will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

SUBMITTALS

- F. Design computations demonstrating compliance with the criteria specified herein and shown on the Plans, prepared and signed and stamped by a registered professional engineer licensed in the Commonwealth of Massachusetts. The design calculations shall include:
 - 1. Statement of all assumptions made, and copies of all references used in the calculations.
 - 2. Analyses demonstrating compliance with all applicable earth, water, surcharges, seismic, or other loads, as specified herein and required by AASHTO.
 - 3. Analyses or studies demonstrating durability and corrosion resistance of retaining wall systems for the proposed location and environment. The designers shall provide all corrosion protection devices necessary for the retaining wall to have a minimum service life of 75 years in the proposed location and environment
- G. A detailed resume of the wall designer listing similar projects and demonstrating necessary experience to perform the retaining wall design, including a brief description of each project that is similar in scope. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address and current phone number.

ITEM 995.01 (Continued)

- H. A detailed listing of prefabricated modular wall systems that the contractor has constructed, including a brief description of each project and a listing of personnel who will construct the walls, demonstrating their experience in construction of prefabricated modular block walls. A reference shall be included for each project listed. As a minimum, the reference shall include an individual's name, address, and current phone number.
- I. Manufacturer's product data for the prefabricated modular block wall system, including material, manufacture, erection specifications, all specified erection equipment necessary, details of buried prefabricated modular block wall elements, structures design properties, type of backfill, and details for connections between wall units, as required.
- J. Shop Drawings showing the configuration and all details, dimensions, quantities, and cross-sections necessary to construct the prefabricated modular block wall, including but not limited to the following:
1. A plan view of the wall which shall include Contract limits, stations and offsets, and the face of wall line shown on the Plans.
 2. An elevation view of the wall which shall include the elevations at the top of the wall, and top of leveling pads, at all horizontal and vertical break points. The elevation view shall also show designation as to the type of retaining wall system(s), and an indication of the final ground line and maximum calculated bearing pressures.
 3. A typical cross section or cross sections showing the elevation relationship between existing ground conditions and proposed grades, and the proposed wall configuration, including details for the proposed methods for connecting to proposed conditions. The sections shall also indicate the location of the face of wall shown on the Plans.
 4. General notes pertaining to design criteria and wall construction.
 5. A listing of the summary of material quantities for each wall.
 6. Details of sleeves and pipes and other embedded items to be installed through the walls.
 7. Clearly indicated details for construction of walls around foundations or any other potential obstructions.
 8. Details of the architectural treatment of wall units.
 9. Drainage design detail and design scheme.
 10. Location of utilities.
 11. Sequence and schedule of construction, including overall construction schedule.
 12. Methods of excavation and requirements for proper backfill.
 13. Method of maintaining stability of excavated trenches.
 14. Method of monitoring plumbness and deviation of wall.
 15. Excavation support system, if any.
 16. Any acceptance testing and frequency.
 17. Details and location of all necessary construction and expansion joints.
 18. Connection details at the interface of the wall and any adjacent proposed abutment structure.
 19. Details of impermeable membrane connection to wall units and to runoff collection system.

ITEM 995.01 (Continued)

Prior to performing any work under this Section, the Contractor shall have received approval for all submittals for the prefabricated modular reinforced concrete wall system. The Contractor shall bear full responsibility and costs for all materials ordered or work performed prior to approval of the submittals or written authorization from the Engineer.

Design Requirements

In general, the prefabricated concrete modular block wall system shall be designed in accordance with the manufacturer's requirements, as specified herein and shown on the Plans, and in accordance with AASHTO LRFD Standard Specification for Highway Bridges 8th Edition, Section 11.11. Where conflicting requirements occur, the more stringent shall govern.

The prefabricated modular reinforced concrete wall system shall be designed so that the maximum factored bearing pressure does not exceed 4,500 pounds per square foot. The provided maximum factored bearing pressure is based on an embedment depth of 4.5', an effective footing width of 3', and a maximum settlement of 1".

Wall units shall have tongue and groove, ship lap or similar approved connections along horizontal joints for block-type wall systems, and along both vertical and horizontal joints for panel-type systems.

Prefabricated Concrete Modular Wall units shall be installed on cast-in-place concrete leveling pads.

All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, fences, concrete parapet wall or other appurtenances shown on the Plans shall be accounted for in the stability design of the wall. The concrete anchors required for the utility brackets are incidental to this item.

Walls or wall sections which intersect at an angle of one hundred thirty (130) degrees or less shall include a special corner element to cover the joint formed by the abutting walls or wall sections and to permit relative movement. Corner elements shall not consist of connected standard facing panels.

CONSTRUCTION

Prefabricated Concrete Modular Wall Units

The wall units shall be fabricated in accordance with Section M4 and Section 901, with the following exceptions and additions:

ITEM 995.01 (Continued)

- F. Inspection and Rejection: The quality of materials, process of manufacture, and finished units shall be subject to inspection by the Engineer prior to shipment. Precast units may be subject to rejection on account of failure to conform to this specification. Individual units may be rejected because of any of the following:
1. Variations in the exposed face that substantially deviate from the approved architectural model as to color, texture, relief, and reveals in accordance with precast concrete industry standards.
 2. Dimensions not conforming to the following tolerances:
 - i. Position of panel connection devices within 1", except for coil and loop imbeds which shall be 3/16". All other dimensions within 3/16".
 - ii. Panel squareness as determined by the difference between the two diagonals shall not exceed 1/2".
 - iii. Surface defects on smooth-formed surfaces measured over a length of five feet shall not exceed 1/8". Surface defects on textured-finished surfaces measured over a length of 5' shall not exceed 5/16".
 3. Defects indicating honeycombed or open texture.
 4. Defects which would affect the structural integrity of the unit including cracked or severely chipped wall units.
- G. Unless otherwise indicated on the plans, the concrete surfaces shall be finished in accordance with Section 901.68 and as modified herein. The wall units shall be cast on a flat area. The coil embeds, tie strip guide, and other galvanized devices shall not contact or be attached to the face panel reinforcement steel.
- H. The date of manufacture, production lot number, and the piece mark shall be clearly scribed on an unexposed face of each panel.
- I. All units shall be handled, stored, and shipped in such a manner as to eliminate the dangers of chipping, discoloration, cracks, fractures, and excessive bending stresses. Wall units in storage shall be supported in firm blocking to protect the panel connection devices and the exposed exterior finish.

Delivery, Storage, and Handling

The Contractor shall check the material upon delivery to assure that the proper material has been received. A product certification should be provided with each shipment.

All wall materials and modular block units shall be stored elevated from the ground and protected to prevent all mud, wet cement, epoxy, and like substances from affixing themselves to the wall units or materials. The wall units shall be supported during storage to prevent excessive bending stress. For storage exceeding 30 days in duration, all materials shall be stored in or beneath a trailer or covered with a colored tarpaulin to prevent long-term exposure.

ITEM 995.01 (Continued)

Wall Excavation

Earth excavations shall be in accordance with the requirements of Section 120 and in close conformity to the limits and construction stages shown on the Plans. Sections 120.80, 120.81, and 120.82 do not apply to the work covered in this section. Payment for excavation and incidentals to complete the excavation are included in the Prefabricated Concrete Modular Wall Item. Should the Contractor elect to utilize temporary steel sheeting or other method of support of excavation, the work shall be considered incidental to this item and will not be quantified or paid for separately.

Foundation Preparation

The foundation for the structure shall be graded level for a width equal to the length of reinforcement elements plus 1 foot. Prior to wall construction the subgrade material below the concrete leveling slab shall be excavated to undisturbed soil with a smooth blade bucket and compacted with at least 3 passes of a reversible plate compactor weighing at least 800 lb to provide a hard and level surface to support the stone leveling slab and wall units. Any foundation soils found to be unsuitable shall be removed and replaced with Special Borrow Material as per Section 140 and Section 150. The foundation for the structure shall be inspected and approved by the Engineer before erection is started.

Wall Erection

Precast concrete modular block units shall be placed so that their final position is as shown on the Plans. For erection, units are handled by means of lifting devices embedded in the units. Units should be placed in successive horizontal lifts in the sequence shown on the approved Shop Drawings as backfill placement proceeds. As backfill material is placed behind the units, the units shall be maintained in position by means of temporary wedges or bracing according to the wall supplier's recommendations. Concrete facing vertical tolerances and horizontal alignment tolerances shall not exceed 3/4 inch when measured with a ten-foot straight edge. During construction, the maximum allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (top to bottom) shall not exceed 1/2 inch per ten feet of wall height.

Backfill Placement

Backfill placement shall closely follow erection of each course of units. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the units. Any wall materials which become damaged during backfill placement shall be removed and replaced at the Contractor's expense. Any misalignment or distortion of the wall units due to placement of backfill outside the limits of this specification shall be corrected at the Contractor's expense.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize corrections as outlined in Note 7 of that test). For backfills containing more than 30 percent retained on the 3/4-inch sieve, a method of compaction consisting of at least 4 passes by a heavy roller shall be used.

ITEM 995.01 (Continued)

The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Backfill materials shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniformly acceptable throughout the entire lift.

The maximum lift thickness after compaction shall not exceed 12 inches. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

Compaction within three feet of the back face of the wall shall be achieved by at least three passes of lightweight mechanical tamper, roller, or vibratory system.

At the end of each day's operation, the Contractor shall slope the last lift of the backfill away from the wall facing to rapidly direct runoff away from the wall face. In addition, the Contractor shall not allow surface runoff from other areas to enter the wall construction site.

Drainage

Weep holes shall be provided through the PCMG wall units along the wall system and can be shop fabricated or field cored.

ITEM 995.01 (Continued)

SCHEDULE OF BASIS FOR PARTIAL PAYMENT

Within ten (10) days after the award of the Contract, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of unit prices for the major components of the bridge structure as listed below. The bridge structure Lump Sum breakdown quantities provided below are estimated and not guaranteed. The total of all partial payments to the Contractor shall equal the Lump Sum contract price regardless of the accuracy of the quantities furnished by the Engineer for the individual bridge components. The cost of labor and materials for any Item not listed but required to complete the work shall be considered incidental to Item 995.01 and no further compensation will be allowed.

<u>Item</u>	<u>Description</u>	<u>Qty</u>	<u>Unit</u>	<u>Price</u>	<u>Total</u>
901.	4000 PSI, 1.5 IN., 565 Cement Concrete	95	CY		
904.3	5000 PSI, 3/4 IN., 685 HP Cement Concrete	50	CY		
910.	Steel Reinforcement for Structures	6,500	LB		
910.1	Steel Reinforcement for Structures – Epoxy Coated	11,500	LB		
916.1	Precast Concrete Rigid Frame	1	LS		
965.2	Membrane Waterproofing for Bridge Decks- Spray Applied	1,100	SF		
970.	Bituminous Damp-Proofing	115	SY		
975.1	Metal Bridge Railing (3 Rail), Steel (Type S3-TL4)	65	FT		
996.5	Precast Concrete Modular Wall	1,350	SF		

Totals – Bridge No. A-19-14

The above schedule applies only to Bridge Structure No. A-19-014. Payment for similar materials and construction at locations other than at this bridge structure shall not be included under this Item. Sub-Item numbering is presented for information only in coordination with the MassDOT-Highway Division Standard Nomenclature.

ITEM 1000.1

DATA CONDUIT ACCOMMODATIONS

LUMP SUM

This Item is included to pay for all work and coordination to be performed by the Contractor that is associated with the temporary and permanent relocation of data conduits embedded in the existing bridge deck and buried in the roadway approaches. The work shall be as outlined in the Contract Drawings, and as further described in this Specification.

GENERAL

Verizon Communications Inc. (Verizon) owns and maintains infrastructure within the project limits, including a duct bank consisting of twelve (12) 4-inch dia. conduits that must remain in service for the duration of construction. As such, a temporary utility bridge will be used to support these conduits during Stage 1 construction while the existing bridge is removed, and while the Stage 1 portion of the replacement structure is installed. The Contractor shall be responsible for assisting Verizon and/or Verizon's contractor (collectively referred to herein as "Verizon") with certain tasks associated with the existing Verizon facilities. Temporary Utility Bridge plans, as prepared by American U-Tel Inc. on behalf of Verizon, are located in Appendix J. Refer to sheet titled Temporary Utility Bridge Construction Sequence for a narrative describing the responsibilities of the Contractor (referred to as "Bridge Contractor" in those plans) versus the responsibilities of Verizon (referred to as "American U-Tel" in those plans).

The work under this item shall consist of partial and selective bridge demolition as necessary to expose the existing steel, timber, and/or fiberglass data conduits that are located on, or encased within, the concrete bridge deck of the West Main Street bridge. The purpose of this work is to assist Verizon with the extraction of the conduits from the existing structure with sufficient clearance for the installation of a utility support bridge (to be installed by Verizon). This work shall include all labor and materials associated with assisting Verizon with conduit break-out and removal of concrete from the conduits via concrete demolition and/or excavation. This work shall also include any temporary shoring, bracing, or support of the existing structure within the limits of Stage 1 construction that may be necessary to facilitate partial removal of the structure for conduit break-out that would not otherwise be necessary for staged bridge demolition.

Trench excavation in the approach roadway to expose the existing data conduits will be performed by Verizon. However, this item shall include any and all measures necessary for assisting Verizon with that effort including but not limited to roadway or sidewalk pavement sawcutting and/or removal, and for continuing construction of the project while Verizon completes this excavation and while the temporary utility bridge is in place.

Verizon will excavate and/or prepare the existing ground as they deem necessary at the two Temporary Utility Bridge foundation locations, per the plans prepared by American U-Tel. However, this item shall include any supplemental excavation and/or ground preparation for the Temporary Utility Bridge foundations, beyond the work identified to be completed by Verizon, that may be necessary for the Contractor to continue work per the contract once the Temporary Utility Bridge has been installed.

ITEM 1000.1 (Continued)

This work shall also include all on- and off-site coordination with Verizon, and other utility owners and their subcontractors or representatives, as necessary to complete the work that would not be otherwise necessary without temporary support of the existing data conduits. Coordination may include, but not be limited to: installation, adjustment, and/or reinstallation of excavation support systems (steel sheeting) around the utility support bridge, including coordination with National Grid Gas as outlined in Item 1000.2; assisting Verizon with, or accommodating their work to, adjust the location of the temporary utility bridge after conduit breakout; coordination with Verizon and/or NG Gas regarding installation of gas main piping in the vicinity of the temporary utility bridge; coordination with the precast concrete rigid frame fabricator and/or Verizon regarding the permanent utility bay and utility support details; installation of precast concrete rigid frame elements around/beneath the utility support bridge; installation and removal of formwork over the utility bay for the concrete deck overpour; and completion of any construction activities occurring above/under/near the utility support bridge that would not otherwise be necessary if the utility bridge were not present.

DESIGN

The Temporary Utility Bridge has been designed by Verizon and included herein as Appendix J.

MATERIALS

Verizon will provide and install all materials necessary to construct the Temporary Utility Bridge, as well as any conduits and other appurtenances necessary to replace the conduit around existing data cables and to incorporate the existing conduits into the replacement bridge structure. Verizon will also provide and install all hardware for the permanent utility support system.

The Contractor shall coordinate with Verizon and the designer and/or manufacturer of the precast concrete rigid frame to determine the measures necessary for installing the permanent utility supports within the utility bay of precast concrete frame elements, including but not limited to embedments into the frame elements for attachment thereof.

CONSTRUCTION METHODS

Permanent relocation of the existing Verizon duct bank is a critical path task for this project, as outlined in Item 1000.2. Extreme caution must be used to avoid damaging the existing communication cables contained within the conduits whenever working near Verizon's facilities. A representative from Verizon will monitor construction activities, at no cost to the contract.

The Contractor shall perform selective bridge demolition and concrete excavation to expose the existing twelve conduits supported on, or encased in, the concrete bridge deck to the limits as necessary to install the Temporary Utility Bridge, as discussed in this Special Provision and in accordance with Item 115.1 Demolition of Bridge No. A-19-014, prior to continuing other bridge demolition and excavation work per the contract. The Contractor shall assist Verizon with the

ITEM 1000.1 (Continued)

breakout and removal of concrete and conduits from the twelve-duct formation using CAUTION not to damage the conduits or the data cables within.

Verizon will temporarily support each of the twelve existing conduits on the Temporary Utility Bridge. Verizon will remove the conduits from around the telephone cables and place them in new split-fiberglass or steel conduits, as deemed necessary by Verizon.

Verizon will excavate and/or prepare existing ground as required at the two Temporary Utility Bridge foundation locations per the plans. Contractor shall coordinate with Verizon to optimize the location of the foundations based on the location of the existing conduits and the limits of excavation and/or excavation support systems. Excavation limits for bridge reconstruction, in areas where excavation support systems are not specifically prescribed, may encroach into the footprint of the Temporary Utility Bridge foundations; any supplemental excavation support measures necessary as a result of the Temporary Utility Bridge shall be included in this item. Contractor's activities, including but not limited to excavation for installation of precast concrete rigid frame elements, shall not cause undermining or adversely impact the stability of the temporary bridge foundations.

Verizon will install the Temporary Utility Support System per the plans, as necessary to properly support their facilities and allow for removal of the remainder of the existing bridge structure.

Verizon will prepare the subgrade for the conduit in its final location. The Contractor will be required to assist Verizon in this task by allowing access to the site and providing other construction support as necessary.

After Contractor completes the installation of the precast rigid frame elements that form the utility bay in the replacement bridge, Verizon will install conduit support hardware and relocate the conduits to their final location in the utility bay. Verizon will replace existing conduits with new split fiberglass or steel conduit, as required, including any spacers and supports.

After conduits have been installed into their final location in the utility bay, Verizon will remove the Temporary Utility Support Bridge.

The Contractor will be responsible for constructing the cast-in-place concrete overlay on the rigid frame after the data conduits have been relocated into the utility bay of the replacement bridge. The formwork necessary to support the overlay over the utility bay must be removed after the concrete placement is completed, following the required concrete curing period. The use of stay-in-place concrete forms is not permitted by MassDOT and shall not be used on this project. Temporary adjustment of the relocated conduits from their final condition in the utility bay may be necessary to provide the required clearance above the conduits for the installation and removal of formwork. Contractor should coordinate with Verizon regarding any conduit adjustment required to accommodate formwork installation and removal.

ITEM 1000.1 (Continued)

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Data Conduit Accommodations shall be measured and paid for as a unit. No separate measurement or payment will be made for the work performed under this item. A unit consists of assisting Verizon with conduit trench excavation to expose conduits in the roadway approaches to the bridge; selective bridge demolition and concrete removal/excavation as required to assist Verizon with the break-out of the conduits from the existing bridge structure; design, installation, maintenance, and removal of any temporary structural support system(s) that may be necessary for partial demolition of the Stage 1 construction portion of the bridge to accomplish conduit break-out, and any supplemental excavation support measures necessary as a result of the Temporary Utility Bridge; assisting Verizon with excavation as necessary for temporary utility bridge foundations; adjustment or reinstallation of excavation support systems as necessary to facilitate installation of the temporary utility bridge; assisting Verizon with conduit trenches including subgrade preparation and backfilling; and coordination with Verizon and other utility owners to complete the work as described in this Special Provision.

Disposal of excavated and discarded materials generated from bridge demolition during conduit exposure and/or break-out shall be paid for under Item 115.1 Demolition of Bridge No. A-19-014. The accepted quantity of Data Conduit Accommodations will be paid for at the contract unit price per unit of work completed, as described in this Special Provision.

Within ten (10) days after the award of the Contract, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of values of the components of work associated with Item 1000.1 for the purpose of making partial payments. The total of all partial payments to the Contractor shall equal the Lump Sum contract price.

ITEM 1000.2

GAS MAIN ACCOMMODATIONS

LUMP SUM

This Item is included to pay for all work and coordination to be performed by the Contractor that is associated with construction of the proposed project in the vicinity of existing and proposed gas main infrastructure, as well as for the Contractor's work for the permanent relocation of existing gas facilities onto the replacement bridge. The work shall be as outlined in the Contract Drawings, and as further described in this Specification.

GENERAL

National Grid Gas (NG Gas) owns and maintains infrastructure within the project limits, including a 4" dia. gas distribution main and an 8" dia. gas transmission main, both located in the northern portion of West Main Street and crossing Nonacoicus Brook within the downstream portion of the hydraulic opening of the existing West Main Street Bridge. These facilities will be upgraded by NG Gas and relocated to the southern (upstream) fascia of the replacement bridge as part of this project. NG Gas will provide materials and labor associated with the permanent gas main relocations in the approach roadways, and for installation of the gas mains onto the replacement bridge. The Contractor shall be responsible for certain coordination and construction activities to assist NG Gas with these relocations.

Work to be completed by the Contractor under this item includes, but is not limited to, the following:

- Utility and general construction coordination as outlined herein.
- Complying with NG Gas construction requirements, including vibration monitoring for any construction activities that are necessitated by the presence of existing or proposed NG Gas facilities.
- Removal and disposal of gas infrastructure that is replaced or abandoned within the project limits.
- Working around existing or proposed NG Gas facilities, including any specialized construction or excavation procedures, or any additional activities necessitated by the presence of existing or proposed NG Gas facilities.

The role of NG Gas and their responsibilities related to gas main infrastructure include:

- All gas piping work including trench excavation and backfill, supplying materials, installing piping and making all connections, and decommissioning existing gas infrastructure for removal by the Contractor.
- Supplying all materials and hardware necessary for the permanent relocation of gas main piping onto the replacement bridge.
- Installation of gas main support hardware and piping onto the replacement bridge.
- Providing inspection and/or oversight for construction activities occurring near NG Gas facilities, as required per applicable NG Gas construction standards.
- Removal of existing infrastructure to be replaced or abandoned within the project limits as part of the NG Gas upgrades.

This work shall also include all on- and off-site coordination with NG Gas, and other utility owners and their subcontractors or representatives, as necessary to complete the work that would not

ITEM 1000.2 (Continued)

otherwise be necessary without the presence of existing gas infrastructure and the permanent relocation thereof. Coordination and resulting work to be completed by the Contractor may include, but not be limited to: installation, adjustment, and/or reinstallation of excavation support systems (steel sheeting) in the vicinity of existing and/or proposed gas infrastructure; specialized construction procedures associated with installing excavation support systems near gas infrastructure; assisting NG Gas with, or accommodating their work to, remove existing or install new gas main infrastructure; coordination with NG Gas and the designer/manufacturer of the precast concrete rigid frame and/or precast concrete modular retaining wall system regarding the permanent relocation of gas piping to the southern fascia of the replacement bridge; coordination with Verizon regarding the schedule for completion of data conduit relocation work, and Verizon's subsequent removal of the temporary utility bridge; coordination with NG Gas and the guardrail/bridge rail installation subcontractor regarding the sequence for installing guardrail within the vicinity of existing and proposed gas main infrastructure; and the completion of any construction activities occurring in the vicinity of gas main infrastructure that would not otherwise be necessary if gas facilities were not present.

DESIGN

Design of the gas main relocation work, including the permanent gas main piping support system, has been completed by NG Gas; relevant design plans are included in Appendix M.

MATERIALS

NG Gas will provide and install all piping and other materials necessary for the permanent gas main supports to be located on the southern fascia of the replacement bridge, and for the penetrations of the relocated gas main piping through the southern precast modular wingwall system. The Contractor shall coordinate with NG Gas and the designer and/or manufacturer of the precast concrete bridge elements to determine the measures necessary for installing the permanent gas piping supports onto the concrete brush curb and/or upstream fascia of the precast concrete frame element, including but not limited to embedments into the headwall/brush curb and/or rigid frame elements for attachment thereof, and for penetrations of gas main piping through the modular wingwall system.

CONSTRUCTION METHODS

Permanent relocation of the existing gas distribution and transmission mains is a critical path task for this project. Gas main relocation work will be performed during Stage 1 construction and must be completed before removal of the Stage 2 portion of the existing bridge is completed. See Construction Sequence, below, for further details.

The Contractor shall be responsible for complying with all applicable requirements of National Grid Gas' General Guidelines for Working Around Gas Utilities (refer to Appendix I of these Specifications). Important and/or particularly relevant sections of these Guidelines include, but are not limited to, the following:

ITEM 1000.2 (Continued)

- Exposure of Gas Facilities
- Protection of Exposed Pipe
- Vibration
 - Low levels of vibration must be maintained when working around gas facilities. This project includes construction activities that are anticipated to induce vibration and therefore require vibration monitoring.
 - Refer to NG Gas Damage Prevention Gas Policy “Vibrational and Impact Forces in the Vicinity of Underground Gas Facilities” for further guidance on vibration monitoring requirements.
- Regulator Stations
 - There is an existing regulator station located within the project limits, near Sta. 4+00 LT. This station is being decommissioned as part of the NG Gas upgrade project; however, it will remain in-service for a portion of the construction duration and the NG Gas requirements regarding working around regulator stations must be followed.
- Excavations Including Transmission Pipelines
 - The project includes excavation within 15’ of the existing 8” dia. gas transmission main, and the Contractor must comply with the excavation requirements for working near transmission mains. Note that some of the required excavation may not occur until after the gas transmission main has been transferred to the south side of the bridge, and the existing piping in the north has been decommissioned, which could reduce or eliminate potential conflicts with transmission pipelines.

The Contractor shall coordinate with NG Gas to clarify the specific construction requirements applicable to this project. All work (and cost) associated with complying with NG Gas requirements shall be included in Item 1000.2 Gas Main Accommodations.

CONSTRUCTION SEQUENCE

Certain construction activities for the project must be completed in a specific sequence due to work being completed by/for other utilities, or because of the requirements associated with working around gas infrastructure. The following is a partial list of the activities related to the existing and relocated gas infrastructure that may impact the construction sequence. This list is provided for the Contractor’s benefit and shall not be considered a complete list of all construction activities with schedule dependencies related to other work at the site. The Contractor is responsible for developing and maintaining the construction schedule, and for coordinating and performing the work in a manner that complies with the requirements of these Specifications.

- **Installation of steel sheeting for excavation support**
 - Sheeting for excavation support, particularly for Stage 2 construction, is depicted within 10’ of existing gas infrastructure. It may not be possible to install some portions of the excavation support system until the gas distribution and transmission mains have been permanently relocated to the south side of the bridge, and/or until after the existing regulator station has been decommissioned.

ITEM 1000.2 (Continued)

- **Installation of gas main piping in approach roadways**
 - Installation of gas main piping in Stage 1 construction (by NG Gas) cannot be completed until after the Verizon data conduits have been relocated to their permanent location within the utility bay of the replacement bridge, and after the subsequent removal of Verizon's temporary utility bridge.
- **Completing tie-ins of relocated gas main piping**
 - NG Gas must bring the new gas distribution and transmission mains online before the existing gas piping located in the Stage 2 construction area can be decommissioned and removed. Coordination with NG Gas indicates this tie-in work cannot occur during the home heating season and therefore must be completed on or before the approximate date of October 15. This is a critical path task to be completed in Stage 1 construction because removal of the existing (decommissioned) piping must occur early in Stage 2 construction, prior to competing demolition of the existing bridge.
- **Installation of guardrail**
 - Steel posts for the bridge rail on the south side of the bridge that are located within 10' (laterally) of the proposed gas piping must be installed prior to the installation of the relocated gas transmission and distribution mains.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Gas Main Accommodations shall be measured and paid for as a unit. No separate measurement or payment will be made for the work performed under this item. A unit consists of coordinating with NG Gas to determine the construction requirements applicable to this project; coordinating with NG Gas throughout the project to provide the required construction notifications; hand or vacuum excavation as required by NG Gas to expose existing gas pipe; protection of NG Gas' existing facilities; vibration monitoring of the type, frequency, and duration as required by NG Gas, for any construction activities for which vibration monitoring is necessary because of NG Gas; alternative construction methods as may be necessary to reduce vibration, if required by NG Gas; coordinating with NG Gas and the precast concrete fabricator regarding design, detailing, and installation of the permanent gas main support system; removal of existing gas main infrastructure that is replaced or abandoned within the project limits; and coordination with NG Gas and other utility owners to complete the work as described in this Special Provision.

The accepted quantity of Gas Main Accommodations will be paid for at the contract unit price per unit of work completed, as described in this Special Provision.

Within ten (10) days after the award of the Contract, the Contractor shall submit, in duplicate, for the approval of the Engineer, a schedule of values of the components of work associated with Item 1000.2 for the purpose of making partial payments. The total of all partial payments to the Contractor shall equal the Lump Sum contract price.

APPENDIX A

AYER CONSERVATION COMMISSION – ORDER OF CONDITIONS



Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 – Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
100-0488
MassDEP File #
eDEP Transaction #
Ayer
City/Town

A. General Information

Please note:
this form has
been modified
with added
space to
accommodate
the Registry
of Deeds
Requirements

Important:
When filling
out forms on
the
computer,
use only the
tab key to
move your
cursor - do
not use the
return key.



1. From: Ayer
Conservation Commission

2. This issuance is for
(check one): a. Order of Conditions b. Amended Order of Conditions

3. To: Applicant:

<u>Matt</u> a. First Name	<u>Hernon</u> b. Last Name
<u>Ayer Department of Public Works</u> c. Organization	
<u>25 Brook Street</u> d. Mailing Address	
<u>Ayer</u> e. City/Town	<u>MA</u> f. State
	<u>01432</u> g. Zip Code

4. Property Owner (if different from applicant):

<u></u> a. First Name	<u></u> b. Last Name
<u></u> c. Organization	
<u></u> d. Mailing Address	
<u></u> e. City/Town	<u></u> f. State
	<u></u> g. Zip Code

5. Project Location:

<u>West Main St. At Nonacoicus Brook</u> a. Street Address	<u>Ayer</u> b. City/Town
<u>25 & 26</u> c. Assessors Map/Plat Number	<u>Public ROW &25-11, 26-31, 26-42, 26-43</u> d. Parcel/Lot Number
Latitude and Longitude, if known:	
<u></u> d. Latitude	<u></u> e. Longitude



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A. General Information (cont.)

6. Property recorded at the Registry of Deeds for (attach additional information if more than one parcel):
 Middlesex South
 a. County 71536 b. Certificate Number (if registered land) 1
 c. Book _____ d. Page _____
7. Dates: 4/16/2024 5/09/2024 5/13/2024
 a. Date Notice of Intent Filed b. Date Public Hearing Closed c. Date of Issuance
8. Final Approved Plans and Other Documents (attach additional plan or document references as needed):
 Town of Ayer Department of Public Works Notice of Intent
 a. Plan Title _____
 b. Prepared By Kristopher Surette 52635
3/29/2024 c. Signed and Stamped by
 d. Final Revision Date _____ e. Scale _____
 f. Additional Plan or Document Title _____ g. Date _____

B. Findings

1. Findings pursuant to the Massachusetts Wetlands Protection Act:
 Following the review of the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act (the Act). Check all that apply:
- a. Public Water Supply b. Land Containing Shellfish c. Prevention of Pollution
 d. Private Water Supply e. Fisheries f. Protection of Wildlife Habitat
 g. Groundwater Supply h. Storm Damage Prevention i. Flood Control
2. This Commission hereby finds the project, as proposed, is: (check one of the following boxes)

Approved subject to:

- a. the following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.



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 Ayer
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B. Findings (cont.)

Denied because:

- b. the proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect the interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**
- c. the information submitted by the applicant is not sufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the Act's interests, and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**
- 3. Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310 CMR 10.02(1)(a) _____ a. linear feet

Inland Resource Area Impacts: Check all that apply below. (For Approvals Only)

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. <input checked="" type="checkbox"/> Bank	18 p; 262 t a. linear feet	18p 262t b. linear feet	262 c. linear feet	262 d. linear feet
5. <input checked="" type="checkbox"/> Bordering Vegetated Wetland	340 p; 1,130 t	340p 1,130t b. square feet	700 c. square feet	700 d. square feet
6. <input checked="" type="checkbox"/> Land Under Waterbodies and Waterways	60 p; 2,710 t a. square feet 175 e. c/y dredged	60 p 2,710t b. square feet 175 f. c/y dredged	60 c. square feet	60 d. square feet
7. <input checked="" type="checkbox"/> Bordering Land Subject to Flooding	3,875 a. square feet	3,875 b. square feet	2,710 c. square feet	2,710 d. square feet
Cubic Feet Flood Storage	e. cubic feet	f. cubic feet	16.7 g. cubic feet	16.7 h. cubic feet
8. <input type="checkbox"/> Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9. <input checked="" type="checkbox"/> Riverfront Area	26,780(1,270p;25,510T 18,420 (800p)17,620	26,780 b. total sq. feet 18,420	800 e. square feet	800 f. square feet
Sq ft within 100 ft	8,360(470 perm;7,890	d. square feet 8,360	470 e. square feet	740 f. square feet
Sq ft between 100-200 ft		h. square feet	i. square feet	j. square feet



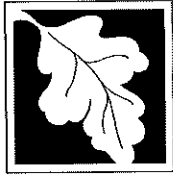
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B. Findings (cont.)

Coastal Resource Area Impacts: Check all that apply below. (For Approvals Only)

	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. <input type="checkbox"/> Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. <input type="checkbox"/> Land Under the Ocean	_____ a. square feet	_____ b. square feet		
	_____ c. c/y dredged	_____ d. c/y dredged		
12. <input type="checkbox"/> Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. <input type="checkbox"/> Coastal Beaches	_____ a. square feet	_____ b. square feet	_____ cu yd c. nourishment	_____ cu yd d. nourishment
14. <input type="checkbox"/> Coastal Dunes	_____ a. square feet	_____ b. square feet	_____ cu yd c. nourishment	_____ cu yd d. nourishment
15. <input type="checkbox"/> Coastal Banks	_____ a. linear feet	_____ b. linear feet		
16. <input type="checkbox"/> Rocky Intertidal Shores	_____ a. square feet	_____ b. square feet		
17. <input type="checkbox"/> Salt Marshes	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
18. <input type="checkbox"/> Land Under Salt Ponds	_____ a. square feet	_____ b. square feet		
	_____ c. c/y dredged	_____ d. c/y dredged		
19. <input type="checkbox"/> Land Containing Shellfish	_____ a. square feet	_____ b. square feet	_____ c. square feet	_____ d. square feet
20. <input type="checkbox"/> Fish Runs	Indicate size under Coastal Banks, Inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	_____ a. c/y dredged	_____ b. c/y dredged		
21. <input type="checkbox"/> Land Subject to Coastal Storm Flowage	_____ a. square feet	_____ b. square feet		
22. <input type="checkbox"/> Riverfront Area	_____ a. total sq. feet	_____ b. total sq. feet		
Sq ft within 100 ft	_____ c. square feet	_____ d. square feet	_____ e. square feet	_____ f. square feet
Sq ft between 100-200 ft	_____ g. square feet	_____ h. square feet	_____ i. square feet	_____ j. square feet



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B. Findings (cont.)

* #23. If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c (BVW) or B.17.c (Salt Marsh) above, please enter the additional amount here.

23. Restoration/Enhancement *:

a. square feet of BVW	b. square feet of salt marsh
-----------------------	------------------------------

24. Stream Crossing(s):

0	1
a. number of new stream crossings	b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects.

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:
 - a. The work is a maintenance dredging project as provided for in the Act; or
 - b. The time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.
 - c. If the work is for a Test Project, this Order of Conditions shall be valid for no more than one year.
5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order. An Order of Conditions for a Test Project may be extended for one additional year only upon written application by the applicant, subject to the provisions of 310 CMR 10.05(11)(f).
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not extend the issuance date of the original Final Order of Conditions and the Order will expire on _____ unless extended in writing by the Department.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.



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C. General Conditions Under Massachusetts Wetlands Protection Act

8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work.
10. A sign shall be displayed at the site not less than two square feet or more than three square feet in size bearing the words,

"Massachusetts Department of Environmental Protection" [or, "MassDEP"]
"File Number 100-0488 "
11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before MassDEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.



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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.
19. The work associated with this Order (the "Project")
- (1) is subject to the Massachusetts Stormwater Standards
- (2) is NOT subject to the Massachusetts Stormwater Standards

If the work is subject to the Stormwater Standards, then the project is subject to the following conditions:

- a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Construction General Permit as required by Stormwater Condition 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.
- b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that:
- i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures;
 - ii.* as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized;
 - iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10;



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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

iv. all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition;

v. any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 18(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following:

i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and

ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollution Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 18(f) through 18(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 18(f) through 18(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.



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C. General Conditions Under Massachusetts Wetlands Protection Act (cont.)

- g) The responsible party shall:
 1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
 2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and
 3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

- h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.
- i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.
- j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.
- k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.
- l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions (if you need more space for additional conditions, please attach a text document):

See Attached

- 20. For Test Projects subject to 310 CMR 10.05(11), the applicant shall also implement the monitoring plan and the restoration plan submitted with the Notice of Intent. If the conservation commission or Department determines that the Test Project threatens the public health, safety or the environment, the applicant shall implement the removal plan submitted with the Notice of Intent or modify the project as directed by the conservation commission or the Department.



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D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? Yes No
2. The Ayer Conservation Commission hereby finds (check one that applies):

a. that the proposed work cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw, specifically:

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

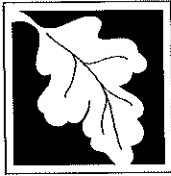
Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order of Conditions is issued.

b. that the following additional conditions are necessary to comply with a municipal ordinance or bylaw:

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows (if you need more space for additional conditions, attach a text document):



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E. Signatures

This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

5/24/2004
 1. Date of Issuance

Please indicate the number of members who will sign this form.
 This Order must be signed by a majority of the Conservation Commission.

4
 2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate Department of Environmental Protection Regional Office, if not filing electronically, and the property owner, if different from applicant.

Signatures:

[Signature]
[Signature]
[Signature]
[Signature]

by hand delivery on
5/24/2004
 Date

by certified mail, return receipt requested, on

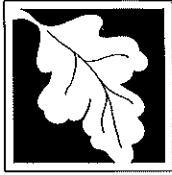
 Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.



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G. Recording Information

Prior to commencement of work, this Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

Conservation Commission

Please be advised that the Order of Conditions for the Project at:

Project Location

MassDEP File Number

Has been recorded at the Registry of Deeds of:

County

Book

Page

for:

Property Owner

and has been noted in the chain of title of the affected property in:

Book

Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

**ATTACHMENT A
SPECIAL CONDITIONS
Order of Conditions
Ayer Department of Public Works, West Main Street Bridge
DEP File # 100-0488**

FINDINGS:

Under the Order of Conditions (“the Order”) issued under MassDEP File Number 100-0488 to Ayer Department of Public Works (“the Applicant”), the Ayer Conservation Commission (“the Commission”) hereby finds that in addition to the preceding General Conditions #1-20, Special Conditions listed herewith are necessary to achieve Performance Standards set forth in the Wetlands Protection Act (“WPA,” MGL Chapter 131, Section 40) as codified in 310 CMR 10.00 (“the WPA Regulations”) as well as the Town of Ayer Wetlands Protection Bylaw (“the Bylaw,” Article XXVI) and local regulations (“Bylaw Regulations”). “Resource Areas” are enumerated under 310 CMR 10.02(1) and Bylaw Article XXVI, Section 2A. Under the Bylaw, the Buffer Zone is considered to be a Resource Area (Section 3A).

The project consists of the replacement of an existing bridge over the Nonacoicus Brook. The new bridge will have an increased hydraulic capacity. As part of the project wetland impacts will be limited but an area will be filled with a replication area proposed.

The Commission orders that all work should be performed in accordance with said General and Special Conditions, the referenced Notice of Intent, and all other relevant documents listed below in Special Condition 2.

Any violation of these Conditions is considered a breach of the WPA and/or the Bylaw, which may make the Applicant subject to an Enforcement Order, a Cease & Desist Order, and/or a fine from MassDEP and/or this Commission. Under Article LIII (Enforcement) of the Bylaws of the Town of Ayer, the Commission is considered an enforcement officer for the Act and the Bylaw. Article LIII specifies the fine to be up to three hundred dollars per violation, with each day a violation exists constituting a separate offense.

In the Conditions below, all references to Resource Area/s shall be assumed to include Wetlands, Buffer Zones to Wetlands (100 ft.), and Riverfront Areas (200 ft.) subject to the jurisdiction of the Commission, unless otherwise specified.

ADMINISTRATIVE CONDITIONS

1. **All work must be in compliance with DEP General Conditions 1-20 as well as all Special Conditions from the Ayer Conservation Commission herein, as stated below:**
2. The work shall conform to the following approved Plans and key documents unless otherwise specified in this Order. All documents will be submitted to the Conservation Agent in both paper and electronic formats:

WPA Form 3/Notice of Intent:	DEP File # 100-0488
Submitted on behalf of:	Ayer Department of Public Works
Property Owner:	Town of Ayer
Project Location:	West Main Street Ayer, MA 01432
Prepared by:	Tighe and Bond, Inc
Stamped by:	Kristopher Surette
Site Plan:	
Final Revision Date/Sheet Name:	West Main Street Bridge / March 29, 2024

3. This Order, including these Special Conditions, shall apply to the Applicant or any successor(s) in interest or successor(s) in control of the property subject to this Order, including all current or future tenants, and shall survive until the issuance and recording of the Certificate of Compliance. Some conditions may be designated as “perpetual” in the COC and therefore survive this Order.
4. The Commission shall be notified in writing within 30 days of all transfers of title of any portion of property where activity has occurred under this Order, and that takes place prior to the issuance and recording of a Certificate of Compliance.
5. The approved wetland boundaries pertaining to this Order are only valid for the specific project associated with DEP # 100-0488 and not for any future projects.
6. Proof of recording of this Order at the Middlesex South Registry of Deeds must be submitted to the Commission prior to the commencement of any work within areas jurisdictional under the Act and/or the Bylaw.
7. This Order authorizes **only** the activity described on the approved Plans and documents referenced in this Order.
8. The Applicant and the Applicant’s designated representatives (including but not limited to site supervisors, contractors, subcontractors, and engineers) are responsible for the project’s completion in accordance with the approved Plans and this Order. **To ensure compliance, a copy of this Order and the approved plans shall be kept on site at all times while activities regulated by this Order are being performed.**

9. Any **changes** to the Plans approved under this Order, including those resulting from review requirements by other Town boards/departments or from unforeseen site conditions, and which may or will alter an area subject to protection under the Act and/or the Bylaw, must be submitted to the Agent or the Commission in writing for approval prior to implementation. The Agent/Commission will then determine if such alterations to the Plans may be treated as a Field Change, as an Amendment to this Order requiring a Public Hearing, or if such alterations are substantial enough to require the filing of a new Notice of Intent. Any errors found in the Plans or information submitted by the Applicant shall be considered as changes.
10. Members and agents of the Commission shall have the right to enter and inspect the premises at reasonable times, in reasonable intervals, with reasonable notification to the Site Supervisor, to evaluate compliance with the Conditions, up to such a time that the Certificate of Compliance is issued. The Commission may require the submittal of additional data (such as work or data logs, purchase receipts, or product specifications) reasonably deemed necessary by the Commission to determine whether the project is in compliance with the Conditions. Potential violations of perpetual Conditions shall not grant the Commission or its agents' passage over private property.

PRE-CONSTRUCTION CONDITIONS.

11. Throughout the duration of the project and until the issuance of the Certificate of Compliance, wetland boundaries shall be clearly marked with flags/stakes so that said areas are clearly distinguishable at all times. Such markers are to be repaired or replaced as necessary.
12. The Applicant or designated representatives must provide the Commission with the names, addresses, and telephone numbers (both business and 24-hour emergency numbers) of the person(s) responsible for compliance with this Order. The Commission shall also be notified in writing of any changes or updates to this information.
13. Signage to be exhibited on site, visible from the street, shall include the 2-3 square foot sign required to display the MassDEP File Number (General Condition 10, WPA Form 5) as well as any such additional signage as required by the Commission. All such signage shall remain in place until the issuance of a Certificate of Compliance.
14. The Applicant and/or designated representative(s) shall hold a pre-construction meeting with the Agent –jointly with other Town departments if appropriate – prior to the start of any work to ensure this Order is fully understood by all parties. The Applicant shall also submit in writing for the Commission's approval the following items as checked:
 - a. Sequence of construction activities and time table;
 - b. Method of Procedures (MOP) detailing:
 - i. a clearing plan showing areas to be cleared and areas to be left in a natural state;

- ii. protocols and contingencies for protecting Resource Areas during construction;
 - iii. response plan for encountering unforeseen conditions or emergencies;
 - iv. protocols for reporting problems to relevant entities, including the Agent;
 - v. a set of photographs depicting the project site in pre-activity condition.
15. Following the pre-construction meeting, erosion controls shall be installed with minimal disturbance of shrubs and herbaceous plants. **These controls must be inspected and approved by the Agent prior to the commencement of any work on site. The Commission must be notified at least 7 days prior to the commencement of work for such inspection.**

EROSION AND SEDIMENTATION CONTROLS

16. The erosion and deposition of soils, silt, and sediments into Wetland, Riverfront and Buffer Zone Resource Areas beyond the approved LOW shall be prevented at all times by effective control measures as specified in the referenced Notice of Intent and Plans, and in accordance with conditions noted below:
17. Prior to construction activity on site, the LOW shall be clearly marked or survey-located, beyond which no work shall occur. Erosion controls generally signify the LOW but the Commission may also require staked orange snow fencing to be installed in some areas as well. Workers shall be informed that no use of machinery, storage of machinery or materials, stockpiling of soil, or construction activity is to occur beyond this line at any time.
18. Temporary erosion control methods, as approved by the Commission, shall consist of any combination of silt fencing, staked haybales, compost filter sock, or straw wattles. Again, their installation must be inspected by the Conservation Agent prior to work beginning. Controls should comply with MassDEP's Complete Erosion and Sedimentation Control Guidelines.
19. The Commission or its Agent may require the Applicant to employ additional erosion controls as they reasonably deem necessary or where conditions indicate that existing control methods are insufficient to protect the Resource Areas.
20. While construction is active on a project site, controls shall be inspected regularly to ensure they remain in good working order. Controls must also be inspected following storm events to check for signs of erosion, wash-out, rills, or other damage caused by flowing water. Controls should also be inspected in the spring following a significant warming period when snow/ice has been present on the ground. Upon the discovery of any failure of erosion control measures resulting in the deposition of run-off materials into protected Resource Areas beyond the LOW, the incident shall be immediately reported to the Commission at (978)-772-8200 ext. 143 and to concom@ayer.ma.us.

21. All accumulated sediment shall be removed from the face of the erosion control barriers using hand tools (e.g. shovels, rakes, wheelbarrows) whenever the level of sediment is within six (6) inches of the top of the barrier.
22. Any unforeseen accumulation of sedimentation that takes place beyond the erosion control barriers/LOW shall be removed immediately using hand tools. The cause of the failure shall be immediately addressed as soon as reasonably practical.
23. Soil, sediment, debris, or other material removed during maintenance or repair of erosion control barriers, or remediation of erosion damage, shall be disposed of outside of the Resource Area/LOW.
24. For the duration of the project, the Applicant shall maintain a reserve of the approved erosion control products for emergency repairs. For large projects, this shall be equal to at least 15% of the maximum extent of erosion control materials used on site.
25. Erosion controls and wetland flags must remain in place until all disturbed surfaces have been permanently stabilized and a Certificate of Compliance has been issued by the Commission. Biodegradable material may be broken up and spread on site within the LOW, but not within any Resource Areas or Conservation Easement. Non-biodegradable materials, such as plastic twine, must be removed and discarded off-site. All erosion control material must be dismantled and/or removed after the issuance of the Certificate of Compliance.

GENERAL SITE CONDITIONS

26. Exposed soils within the Buffer Zone shall be stabilized (either temporarily or permanently) as soon as practical following disturbance (e.g. excavation and grading). This includes slopes and other disturbed areas not subject to further construction activities. Temporary stabilization shall consist of seeding with annual oats, ryegrass, or other approved species, or through the use of products such as erosion control blankets, geotextile fabrics, etc.
27. The use of vehicles or equipment (anything motorized or that may potentially leak harmful materials such as fuels or lubricants) shall be operated, parked, and maintained so as to minimize impact to Resource Areas and limit alterations to those areas clearly identified on the Plans. Pumps, generators, or other stationary equipment containing fuel, oil, or other potential contaminants, may not be stored or operated within Resource Areas without written approval of the Commission or its Agent. If permitted, equipment shall be contained within or on an impervious barrier, to be inspected daily for any sign of leakage. No underground storage of fuel or other hazardous substances is permitted in areas within the jurisdiction of the Commission.
28. No vehicles or equipment are to enter or cross a Resource Area or Buffer Zone outside of the LOW for this Order (e.g. temporary access road, construction mats) unless the

location of disturbance is marked on the Plans referenced in this Order and submitted with a plan for restoration of the Resource Area/Buffer Zone disturbance.

29. There shall be no pumping of water from wetlands without written permission from the Commission.
30. No oil, calcium chloride, or other salt shall be used within Resource Areas or Buffer Zones during any construction phase for the control of dust.
31. Cement trucks shall not be washed out in Resource Areas or deposited into any drainage system. Any deposit of excess cement or concrete products shall be immediately removed.
32. There shall be no dumping of leaves, grass clippings, brush, Christmas trees, or other debris into the wetland Resource Areas.
33. The use of deicing chemicals such as sodium chloride is prohibited on driveways located with Wetland Resource Areas and Buffer Zones.
34. No hazardous waste shall be introduced or discharged into or toward Resource Areas or into the sewage/stormwater systems in such a manner as to impact Resource Areas unless previously identified and approved by the Commission, Board of Health, MassDEP, and/or the United States Environmental Protection Agency.
35. The removal and remediation of hazardous waste, from an area subject to protection under the Act and/or the Bylaw, shall be conducted under the direction of the Massachusetts Department of Environmental Protection, Environmental Protection Agency, or other applicable state or federal agencies.
36. Any material placed in Resource Areas beyond the LOW by the Applicant without express authorization under this Order shall be removed by the Applicant upon demand by the Commission or its Agent.
37. From the start of construction to the end of the first year after the Certificate of Compliance is issued the Conservation Agent will inspect the property after any plowable snow.

GRADING, LANDSCAPING, SLOPES

38. Where possible, site grading and construction shall be scheduled to avoid periods of high surface water. Once begun, grading and construction shall continue in an expeditious manner to minimize the opportunity for erosion.
39. Grading shall be accomplished so that runoff is not directed onto the property of others, except as indicated on the approved Plans.

40. No proposed earthen embankment in the buffer zone shall have a slope steeper than 2:1 (horizontal: vertical) without prior written approval of the Commission.

SOILS, STOCKPILES, FILL, RIPRAP, TEMPORARY ROADS

41. All construction or landscaping materials, waste products, grubbed stumps, soil, slash, slurry pits, inorganic debris, etc. shall be stockpiled or deposited outside of all Resource Areas unless otherwise specified in this Order and shown on the approved Plans.
42. At no time shall debris or other material be buried or disposed of within the Buffer Zone other than that fill which is explicitly allowed by this Order and as shown on the referenced Plans.
43. Only crushed stone of uniform size or erosion control mats shall be used for temporary construction roadways.
44. Riprap material shall be clean and free of trash, tree stumps, roots, and other deleterious material.

STORMWATER MANAGEMENT / DEWATERING

45. Runoff shall be managed in accordance with the stormwater management plan developed for this project.
46. The storm drainage system, detention basins, compensatory flood storage areas, and wetland crossings shall be constructed to the extent practical as early in the project timeline as possible.
47. There shall be no direct discharge of stormwater runoff into streams or other Resource Areas. Runoff from the site shall be directed overland to maximize groundwater recharge and cleansing of the runoff through contact with natural soils and vegetation.
48. All existing and/or new catch basins and oil traps on streets adjacent to the project shall be protected by silt sacks to prevent sediment from entering the drainage system. Silt sacks shall be maintained and regularly cleaned of sediments until all areas associated with the work permitted by this Order have been permanently stabilized and the Commission and/or Agent have formally approved their removal.
49. Unless or until put into an easement to the Town of Ayer, the Applicant or designee shall maintain all elements of the drainage systems within any areas subject to the Commission's jurisdiction in order to avoid blockages and siltation which might cause failure of the system. Vegetative cover shall also be maintained on-site to ensure the proper functioning of the drainage system. This Condition shall in no way impede the control of invasive species, should a conflict arise.

50. Any runoff resulting from washing of vehicles or equipment shall neither be directed to, nor dumped into, any on-site drainage system or Resource Area.
51. If necessary, dewatering activities shall be conducted as shown on the approved plans and shall be monitored daily to ensure that sediment-laden water is appropriately settled prior to discharge toward Resource Areas. No discharge of water is allowed directly into an area subject to jurisdiction under the Act or the Bylaw.

ONGOING MAINTENANCE

52. Whenever maintenance work within Resource Areas or that may impact Resource Areas is to be performed, the Commission shall be notified in writing in advance. This includes, but is not limited to, clearing sediment from a stream or drainage channel, replacing leach fields, repairing drains, road maintenance/repaving, and the cleaning or maintenance of stormwater/drainage structures. **This condition shall be noted in the Certificate of Compliance as a perpetual condition.**

CERTIFICATE OF COMPLIANCE

53. Upon completion of construction and final soil stabilization, or within one year of the issuance of an Occupancy Permit, the Applicant shall submit the following to the Commission in order to request a Certificate of Compliance (COC):
 - a. A completed Request for a Certificate of Compliance (WPA Form 8A);
 - b. A written statement from a Registered Professional Engineer certifying that the work has been completed in compliance with this Order, the Plans, and any approved revisions if applicable. Substantial deviations and their potential impact must be described in detail. If the work completed differs significantly from the work approved by the Commission, the Commission may require the Applicant to implement measures necessary to comply with this Order or seek an amended Order of Conditions.
 - c. An 'As-Built' plan signed and stamped by a Registered Professional Engineer or Land Surveyor showing post-construction conditions within all jurisdictional areas under the scope of the project as permitted under this Order. The As-Built shall include at a minimum:
 - i. all Resource Area boundaries (wetlands, buffer zones, riverfront) and regulatory setback areas taken from the approved Plans;
 - ii. distances of any structures (buildings, septic system components, wells, utility lines, fences, retaining walls, roads/driveways, pools, etc.) to wetland Resource Areas and Buffer Zone or Riverfront lines;
 - iii. line depicting the limitation of yard/lawn expansion without new review/approval by the Commission;
 - iv. the location of any required signage or boulders;

- v. locations and elevations of all stormwater management conveyances, structures, basins, rain gardens, and other Best Management designs, including foundation drains and outlet pipes;
- vi. wetland replication areas constructed under this Order and confirmed successful after two growing seasons;
- d. Post-construction photographs for comparison with pre-construction photographs if required.
- e. Invasive species located in the area should be removed to the most extent practicable. This should be conducted using no herbicides in order to protect the health of the brook.

APPENDIX B

US ARMY CORP. OF ENGINEERS SECTION 404 PERMIT

PERMIT PENDING

**DOCUMENT WILL BE
ISSUED TO CONTRACTOR**

APPENDIX C

MASSDEP – MINOR MODIFICATION APPROVAL



Department of Environmental Protection

One Winter Street Boston, MA 02108 • 617-292-5500

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Kathleen A. Theoharides
Secretary

Martin Suuberg
Commissioner

June 2, 2020

WorldTech Engineering
C/o Stantec Consulting Services Inc.
136 West Street, Suite 203
Northampton MA 01060-3711
Attn: Lori Benoit

RE: West Main Street Bridge Replacement
Ayer, Middlesex County
Approval of Minor Project Modification

Dear Ms. Benoit:

The Massachusetts Department of Environmental Protection Waterways Program (the "Department") has received your prior request letter (request) dated March 26, 2018 and revised as described in letter dated February 24, 2020 from WorldTech Engineering on behalf of the Town of Ayer seeking approval of the planned replacement of the West Main Street Bridge over Nonacoicus Brook.

Based on the information provided in 2018 and 2020, we understand the project will remove the existing bridge in-whole and followed by construction of a new bridge within substantially the same footprint. The new bridge enhances navigation by increasing the clearance beneath the bridge and significantly expands the opening span from a maximum of 10-feet (existing) to 28-feet (proposed).

The March 2018 design plans included placement of a combination of rock, cobble and gravel fill to provide scour protection around the abutments and temporary steel sheet piling. The February 2020 design revision includes leaving the sheet piling to remain in place around the abutment footing in lieu of the placement of combined fill. The gap between sheet piling and the abutment footing will be infilled with partially grouted riprap. This results in a reduction in the amount of dredging, as the combined rock fill will no longer be needed and will result in reduced amount of dredging and allows the potential use of native material to be reused along the streambed.

The request included a project description and the following Exhibits:

- 1) USGS Project site locus map;
- 2) Various historic maps circa 1917 – 1935, demonstrating the bridge existed prior to 1939,
- 3) Plans entitled; “West Main Street over Nonocoicus Brook, A-19-014 (C1R)” dated June 7, 2019 prepared by Hoyle, Tanner and Associates Inc.

The Department has reviewed the referenced materials as well as published licensing, cartographic and legislative materials maintained by local, state and federal agencies and the Massachusetts State Library.

Based on these materials the Department determined the following:

- A. A road bridge has existed at the project site since at least 1935, in substantially the same alignment as the existing and planned replacement structures.
- B. There does not appear to have been any unauthorized alterations to the bridge since at least January 1, 1984 with regard to structural alterations or change in use.
- C. The proposed replacement bridge will maintain the vertical clearance between the ordinary high-water mark to the lowest chord, avoiding further impacts to navigation from those in-place likely since 1935 and at least since January 1, 1984.
- D. The proposed replacement bridge will increase the clear-span width between the abutments from 7± feet to 28± feet, further reducing the structure’s impact on navigation when comparing existing and proposed conditions.
- E. The proposed steel sheet piling to be installed to facilitate construction will be located outside the footprint and will not be located within a geographic area subject to jurisdiction pursuant to 310 CMR 9.04.

CONCLUSION

Based on this review, the Department concludes that the continuation in use of the existing bridge is exempt from licensing pursuant to 310 CMR 9.05(3)(a) and (c) as an existing public service project and (f) as an existing structure in on or over a nontidal river or stream constructed prior to 1939. Furthermore, the replacement of the existing bridge, as currently proposed meets the regulatory criteria for Minor Project Modification pursuant to 310 CMR 9.22(3) and no further review under M.G.L. Chapter 91 or 310 CMR 9.00 is required.

Please be advised that this Departmental action does not relieve or exempt you of the requirement to obtain all other applicable local, state and federal authorizations necessary to perform said activities.

West Main Street Bridge Replacement / Minor Project Modification Approval
Ayer, Middlesex County
June 2, 2020

Should you have any questions pertaining to this matter please do not hesitate to contact Jerome Grafe at Jerome.Grafe@mass.gov (617) 292-5708.

Sincerely,

A handwritten signature in black ink, appearing to read "Daniel J. Padien". The signature is fluid and cursive, with a prominent initial "D" and a long, sweeping underline.

Daniel J. Padien
Program Chief
Waterways Regulation Program

Cc: Ayer Conservation Commission
WorldTech Engineering

APPENDIX D

MASSACHUSETTS DIVISION OF FISHERIES & WILDLIFE
NEGATIVE DETERMINATION



MASSWILDLIFE

DIVISION OF FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
[MASS.GOV/MASSWILDLIFE](https://www.mass.gov/masswildlife)

April 29, 2024

Matthew Hernon
Town of Ayer Department of Public Works
25 Brook Street
Ayer, Massachusetts 01432

Ayer Conservation Commission
1 Main St
Ayer, MA 01432

RE: Applicant: Matthew Hernon, Town of Ayer Department of Public Works
 Project Location: West Main Street at Nonacoicus Brook
 Project Description: Bridge replacement
 DEP Wetlands File No.: -
 NHESP File No.: 24-18409
 Heritage Hub Form ID: RC-85669

Dear Commissioners & Applicant:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") received a Notice of Intent with site plans (dated 3/29/24, revised date N/A) in compliance with the rare wildlife species section of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.58(4)(b), 10.59). The Division also received the MESA Review Checklist and supporting documentation for review pursuant to the MA Endangered Species Act Regulations (321 CMR 10.18).

WETLANDS PROTECTION ACT (WPA)

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not adversely affect** the actual Resource Area Habitat of state-protected rare wildlife species. Therefore, it is our opinion that this project meets the state-listed species performance standard for the issuance of an Order of Conditions.

Please note that this determination addresses only the matter of rare wildlife habitat and does not pertain to other wildlife habitat issues that may be pertinent to the proposed project.

MASSACHUSETTS ENDANGERED SPECIES ACT (MESA)

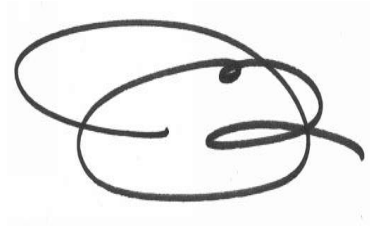
Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site

MASSWILDLIFE

plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Melany Cheeseman, Endangered Species Review Assistant, at Melany.Cheeseman@mass.gov, (508) 389-6357.

Sincerely,

A handwritten signature in black ink, appearing to read "Jesse Leddick". The signature is stylized with several loops and a long horizontal stroke at the end.

Jesse Leddick
Assistant Director

cc:

APPENDIX E

CERTIFICATE – ENVIRONMENTAL NOTIFICATION FORM (ENF)



The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
<http://www.mass.gov/eea>

May 11, 2018

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME : West Main Street Bridge Replacement
PROJECT MUNICIPALITY : Ayer
PROJECT WATERSHED : Nashua River
EEA NUMBER : 15837
PROJECT PROPONENT : Town of Ayer, Department of Public Works
DATE NOTICED IN MONITOR : April 11, 2018

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G. L. c. 30, ss. 61-62I) and Section 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that this project **does not require** the preparation of an Environmental Impact Report (EIR).

Project Description

As described in the Environmental Notification Form (ENF), the project consists of the replacement of the structurally deficient and hydraulically undersized West Main Street Bridge over the Nonacoicus Brook in the Town of Ayer. A recent bridge inspection report developed by the Massachusetts Department of Transportation (MassDOT) indicated that the bridge is in poor to severe condition with portions of the structure in a state of advanced deterioration. The purpose of the project is to improve the safety of the bridge by replacing the aging and deteriorating structure. The bridge will be removed and replaced with a three-sided, precast concrete bridge with a span length of approximately 28-feet (ft). The bridge will accommodate two 11-ft wide travel lanes, two 5-ft wide shoulders that will

serve as dedicated bike lanes, and two 6-ft wide sidewalks. The ENF indicated that that the project has been designed to be consistent with MassDOT's Complete Streets design guidelines.

Project Site

As described in the ENF, the West Main Street Bridge was built in 1850 and reconstructed in 1990. The bridge is a three-sided, natural bottom culvert comprised of a concrete slab deck supported by steel railroad rails which bear on stone masonry abutments and wingwalls. The bridge has a total span of approximately 10-ft with a hydraulic opening that narrows from 10-ft on the upstream side to 7-ft on the downstream side. The bridge carries two lanes of traffic with 2-ft shoulders and a 4-ft wide sidewalk along the south (downstream) side of the bridge. The bridge is a critical utility corridor; it carries a gas transmission main, sewer main, water main, and a telecommunications conduit. The bridge crosses Nonacoicus Brook and its regulatory floodway. According to the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) for Middlesex County (Map No. 25017C0211E, effective June 4, 2010), the adjacent land is located within a designated AE Zone (Areas subject to inundation by the 1-percent-annual-chance flood event). On-site wetland resource areas include Land Under Water (LUW), Inland Bank, Bordering Vegetated Wetland (BVW), Bordering Land Subject to Flooding (BLSF), and Riverfront Area. The project site is located within the Squannassit Area of Critical Environmental Concern (ACEC).

The ENF indicated that a failure of the West Main Street Bridge would have a significant impact on the transportation network as it is one of the main corridors for vehicles entering and exiting the town. The proximate Shirley Street Bridge previously provided secondary vehicular access over the Nonacoicus Brook; however it was closed in 2015 due to structural concerns. The ENF indicated that bridge rehabilitation or replacement of the Shirley Street Bridge may occur in the future, pending available funding. Should work at the Shirley Street Bridge be proposed, the Town should consult with the MEPA Office to determine whether additional review would be required.

Environmental Impacts and Mitigation

As described in the ENF, the project will alter the following wetland resource areas: Bank (83 lf temporary/48 lf permanent), BVW (1,372 sf temporary/339 sf permanent), LUW (1,679 sf temporary/1,098 sf permanent), BLSF (2,294 sf temporary/2,803 sf permanent), and Riverfront Area (2,300 sf temporary/25,163 sf permanent). It will alter approximately 1,481 sf of land (including creation of 610 sf of impervious area) located within the Squannassit ACEC.

Measures to avoid, minimize, and mitigate environmental impacts include: use of erosion and sedimentation control measures during the construction period, implementation of a construction period traffic management plan, in-situ restoration of wetlands, and wetland replication and compensatory flood storage (if required by the Conservation Commission).

Jurisdiction and Permitting

The project is undergoing review and requires an ENF pursuant to Sections 11.03(3)(b)(1)(e), 11.03(3)(b)(1)(f), and 11.03(11)(b) of the MEPA regulations because it requires a State Agency Action and will result in the expansion of existing fill or structures within a regulatory floodway, alteration of

greater than one-half acre or more of any other wetlands (LUW, BLSF, Riverfront Area), and is located within an ACEC (respectively). The project may require a 401 Water Quality Certification (WQC) from the Massachusetts Department of Environmental Protection (MassDEP). It will receive Financial Assistance from MassDOT.

The project requires an Order of Conditions from the Ayer Conservation Commission (or in the case of an appeal, a Superseding Order of Conditions from MassDEP) and a National Pollutant Discharge Elimination System (NPDES) Construction General Permit from the U.S. Environmental Protection Agency (EPA). It also requires authorization from the U.S. Army Corps of Engineers (ACOE) under the General Permits for Massachusetts in accordance with Section 404 of the Federal Clean Water Act.

Because the project will receive Financial Assistance from the MassDOT Municipal Small Bridge Program, MEPA jurisdiction is broad in scope and extends to all aspects of the project that may cause Damage to the Environment, as defined in the MEPA regulations.

Review of the ENF

The ENF provided a description of existing and proposed conditions, a discussion of project alternatives, preliminary project plans, and identified measures to avoid, minimize and mitigate project impacts. The Proponent's consultant provided supplemental information (including but not limited to clarifying the dredge volume, Preliminary Design Report that included a hydraulic analysis, and Bridge Inspection Reports) to facilitate MEPA review of the project.¹ For purposes of clarity, references to the ENF in this Certificate include this supplemental information

Alternatives Analysis

The ENF evaluated five alternatives based on the following criteria: ability to meet project goals and improve safety, site constraints, cost, construction-phase traffic impacts, and environmental impacts and benefits. Specifically, the ENF evaluated the following alternatives:

- **Alternative 1: No-Build Alternative** – The West Main Street Bridge would remain in its existing condition. This alternative was eliminated because it would not improve the safety of the structurally deficient and deteriorating structure.
- **Alternative 2: Complete Replacement with Road Closure and Detour** – This alternative would replace the bridge structure with a three-sided, precast concrete structure and would have similar environmental impacts as the Preferred Alternative. Under this alternative, the bridge would be completely closed during construction which would reduce the construction timeframe and cost. This alternative was eliminated as closing West Main Street would require a 6-mile detour through adjacent towns.
- **Alternative 3: Rehabilitation of Existing Structure** – This alternative would rehabilitate the bridge to meet safety standards. It would reduce wetland impacts compared to the Preferred

¹ Emails from Lori Benoit (Stantec) and Kristopher Surette (WorldTech Engineering, LLC) to Page Czepiga (MEPA Office) sent 4/26/18.

Alternative. The ENF indicated that this alternative was dismissed due to the advanced deterioration of the bridge which makes rehabilitation ineffective and financially infeasible.

- **Alternative 4: Structure Fully Compliant with MA Rivers and Stream Crossing Standards –** This alternative would replace the bridge with a 32-ft long span, which would comply with the MA Rivers and Stream Crossing Standards (“Stream Crossing Standards”). The ENF indicated that a span of this length would require the use of steel beams on cast-in place concrete abutments and cast-in-place wingwalls which would increase the construction duration and cost. This alternative was dismissed based on the increased cost and negligible improvement in streamflow.
- **Alternative 5: Staged Construction of Replacement Structure (Preferred Alternative, as described herein) –** This alternative includes complete replacement of the bridge, as described in Alternative 2, but with phased construction that would allow one lane of traffic to remain open during construction. This will result in a longer construction duration, but will eliminate the need for the road closure and circuitous detour.

The ENF indicated that the Preferred Alternative was selected as it will increase the hydraulic capacity compared to existing conditions, meet current regulatory load requirements, comply with ADA standards and MassDOT’s Complete Streets design guidance, reduce environmental impacts, and minimize disturbance to traffic patterns during construction.

Area of Critical Environmental Concern/Wetlands

The project is located within the Squannassit ACEC and it will impact Bank, BVW, LUW, BLSF, and Riverfront Area. The ENF indicated that the project is a Limited Project and that it is designed to be consistent with the Stream Crossing Standards to the maximum extent feasible. The Ayer Conservation Commission will review the project to determine its consistency with the Wetlands Protection Act (WPA), the Wetlands Regulations (310 CMR 10.00), and associated performance standards, including Stormwater Management Standards (SMS). The Town submitted a Notice of Intent (NOI) to the Conservation Commission (MassDEP File No. 100-0424) which is under review. Temporary wetland impacts are associated with construction access and use of a cofferdam and stream bypass system during the construction period. Permanent wetland impacts are associated with bridge construction, including replacement of existing sidewalls and wingwalls, placement of scour protection, and extension of sidewalks. According to the ENF, increasing the span of the crossing to 28-ft will provide a net increase of 30 cubic yards (cy) of floodplain storage. To mitigate permanent impact to BVW and BLSF, a wetland replication area will be constructed adjacent to the work area and additional compensatory flood storage will be created (if required by the Conservation Commission). Areas that are temporarily disturbed will be restored to their original condition upon completion of construction.

Comments from MassDEP note that the project will require a 401 WQC because it will dredge greater than 100 cy of material (137 cy). The Proponent indicated that the project has been revised (reduction in thickness of scour protection) to reduce the volume of dredging to less than 100 cy. The Proponent should provide information to MassDEP to support a determination that the project does not require a 401 WQC for dredging. The ENF indicated that the Proponent was coordinating with MassDEP to determine whether the project is exempt from Chapter 91 (c.91) licensing requirements. Correspondence from MassDEP-Division of Waterways confirms that the project does not require a c.91 authorization pursuant to 310 CMR 9.05(3)(c).

Climate Change Adaptation

The Preliminary Design Report included a hydrologic and hydraulic analysis (“hydraulic analysis”) which was performed to guide the design of the project. The hydraulic analysis evaluated existing (minimum 7-ft span) and proposed conditions (28-ft span) during the 10-, 25-, 50-, and 100-year storm events. Under existing conditions, the West Main Street Bridge provides little to no freeboard during the 10- and 25-year storm events and may overtop during the 100-year storm event. Under proposed conditions, the bridge will accommodate the 25-year storm event with 1-ft of freeboard and will pass the 50- and 100- year storm events without overtopping the road. Plans provided with the ENF indicate that there will be 0.6-inches of freeboard during the 100-year storm event.² The hydraulic analysis also evaluated a 36-ft span alternative to determine whether a longer span would improve hydraulic conditions and provide increased freeboard. According to the hydraulic analysis, the crossing is “outlet controlled” and increasing the span length resulted in a negligible difference in the water surface elevation and freeboard. The Preliminary Design Report indicated that additional freeboard could be provided through increasing the roadway profile and re-grading the streambed to lower its elevation by approximately 1-ft. At the MEPA site visit, the Proponent’s consultant indicated these options were dismissed based on the additional cost, presence of existing utilities, and increased environmental impacts.

The ENF noted that the span of the proposed bridge (28-ft) is greater than that of the Shirley Street Bridge (10-ft) located approximately 150-ft upstream. The hydraulic analysis indicated that this location may overtop during the 50- and 100-year storm events. The Preliminary Design Report provided with the ENF also recommended replacement of the Shirley Street Bridge to address structural deficiencies and to improve hydraulic conditions. The ENF indicated that the Shirley Street Bridge may be repaired or replaced, if funding is available. I encourage the Town to further consider whether the two bridges will provide enough freeboard given the effects of climate change, including severe storm events and increasing precipitation. The effects of climate change may adversely impact bridges, culverts, and other critical infrastructure over time. To address this potential vulnerability and those posed to Town’s infrastructure, I encourage the Town to participate in the Municipal Vulnerability Preparedness (MVP) grant program. The MVP program is a community-driven process to define natural and climate-related hazards, identify existing and future vulnerabilities and strengths of infrastructure, environmental resources and vulnerable populations, and develop, prioritize and implement specific actions the Town can take to reduce risk and build resilience.

Stormwater

The ENF indicated that the project has been designed to comply with MassDEP’s Stormwater Management Standards (SMS) to the maximum extent feasible. I refer the Town to MassDEP’s comment letter which indicates that the NOI should be amended with a Stormwater Checklist. Currently, stormwater is collected in four catch basins and discharged into Nonacoicus Brook through two outlet pipes. Proposed improvements include the replacement of existing manholes and catch basins with deep-sump hooded catch basins, installation of new deep-sump hooded catch basins, new drainage piping, and replacement of existing outlet pipes.

²As measured from the bottom of the bridge’s frame slab to the 100-year storm elevation.

Rare Species

The area on the northern side of the bridge contains Priority and Estimated Habitat for rare species as mapped by the Division of Fisheries and Wildlife's (DFW) Natural Heritage and Endangered Species Program (NHESP). Comments from NHESP indicate that the project will not result in a prohibited Take of state-listed rare species.

Construction Period

The ENF indicated that construction will commence in fall 2018 and will last for approximately one year. Construction will occur in two phases to maintain pedestrian access and one lane of alternating two-way vehicular traffic. Phase 1 will include replacement of the westbound side of the bridge and Phase 2 will include replacement of the eastbound side. The Proponent will install a temporary traffic signal for the duration of construction and will prepare and implement a Traffic Management Plan to minimize construction period traffic impacts. Temporary cofferdams and bypass piping will be used to maintain streamflow during construction. The ENF indicated that an upstream dam at Plow Shop Pond may be used to control water levels if work occurs outside of the summer low-flow period. If this alternative is necessary, the ENF indicated that minimum, low-flows would be maintained in Nonacoicus Brook throughout the construction period.


All construction should be managed in accordance with applicable MassDEP Solid Waste and Air Pollution Control regulations pursuant to M.G.L. c.40, §54. I encourage the Proponent to require contractors to install emission control devices on all off-road construction vehicles in an effort to reduce emissions of volatile organic compounds (VOCs), carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment. Off-road vehicles are required to use ultra-low sulfur diesel fuel (ULSD). All construction activities should be undertaken in compliance with the conditions of all State and local permits.

Conclusion

The ENF has sufficiently defined the nature and general elements of the project for the purposes of MEPA review and demonstrated that the project's environmental impacts will be avoided, minimized and/or mitigated to the extent practicable. I hereby determine that no further MEPA review is required. If replacement or significant improvements are proposed to the Shirley Street Bridge, the Town should consult with the MEPA Office to determine whether additional review would be required.

May 11, 2018

Date


Matthew A. Beaton

Comments received:

04/26/2018 Natural Heritage and Endangered Species Program (NHESP)

05/02/2018 Massachusetts Department of Environmental Protection – Central Regional Office
(MassDEP)

05/09/2018 MassDEP – Division of Waterways

MAB/PRC/prc



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Central Regional Office • 8 New Bond Street, Worcester MA 01606 • 508-792-7650

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

Martin Suuberg
Commissioner

May 1, 2018

Secretary Matthew A. Beaton
Executive Office of Environmental Affairs
100 Cambridge Street, 9th Floor
Boston, MA 02114

Attention: MEPA Unit – Paige Czepiga

Re: Environmental Notification Form (ENF)
West Main Street Bridge Replacement
Ayer
EEA #15837

Dear Secretary Beaton,

The Massachusetts Department of Environmental Protection's ("MassDEP") Central Regional Office has reviewed the ENF for the West Main Street Bridge Replacement Project (the "Project") in Ayer. The Project is proposed by the Town of Ayer, Department of Public Works (the "Proponent"). The Project consists of the replacement of the existing West Main Street Bridge over the Nonacoicus Brook in the Town of Ayer. The existing bridge will be removed and replaced within the existing footprint with a 3-sided pre-cast concrete bridge with a 28-foot span length. Removal of the existing abutments and excavation behind the abutments of materials will be necessary to widen the span opening from 7-10 ft to 28 ft. Installation of the bridge footings/sidewalls will require work within a dewatered work area that is segregated from the flow within the brook.

The Project will alter the following wetland resource areas: Bank (83 square feet (sf) temporary and 38 linear feet (lf) permanent), Bordering Vegetated Wetlands (BVW) (1,372 sf temporary and 339 sf permanent), Land Under Water (LUW) (1,679 sf temporary and 1,098 sf permanent), Bordering Land Subject to Flooding (BLSF) (2,294 sf temporary and 2,803 sf permanent), and Riverfront Area (RA) (2,300 sf temporary and 25,163 sf permanent).

The Project is under MEPA review because it meets or exceeds the following review threshold:

- 11.03 (11)(b) - Areas of Critical Environmental Concern (ACEC) - Squannassit ACEC
- 11.03(3)(b)(1)(e) - New fill or structure or Expansion of existing fill or structure, except a pile-supported structure, in a velocity zone or regulatory floodway

The Project requires the following State Agency Permits:

- MassDEP - 401 Water Quality Certification and Chapter 91 License; Superseding Order of Conditions if the Ayer Order of Conditions is appealed.
-

MassDEP offers the following comments on the Project:

Wetlands

The Proponent filed a Notice of Intent (NOI) with the local conservation commission with a copy to MassDEP on March 23, 2018. According to the NOI, the Proponent proposes replacement of 48 lf of Bank, 340 sf of BVW, and 3,386 sf (1,760 cubic feet) of BLSF. Hydraulic analyses provided in the NOI show that although flow may be increased downstream of the bridge under certain conditions due to the Project, the effect is negligible. MassDEP has issued File #100-0424 to the NOI and provided comments including the need to submit a Stormwater Checklist documenting that Stormwater Management Standards have been met to the maximum extent practicable for this redevelopment transportation project.

The local Order of Conditions may serve as the 401 Water Quality Certification the filling of BVW which is less than 5,000 sf, however, the Project requires a separate 401 Water Quality Certificate for dredging because greater than 100 cubic yards of dredging is proposed.

MassDEP appreciates the opportunity to comment on the Project. If you have any questions regarding these comments, please do not hesitate to contact Stella Tamul, Central Regional Office MEPA Coordinator, at (508) 767-2763.

Very truly yours,



Mary Jude Pigsley
Regional Director

cc: Commissioner's Office, MassDEP

Czepiga, Page (EEA)

From: Lynch, Ben (DEP)
Sent: Wednesday, May 09, 2018 12:09 PM
To: Czepiga, Page (EEA)
Cc: Grafe, Jerome (DEP)
Subject: RE: Request for determination on Ch. 91 license exemption for bridge replacement project in Ayer

Page- prior to the Town of Ayer's MEPA filing for a replacement of the West Main Street bridge, EEA No. 15837 (noticed in the April 11, 2018 Monitor), the proponent, contacted the waterway regulation program and worked closely with the Department. The program has determined that, pursuant to 310 CMR 9.05(3)(c), no new c.91 authorization will be required for the replacement of the bridge.

From: Czepiga, Page (EEA)
Sent: Tuesday, May 08, 2018 9:54 AM
To: Lynch, Ben (DEP)
Subject: RE: Request for determination on Ch. 91 license exemption for bridge replacement project in Ayer

Ben,
The comment period closed 5/1, but you can date the email today.
Thanks for checking!

Page Czepiga
Environmental Analyst
MEPA Office

617-626-1021

From: Lynch, Ben (DEP)
Sent: Tuesday, May 08, 2018 9:44 AM
To: Czepiga, Page (EEA); Lynch, Ben (DEP)
Subject: Re: Request for determination on Ch. 91 license exemption for bridge replacement project in Ayer

Hi Page- happy to do that. In the field now so will send it to you when I get back to One Winter. When did the comment period close, and would it be better to use that date for the letter or is a more formal email dated today just as good? Thanks. Ben

Sent from my Verizon, Samsung Galaxy smartphone

Czepiga, Page (EEA)

From: Paulson, David (FWE)
Sent: Thursday, April 26, 2018 3:55 PM
To: Czepiga, Page (EEA); Cheeseman, Melany (FWE)
Subject: West Main Street Bridge Replacement - AYER ENV (15837/18-37423)
Attachments: Ayer_18-37423.pdf

Secretary Matthew Beaton
Executive Office of Environmental Affairs
Attention: MEPA Office
Page Czepiga, EEA No. 15837
100 Cambridge St. Suite 900
Boston, Massachusetts 02114

Project Name: West Main Street Bridge Replacement - AYER
Proponent: Town of Ayer
Location: West Main Street
Document Reviewed: Environmental Notification Form
EEA No.: 15837
NHESP No: 18-37423

Dear Secretary Beaton:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the Division) has reviewed the Environmental Notification Form for the proposed West Main Street Bridge Replacement - AYER and would like to offer the following comments regarding state-listed rare species and their habitats.

On April 19, 2018, the Division issued a "No Adverse/No Take" determination. Attached is a copy of the determination for your review and reference.

We appreciate the opportunity to comment on this project. If you have any questions about this letter, please contact David Paulson, Endangered Species Review Biologist, at (508) 389-6366 or david.paulson@state.ma.us.

David Paulson
Senior Endangered Species Review Biologist
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6366 | e: david.paulson@state.ma.us
mass.gov/masswildlife | [facebook.com/masswildlife](https://www.facebook.com/masswildlife)



MASSWILDLIFE

DIVISION OF FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

Jack Buckley, *Director*

April 19, 2018

Ayer Conservation Commission
1 Main Street
Ayer MA 01432

Mark Wetzel
Town of Ayer Department of Public Works
25 Brook Street
Ayer MA 01432

RE: Applicant: Mark Wetzel, Town of Ayer Department of Public Works
 Project Location: West Main St. over Nonacoicus Brook
 Project Description: Bridge replacement
 DEP Wetlands File No.: 100-0424
 NHESP File No.: 18-37423

Dear Commissioners & Applicant:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") received a Notice of Intent with site plans (dated 4/12/2018) in compliance with the rare wildlife species section of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.58(4)(b), 10.59). The Division also received the MESA Review Checklist and supporting documentation for review pursuant to the MA Endangered Species Act Regulations (321 CMR 10.18).

WETLANDS PROTECTION ACT (WPA)

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not adversely affect** the actual Resource Area Habitat of state-protected rare wildlife species. Therefore, it is our opinion that this project meets the state-listed species performance standard for the issuance of an Order of Conditions.

Please note that this determination addresses only the matter of **rare** wildlife habitat and does not pertain to other wildlife habitat issues that may be pertinent to the proposed project.

MASSACHUSETTS ENDANGERED SPECIES ACT (MESA)

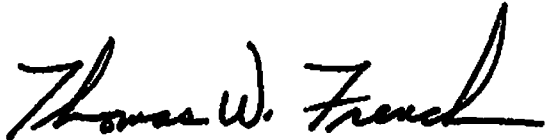
Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries and Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division

MASSWILDLIFE

pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Melany Cheeseman, Endangered Species Review Assistant, at (508) 389-6357.

Sincerely,

A handwritten signature in black ink that reads "Thomas W. French". The signature is written in a cursive style with a large, sweeping flourish at the end.

Thomas W. French, Ph.D.
Assistant Director

cc: MA DEP Central Region
Lori Benoit, Stantec Consulting Services

APPENDIX F

GEOTECHNICAL REPORT

December 28, 2018



Pease International Tradeport
100 International Drive, Suite 360
Portsmouth, New Hampshire 03801
603-431-2520
603-431-8067 fax
www.hoyletanner.com

Mr. Bill Mertz, PE
Vice President
WorldTech Engineering, LLC
300 TradeCenter, Suite 5580
Woburn, Massachusetts 01801

RE: West Main Street Bridge – Ayer, MA
Geotechnical Design Report
Hoyle, Tanner Project No. 924001

1. EXECUTIVE SUMMARY

Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner) herein submits to WorldTech Engineering, LLC (WorldTech), this report presenting geotechnical subsurface information for the proposed bridge replacement project of the West Main Street crossing over Nonacoicus Brook in Ayer Massachusetts. The finding of this report indicate that shallow foundations consisting of spread footings founded on gravel borrow are a feasible foundation alternative for this project.

2. INTRODUCTION

2.1 Scope

In accordance with the agreement between WorldTech and Hoyle, Tanner, the objectives of this report are to evaluate foundation alternatives for the subject bridge replacement project, with preference for use of shallow foundations if found to be feasible for this site. Recommendations for the shallow foundation alternative include bearing resistance, estimated foundation settlements, and seismic design parameters.

2.2 Subject Background, Proposed Construction, History

The West Main Street Bridge over Nonacoicus Brook is proposed to be replaced in its entirety. According to the MassDOT bridge inspection report, the existing bridge was built in 1850 and reconstructed in 1900. It consists of a single-span concrete slab deck supported on steel railroad rails which bear on stone masonry abutments and U-backed wingwalls. The overall span of the structure varies from approximately 7' to 10' due to cast-in-place concrete repairs that were made to the existing abutments. The bridge provides a total paved roadway width of 35' which contains 2' shoulders on each side. There is a 4' paved sidewalk along the downstream side of the bridge. The bridge is structurally deficient and hydraulically undersized.

The top of roadway elevation at the existing bridge approaches is approximately 219.5', and the existing channel bottom elevation is approximately 206'. Elevations referenced in this report are relative to the North American Vertical Datum of 1988 (NAVD 88).

The proposed bridge consists of a 28' span precast concrete rigid frame in the approximate alignment of the existing bridge. The proposed foundations will be located behind the existing foundations. The total out-to-out width of the bridge is 47'-11" and carries two 11'-0" travel lanes, two 5'-0" shoulder/bike lanes and two 6'-6" concrete sidewalks. Staged construction is proposed due to the high volume of daily traffic that utilizes this crossing and truck restrictions on the local detour route.

Refer to the Sketch Plans in Appendix A for the approximate location of existing and proposed site features.

2.3 Site Reconnaissance and Overall Description

Hoyle, Tanner personnel visited the site on multiple occasions during the preparation of this report. The existing abutments and wingwalls are in poor-to-severe condition with locations of advanced deterioration noted as well as significant stream migration at the bridge inlet. A complete description of bridge condition is included in the Preliminary Design Report (PDR) dated April 2017 prepared for this project.

3. SUBSURFACE CONDITIONS

3.1 Local Geology: Rock, Surficial and Miscellaneous

The USGS Surficial Geologic Map (Figure 2) of the project location indicates that the soils within the historic channel are swamp deposits and that the soils surrounding the channel are coarse deposits.

3.2 Subsurface Exploration Program

The boring exploration program consisted of two test borings (B-3 and B-4) and two probes (P-3 and P-4). These borings were completed on April 18 and 19, 2016 by Northern Test Boring, Inc. and utilized the Standard Penetration Test (SPT) to gather information about subsurface soil conditions. The bridge borings were drilled one per abutment, and one on each side of the roadway at the approximate location of the proposed abutments. In a similar fashion, the probes were drilled in the remaining two quadrants of the proposed footing locations in an attempt to envelope subsurface strata profiles. These borings utilized hollow stem auguring below the water table. As such, the SPT-N values may have been reduced due to the hydrostatic pressure acting against the soil at the bottom of the boring. As a result, an additional cased boring (SA-1) utilizing rotary wash boring methods was completed on November 16, 2018 by Northern Test Boring, Inc. and under the supervision of Stephens Associates Consulting Engineers, a subconsultant to Hoyle, Tanner. A single additional boring was considered to be sufficient based on the relative uniformity of the soil stratum across the previously completed borings and probes. The results of this additional boring show an increase in the SPT-N values as compared to the hollow stem auger borings. Boring SA-1 is considered to be more representative of the actual soil properties and was therefore used in development of the recommendations presented in this report.

Soil samples were collected at 5' increments for all borings to determine soil stratigraphy, depth to bedrock, and to develop soil engineering properties for foundation recommendations. Boring and probe locations are shown on the key plan in Appendix A. Copies of the boring logs are provided in Appendix B.

3.2.1 Soils Testing, Laboratory and/or In-Situ

Foundation Bearing Soil:

Testing of the in-situ bearing material was beyond the scope of this project. Correlations between SPT-N values collected from boring SA-1 using AASHTO LRFD Bridge Design Specifications, 8th Edition as well as relevant FHWA, NCHRP, and USACOE publications were used to develop soil engineering properties for the purposes of design and foundation recommendations. References for correlations used are included in Appendix D.

Streambed Soil Sampling:

Two streambed soil samples were collected on September 21, 2016 by S.W. Cole Engineering, Inc. One sample was taken upstream of the bridge at an approximate depth of 2 feet to 3 feet below the streambed and the other was taken downstream of the bridge and an approximate depth of 1 foot to 2 feet below the streambed. Results of the testing can be found in Reports of Gradation found in Appendix C.

The streambed sample obtained from the upstream side of the bridge consisted of gravel, sand and trace amounts of fines. Based on laboratory testing, the D_{50} of the upstream sample was 1.8 millimeters. The streambed sample obtained from the downstream side of the bridge consisted of gravel, sand and trace amounts of fines. Based on laboratory testing, the D_{50} of the downstream sample was 1.1 millimeters.

The streambed soil sampling was utilized in the determination of scour depths under the proposed conditions. The scour and stability analysis is described in further detail in the Hydraulic Study Report dated April 2018 prepared for this project.

3.3 Verification of Sample Descriptions on Boring Logs

Soil classification of samples collected from boring SA-1 (completed on November 16, 2018 by Northern Test Boring, Inc.) were completed by Stephens Associates Consulting Engineers, a geotechnical subconsultant to Hoyle, Tanner, and are included on the boring log in Appendix B.

3.4 Subsurface Profile

The subsurface stratigraphy generally consists of a layer of asphalt overlying roadway fills comprised of brown sand with some silt and organics overlying medium to coarse sand and gravel with trace silt, possible till, and bedrock. Generalized descriptions of the subsurface conditions encountered in the test borings are discussed below.

Asphalt: Approximately 1" of Hot Mix Asphalt (HMA) pavement was encountered in the sidewalk in boring B-3 and 5" of HMA pavement was encountered in the roadway in borings B-4 and SA-1.

Roadway Fill: Brown fine-medium sand, some silt with organics. This material was encountered below the pavement layer to the channel elevation.

Native Sand and Gravels: Medium Dense brown fine to coarse sand was encountered below the bottom of channel elevation to 71.5' below ground surface (bgs) at boring SA-1. This layer constitutes the bearing layer for the shallow foundation alternative. Typical SPT-N values for the sand and gravel layers ranged between 10 to 30 blows per foot (bpf). A layer of loose brown sand was observed at 11' to 14' bgs. Since this layer is above the proposed bottom of footing elevation, this material will be excavated during construction and will not affect performance of the foundation alternatives.

Glacial Till: Possible glacial till encountered at 71.5' bgs at boring SA-1 consisted of medium dense light brown fine to coarse sand with gravel and silt. The SPT-N value for this layer was 24 bpf.

Bedrock: Possible bedrock was encountered at a depth of 78' bgs at boring SA-1. Core samples were not successfully collected due to the core barrel plugging at 80' bgs.

Groundwater: Groundwater was encountered at an approximate depth of 13' bgs for borings B-3 and B-4 and 8' below ground surface for SA-1. Borings B-3 and B-4 were taken during low flow conditions.

3.4.1 Applicable Design Parameters for Soil

Design parameters for the in-situ soil bearing layer based on correlations to SPT-N values are provided in Table 1 below. This layer corresponds to the native sand and gravels layer. Supporting calculations are provided in Appendix D.

Table 1: Soil Design Parameters

Property	Value
Soil Friction Angle, ϕ	33 deg
Moist Unit Weight, γ	115 pcf
Young's Modulus, E_s	431 ksf
Poisson's Ratio, ν	0.30

3.5 Seismic Design Category Evaluation

As specified in Section 3 of the MassDOT LRFD Bridge Manual, all seismic analysis and design of bridges shall be performed in accordance with the AASHTO Guide Specifications for LRFD Seismic Bridge Design (AASHTO). The subsurface profile at this site is representative of Site Class E. Using Site Class E is conservative since this site class definition is based on SPT N-values obtained from boring SA-1 over a depth of 78' (the probable bedrock depth). Per AASHTO Table 3.4.2.1-1, the site class should be defined from the average SPT N-values for the upper 100' of soil and therefore it is conservative to ignore the bedrock.

In accordance with AASHTO Article 3.4.1 for Site Class E, the following design response spectra are recommended (see Appendix E):

$$A_s = 0.184$$

$$S_{DS} = 0.382$$

$$S_{D1} = 0.142$$

Where:

- A_s is the response spectral acceleration based on site class E
- S_{DS} is the design spectral acceleration coefficient at 0.2 second period
- S_{D1} is the design spectral acceleration coefficient at 1.0 second period

In accordance with AASHTO Table 3.5-1, the Seismic Design Category (SDC) for the site is SDC A. Per Section 3.4.3.3 of the MassDOT LRFD Bridge Manual, a detailed seismic analysis is not required for the design for SDC A structures.

3.6 Liquefaction Potential

Liquefaction potential was evaluated using the Section 1806.4 of the Massachusetts Building Code, 9th Edition. A soil sample with an SPT-N blow count value of 7 bpf was taken at 45' bgs. Based on figure 1804.6c, this soil sample plots within the liquefaction susceptible portion of the figure.

However, as discussed in Section 3.5 of this report, the bridge is classified in SDC A. Per AASHTO 6.8, liquefaction assessment shall be conducted for SDC C and D structures only. As such, liquefaction potential is not considered in this report.

4. RECOMMENDED FOUNDATION SYSTEM

4.1 Retain or Modify Existing Foundation

Based on the findings in the Preliminary Design Report for this project, retaining or modifying the existing foundations was not studied due to the poor-to-severe condition of the structure and inadequate hydraulic opening of the existing crossing.

4.2 Embankment Considerations

The proposed roadway typical section width, alignment, and profile closely matches the existing conditions. As such, embankment stability or settlement is not studied in this report.

4.3 Shallow Foundation Design

The bottom of footing elevation was established based on the MassDOT LRFD Bridge Manual, 2013, Part II (drawing numbers 3.1.3, 3.1.4, and 3.1.5). Calculations were performed to determine the factored bearing resistance of the soil at the strength and service limit states based on the borings taken, proposed footing sizes, and AASHTO LRFD Bridge Design Specifications. The bearing stratum is approximately 15' below the existing roadway surface. The existing materials at this elevation are considered suitable for direct support of spread footings due to the bearing capacity, relative uniformity of the soil stratum, absence of organic or cohesive soils and the applied loading from the proposed bridge. Based on the proposed footing geometry and the

existing bearing stratum, settlement of the footings is estimated to be approximately 1" based on applied bearing pressures. Since the material is granular, the majority of this settlement will be elastic and will occur as the bridge is constructed and prior to final bridge pavement. Calculations for bearing resistance at the strength and service limit state as a function of applied bearing pressure and effective footing geometry are provided in Appendix D.

The channel material encountered in the borings and streambed sampling is scour susceptible and appropriate scour countermeasures will be designed and incorporated during final design. The proposed design assumes the scour countermeasures are effective in mitigating scour at this crossing, however, the calculations for bearing resistance conservatively assume that the channel has scoured to the bottom of footing elevation.

4.4 Deep Foundation Design

Although feasible, deep foundations were not considered for this project due to the soil conditions being suitable for spread footings. The proposed bridge is to be constructed in stages which would require multiple mobilizations of pile driving equipment during construction, resulting in increased cost for the pile supported foundation alternative.

5. CONSTRUCTION CONSIDERATIONS

5.1 Water Table

As reflected in the difference in observed water level between the August 2016 and November 2018 subsurface investigations, fluctuations in the observed groundwater table will occur due to variations in precipitation, the level of the Nonacoicus Brook, temperature and other factors different from those existing at the time the measurements were made.

5.2 Recommended Method for Water Control

Excavation for the proposed structure will be below the groundwater table, as such, a dewatering plan will be required. It is likely that the foundation excavation areas can be properly dewatered using sump pumps. Pumping areas should be located outside of the footing support limits and properly filtered to prevent the pumping of fines. Pumping shall be continuous until the rigid frame is backfilled to the level of the groundwater table. Construction will be required to follow any constraints imposed by Local, State, and Federal environmental and resource protection regulations.

A temporary water diversion structure will be required to convey Nonacoicus Brook through the work zone during construction. Nonacoicus Brook is relatively shallow within the project limits during the summer low-flow months, allowing for the use of sandbags across the stream at the upstream and downstream project limits to dewater the construction area. Stream flow through the dewatered construction area can be maintained via gravity flow through a temporary culvert, or by pumping the flow through a bypass pipe around the work area. It may also be possible to utilize an existing operable dam located 650' upstream of the site at the outlet of Plow Shop Pond to help regulate streamflow during construction, particularly if construction occurs outside of the

low-flow months. The final water diversion methods utilized for this project will be based on the Contractor's means and methods of construction.

5.3 Excavations

The bearing stratum is approximately 15' below existing grade. It is likely that open cut excavation, where applicable, can be used. To accommodate staged construction, support of excavation such as a steel sheeting cofferdam will be required to maintain one-lane of alternating two-way traffic at all times.

5.4 Obstructions

No natural obstructions that would require specialized equipment or removal methods were observed in the excavation limits based on a review of the boring logs. Excavation measurement and payment should follow MassDOT Standard Specifications for Highway Bridges.

5.5 Protection of Adjacent Structures and Utilities

All existing building structures are located beyond the anticipated limits of excavation.

Overhead utilities and underground utilities are located within project limits. Overhead utilities primarily run along the south side of West Main Street and cross to the north side of the road on each approach of the bridge. Underground utilities consist of two gas mains (4-inch main and an 8-inch critical transmission line), telecommunication ducts, municipal water, and municipal sewer. Coordination with the affected utilities, including any required impacts and or protection methods is ongoing and should be completed during the design phase of the project.

5.6 Sequence of Construction Activities

This project will be constructed using staged construction, while maintaining pedestrian traffic and one lane of alternating two-way vehicular traffic at all times. Final design of the bridge foundation shall include consideration for differential the elastic settlement of the bearing stratum during all stages of construction.

A general stage construction sequence is included in the Sketch Plans in Appendix A.

5.7 Special Geotechnical Monitoring or Instrumentation

No special geotechnical monitoring or instrumentation is recommended for this project.

We trust that this letter meets your expectations. Please feel free to contact me at (603) 431-2520 extension 23, or at alachance@hoyletanner.com, if you have any questions or require additional information regarding these findings.

Sincerely,

Hoyle, Tanner & Associates, Inc.



Aaron Lachance, P.E.

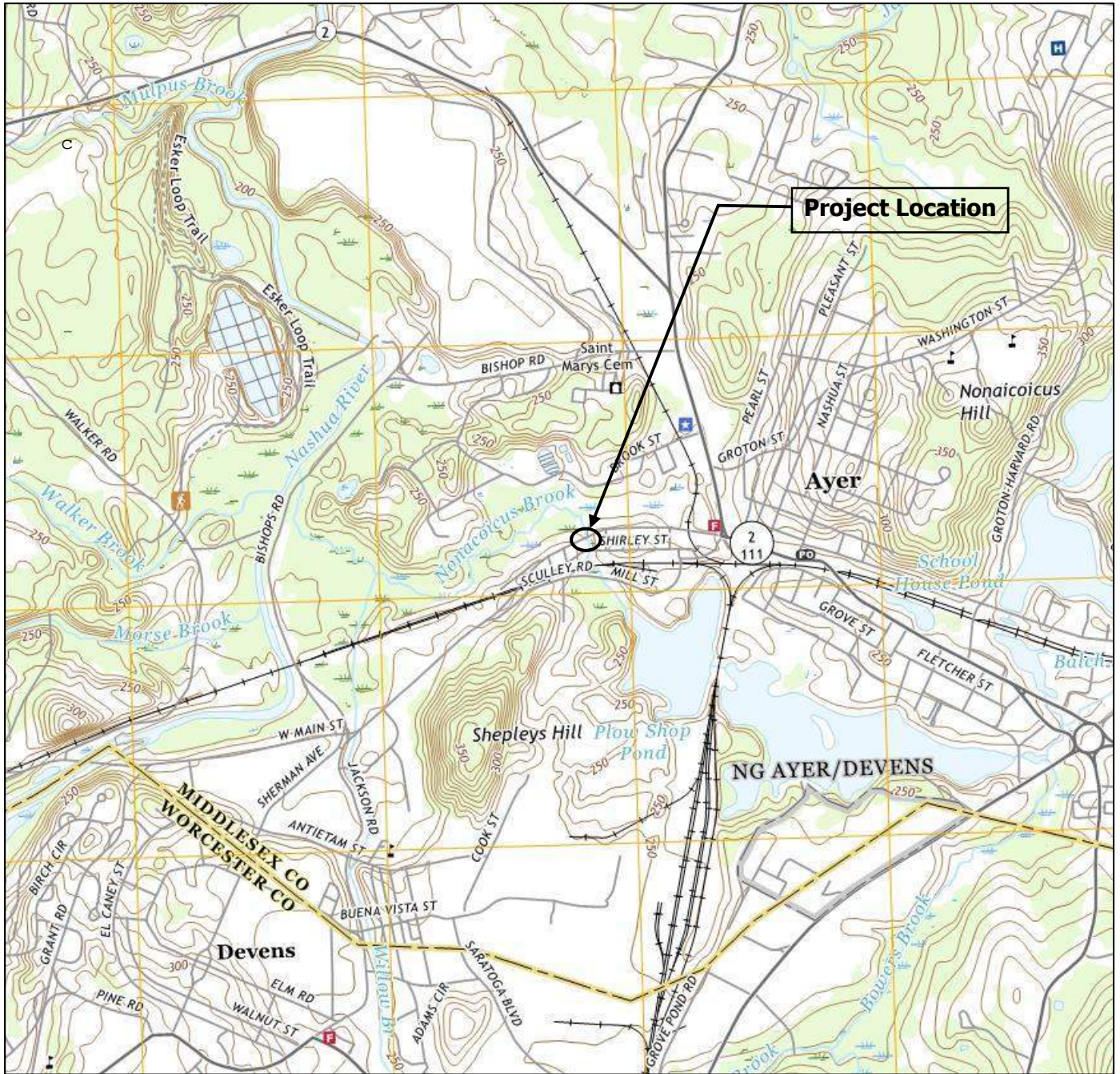
Senior Structural Engineer / Associate

Attachments:

Figure 1	Location Map
Figure 2	USGS Surficial Geologic Map
Appendix A	Sketch Plans
Appendix B	Boring Logs
Appendix C	Streambed Soil Gradation Reports
Appendix D	Bearing Capacity Calculations
Appendix E	Seismic Design Category

Figure 1
Location Map
of Geotechnical Report

LOCATION MAP



<p>West Main Street over Nonacoicus Brook Ayer, MA</p>		<p>Image Source: 2018 USGS Topographic Maps</p>	<p>DATE: 12/2018</p>	
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Figure 2
USGS Surficial Geologic Map
of Geotechnical Report

SURFICIAL GEOLOGIC MAP OF THE ASHBURY-LOWELL-STERLING-BILLERICA 11-QUADRANGLE AREA IN NORTHEAST-CENTRAL MASSACHUSETTS

Compiled by Byron D. Stone and Janet R. Stone
2007



DESCRIPTION OF MAP UNITS

POSTGLACIAL DEPOSITS



-  **Artificial fill**—Earth materials and manmade materials that have been artificially emplaced, primarily in highway and railroad embankments, and in dams; may also include landfills, urban development areas, and filled wetlands.
-  **Floodplain alluvium**—Sand, gravel, silt, and some organic material, stratified and well sorted to poorly sorted, beneath the floodplains of modern streams. The texture of alluvium commonly varies over short distances both laterally and vertically, and generally is similar to the texture of adjacent glacial deposits. Along smaller streams, alluvium is commonly less than 5 ft thick. The most extensive deposits of alluvium on the map are along the Nashua, Squannacook, and Nissitissit Rivers where the texture is predominantly sand, fine gravel, and silt, and total thickness is as much as 25 ft. Alluvium typically overlies thicker glacial stratified deposits.
-  **Swamp deposits**—Organic muck and peat that contain minor amounts of sand, silt, and clay, stratified and poorly sorted, in kettle depressions or poorly drained areas. Most swamp deposits are less than about 10 ft thick. Swamp deposits overlie glacial deposits or bedrock. They locally overlie glacial till even where they occur within thin glacial meltwater deposits.
-  **Early postglacial inland dune deposits**—Fine to medium, well-sorted sand, in transverse, parabolic, and hummocky dunes as much as 30 ft thick. Occur most commonly in large glacial lake basins where sand was derived from extensive glacial-lake deltas that were not yet vegetated and deposited in dune forms by early postglacial winds. Dune sand is now fixed by vegetation except where disturbed by human activities.

GLACIAL STRATIFIED DEPOSITS


Sorted and stratified sediments composed of gravel, sand, silt, and clay (as defined in particle size diagram) deposited in layers by glacial meltwater. These sediments occur as four basic textural units—gravel deposits, sand and gravel deposits, sand deposits, and fine deposits. On this interim map, gravel, sand and gravel, and sand deposits are not differentiated and are shown as *Coarse Deposits* where they occur at land surface. *Fine Deposits* also are shown where they occur at land surface. **Textural changes occur both areally and vertically, however subsurface textural variations are not shown on this interim map.**

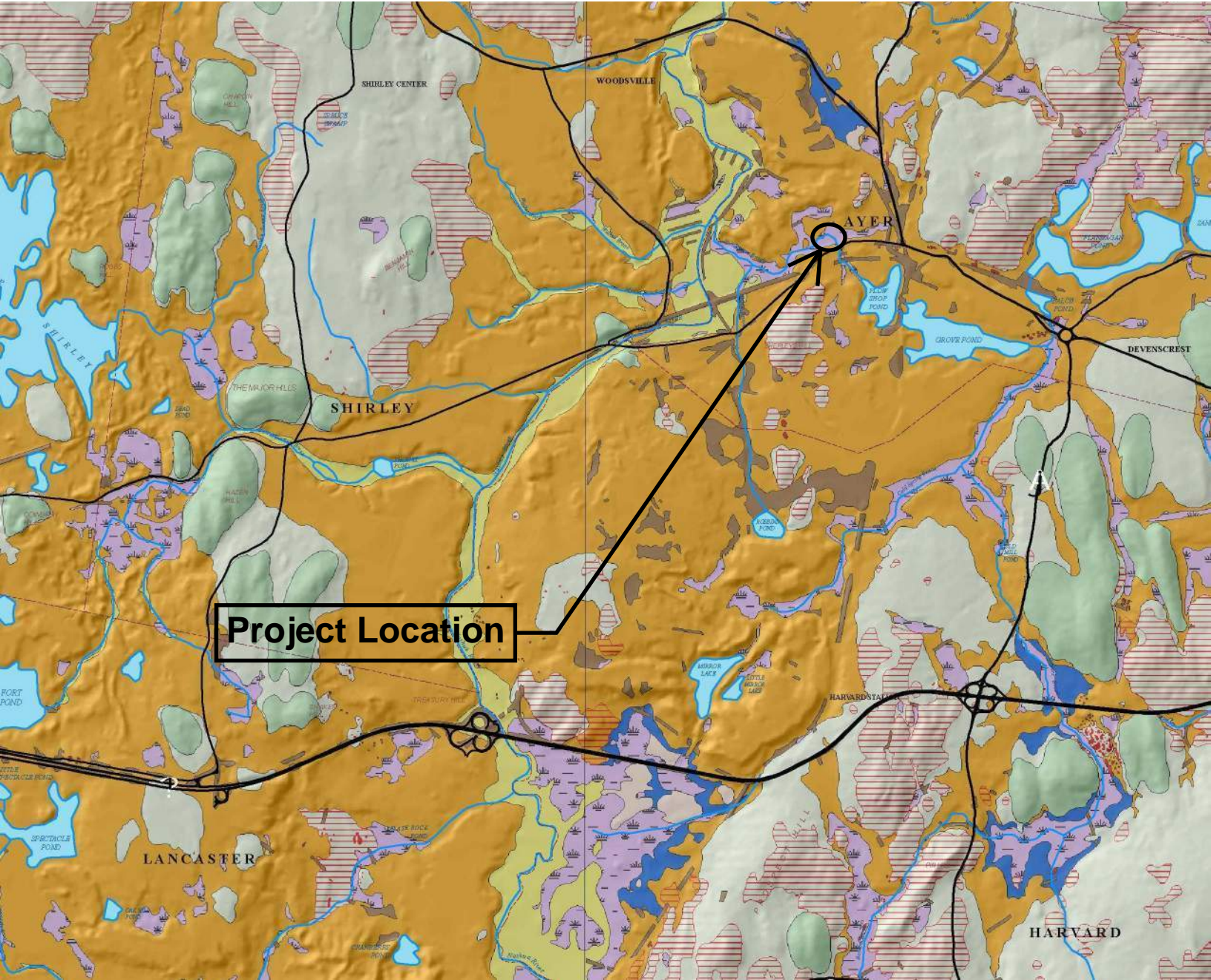
-  **Coarse deposits** include: *Gravel deposits* composed mainly of gravel-sized clasts; cobbles and boulders predominate; minor amounts of sand within gravel beds, and sand comprises few separate layers. Gravel layers generally are poorly sorted and bedding commonly is distorted and faulted due to postdepositional collapse related to melting of ice. *Sand and gravel deposits* composed of mixtures of gravel and sand within individual layers and as alternating layers. Sand and gravel layers generally range from 25 to 50 percent gravel particles and from 50 to 75 percent sand particles. Layers are well to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse. *Sand deposits* composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay.
-  **Glaciolacustrine Fine deposits** include very fine sand, silt, and clay that occurs as well-sorted, thin layers of alternating silt and clay, or thicker layers of very fine sand and silt deposited in glacial lakes. Very fine sand commonly occurs at the surface and grades downward into rhythmically bedded silt and clay varves. Locally, this map unit may include areas underlain by fine sand.

GLACIAL TILL DEPOSITS

-  **Thin till**—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders; in areas where till is generally less than 10-15 ft thick and including areas of bedrock outcrop where till is absent. Predominantly upper till of the last glaciation; loose to moderately compact, generally sandy, commonly stony. Two facies are present in some places; a looser, coarser-grained ablation facies, melted out from supraglacial position; and an underlying more compact, finer-grained lodgement facies deposited subglacially. In general, both ablation and lodgement facies of upper till derived from fine-grained bedrock are finer grained, more compact, less stony and have fewer surface boulders than upper till derived from coarser grained crystalline rocks. Fine-grained bedrock sources include the red Mesozoic sedimentary rocks of the Connecticut River lowland, marble in the western river valleys, and fine-grained schists in upland areas.
-  **Thick till**—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered gravel clasts and few large boulders at the surface; in the shallow subsurface, compact, nonsorted matrix of silt, very fine sand, and some clay containing scattered small gravel clasts in areas where till is greater than 10-15 ft thick, chiefly in drumlin landforms in which till thickness commonly exceeds 100 ft (maximum recorded thickness is 230 ft). Although upper till is the surface deposit, the lower till constitutes the bulk of the material in these areas. Lower till is moderately to very compact, and is commonly finer grained and less stony than upper till. An oxidized zone, the lower part of a soil profile formed during a period of interglacial weathering, is generally present in the upper part of the lower till. This zone commonly shows closely spaced joints that are stained with iron and manganese oxides.

BEDROCK AREAS

-  **Bedrock outcrops and areas of abundant outcrop or shallow bedrock**—Solid color shows extent of individual bedrock outcrops; line pattern indicates areas of shallow bedrock or areas where small outcrops are too numerous to map individually; in areas of shallow bedrock, surficial materials are less than 5-10 ft thick.



APPENDIX A
Sketch Plans
of Geotechnical Report

APPENDIX B
Boring Logs
of Geotechnical Report

Northern Test Boring, Inc. Boring Log

Client: HTA	Project Name: West Main Street
Location: Ayer, Ma	Driller: Mike Nadeau

	Casing	Sample	Core	Ground Water Observation	
Type	HSA	SS		13.0'	
Size	2 1/4"	1 3/8"		Start Date:	Finish Date:
Hammer Wt.		140		4/18/16	4/18/16
Hammer Fall		30"			

No.	Pen	Rec	Sample Depth	Sample Blow Counts				Depth	Stratum Description
S-1	24"	10"	0'-2'	5	7	4	4		1" Pavement (Sidewalk)
									Brown Fine-Medium Sand Some Gravel Trace Silt
S-2	24"	8"	5'-7'	3	3	3	3	5'	
									Brown Medium Sand Some Silt with Organics
S-3	24"	10"	10'-12'	3	3	2	1	10'	
									Brown Fine-Coarse Sand Some Gravel Trace Silt (Native)
S-4	24"	20"	15'-17'	3	6	9	12	15'	
									Brown Fine-Coarse Sand Trace Silt
S-5	24"	10"	20'-22'	2	2	2	2	20'	
S-6	24"	12"	25'-27'	2	2	3	3	25'	
S-7	24"	10"	30'-32'	6	7	7	8	30'	

Northern Test Boring, Inc. Boring Log

Client: HTA	Project Name: West Main Street
Location: Ayer, Ma	Driller: Mike Nadeau

	Casing	Sample	Core	Ground Water Observation	
Type	HSA	SS			
Size	2 1/4"	1 3/8"		Start Date:	Finish Date:
Hammer Wt.		140		4/19/16	4/19/16
Hammer Fall		30"			

No.	Pen	Rec	Sample Depth	Sample Blow Counts				Depth	Stratum Description
S-8	24"	24"	35'-37'	3	3	4	4	35'	Brown Fine-Medium Sand Trace Silt
S-9	24"	24"	40'-42'	3	3	4	4	40'	Brown Fine-Medium Sand Some Fine Gravel Trace Silt
S-10	24"	20"	45'-47'	3	3	4	4	45'	Bottom of Exploration @ 47'
								50'	
									55'
									60'
									65'
									70'

Northern Test Boring, Inc. Boring Log

Client: HTA	Project Name: West Main Street
Location: Ayer, Ma	Driller: Mike Nadeau

	Casing	Sample	Core	Ground Water Observation	
Type	HSA	SS		13.0'	
Size	2 1/4"	1 3/8"		Start Date:	Finish Date:
Hammer Wt.		140		4/18/16	4/18/16
Hammer Fall		30"			

No.	Pen	Rec	Sample Depth	Sample Blow Counts				Depth	Stratum Description
S-1	24"	12"	0'-2'	30	28	9	5	5"	Pavement
									Brown Medium-Coarse Sand and Gravel Trace Silt
									Brown Medium Sand Some Gravel and Silt
S-2	24"	12"	5'-7'	3	2	2	1	5'	
									Fine Sand Some Silt and Organics
S-3	24"	20"	10'-12'	1	1	1	1	10'	
									Peet Layer 11'-13.5'
S-4	24"	11"	15'-17'	8	8	9	9	15'	
									Brown Fine-Coarse Sand Trace Silt (Native)
S-5	24"	24"	20'-22'	2	2	2	2	20'	
S-6	24"	24"	25'-27'	3	4	4	5	25'	
									Brown Fine-Medium Sand Trace Silt
S-7	24"	24"	30'-32'	2	3	3	4	30'	

Northern Test Boring, Inc. Boring Log

Client: HTA	Project Name: West Main Street
Location: Ayer, Ma	Driller: Mike Nadeau

	Casing	Sample	Core	Ground Water Observation	
Type	HSA	SS			
Size	2 ¼"	1 3/8"		Start Date:	Finish Date:
Hammer Wt.		140		4/19/16	4/19/16
Hammer Fall		30"			

No.	Pen	Rec	Sample Depth	Sample Blow Counts				Depth	Stratum Description
S-8	24"	24"	35'-37'	2	2	2	3	35'	Brown Fine-Medium Sand Trace Silt
S-9	24"	24"	40'-42'	2	2	2	2	40'	Bottom of Exploration @ 47'
S-10	24"	24"	45'-47'	2	2	2	3	45'	Bottom of Exploration @ 47'
								50'	Bottom of Exploration @ 47'
								55'	Bottom of Exploration @ 47'
								60'	Bottom of Exploration @ 47'
								65'	Bottom of Exploration @ 47'
								70'	Bottom of Exploration @ 47'

Groundwater:							Project: Bridge over Nonacoicus Brook, Bridge A-19-14		Boring No. SA-1					
Depth:	See Sheet 1						Location: West Main St, Ayer, MA			Sheet 3 of 3				
Time:							Contractor: Northern Test B.		Sampler Type: Split spoon ID 1.375" OD 2"					
Depth (ft.)	Cas. Blows	Sample No.	Pen. (in.)	Rec. (in.)	Blows/6"	Field Tests	Foreman: Mike Nadeau		Hammer Wt.: 140 lb		Fall: 30"			
							Start Date: 11/16/2018		Drill Technique: HSA/Case		ID 4" OD 4.5"			
		Finish Date: 11/16/2018		Rig Type: Rubber Track-Moutned		SACE Staff: RSS		Project Number: 010-18-011						
							Surface El.: + 220 ft		Datum: NAVD88		Equipment			
							Description & Classification					Stratum	Installed	Remarks
	Washed ahead				9									
60	180													
	Washed ahead to foot above next sample	SS-13	24	8	6		Medium dense, brown fine to medium SAND, trace Silt, wet.							
					8									
					11									
					16									
65	193													
	Washed ahead to foot above next sample	SS-14	24	0	6		No Recovery							
					7									
					7									
					9									
70	222													
	Washed ahead to foot above next sample	SS-15	24	15	5		Medium dense, brown fine to medium SAND, little Gravel, trace Silt, wet.							
					7									
					8									
					10									
75	287													
	Washed ahead	SS-16	24	9	11		Medium dense, light brown fine to coarse SAND, little Gravel, little Silt, wet (POSSIBLE TILL).							
					12									
					12									
					15									
80	3 min.	R-1	24	24			Driller encountered possible Bedrock at ~ 78 ft. deep. Cored 78-80. Core barrel plugged - no wash. Dark grey porphyritic meta-igneous rock with large phenocrysts, slightly weathered, extremely fractured RQD - 0. Boring terminated @ ~80 ft. deep at 3:40 pm on 11/16/18							3
	4 min.													

Remarks
 3. Rock core with NX size core barrel.
 NR = Not Recorded
 Soil/rock strata and groundwater surface, where indicated, are approximate. Transitions may be gradual.
 Variations between exploration locations and over time should be expected.



APPENDIX C
Streambed Soil Gradation Reports
of Geotechnical Report

Project Name AYERS MA - WEST MAIN STREET AND SHIRLEY STREET BRIDGES
OVER WAST BROOK - CONSTRUCTION MATERIALS TESTING

Project Number 16-0799

Client HOYLE TANNER & ASSOCIATES, INC.

Lab ID 14867S

Exploration **1-2' BELOW STREAMBED**

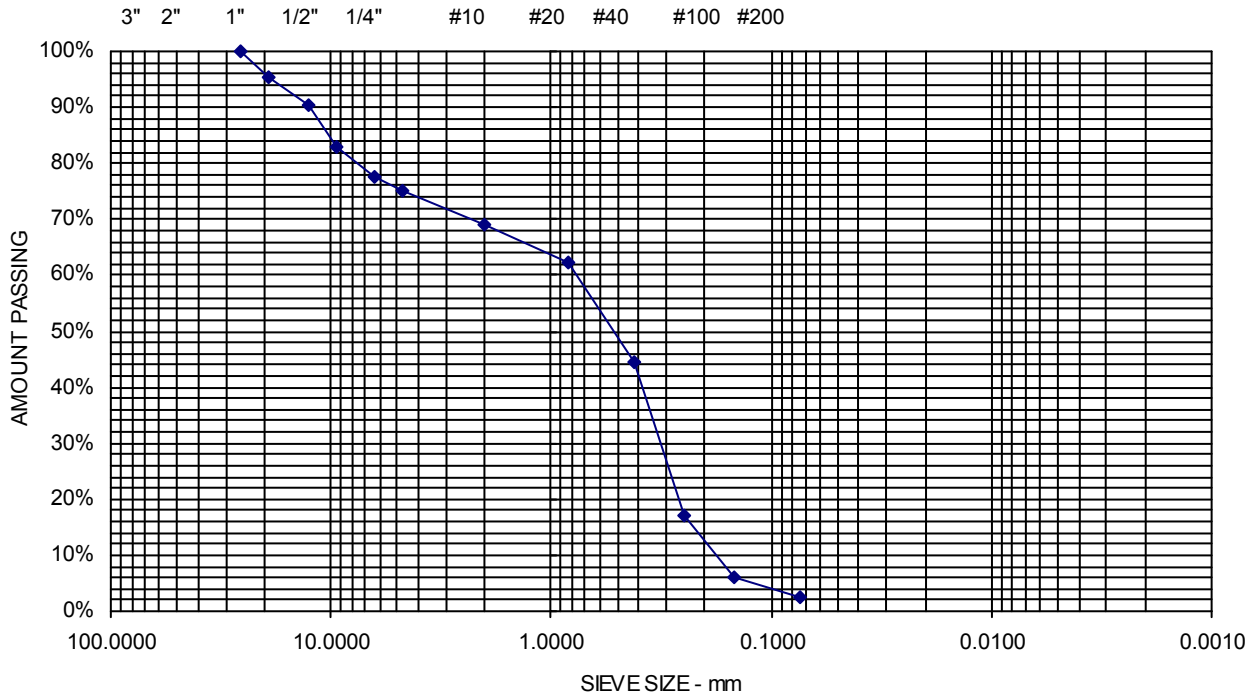
Date Received 7/21/2016

Material Source **SHIRLEY ST - UPSTREAM**

Date Completed 7/23/2016

Tested By BRADLEY GERSCHWILER

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
25.0 mm	1"	100	
19.0 mm	3/4"	95	
12.5 mm	1/2"	90	
9.5 mm	3/8"	83	
6.3 mm	1/4"	78	
4.75 mm	No. 4	75	25.1% Gravel
2.00 mm	No. 10	69	
850 μm	No. 20	62	
425 μm	No. 40	45	72.3% Sand
250 μm	No. 60	17	
150 μm	No. 100	6	
75 μm	No. 200	2.6	2.6% Fines



Comments: D50=0.5 mm

Project Name **AYERS MA - WEST MAIN STREET AND SHIRLEY STREET BRIDGES
OVER WAST BROOK - CONSTRUCTION MATERIALS TESTING**

Client **HOYLE TANNER & ASSOCIATES, INC.**

Exploration **1-2' BELOW STREAMBED**

Material Source **SHIRLEY ST. - DOWNSTREAM**

Project Number **16-0799**

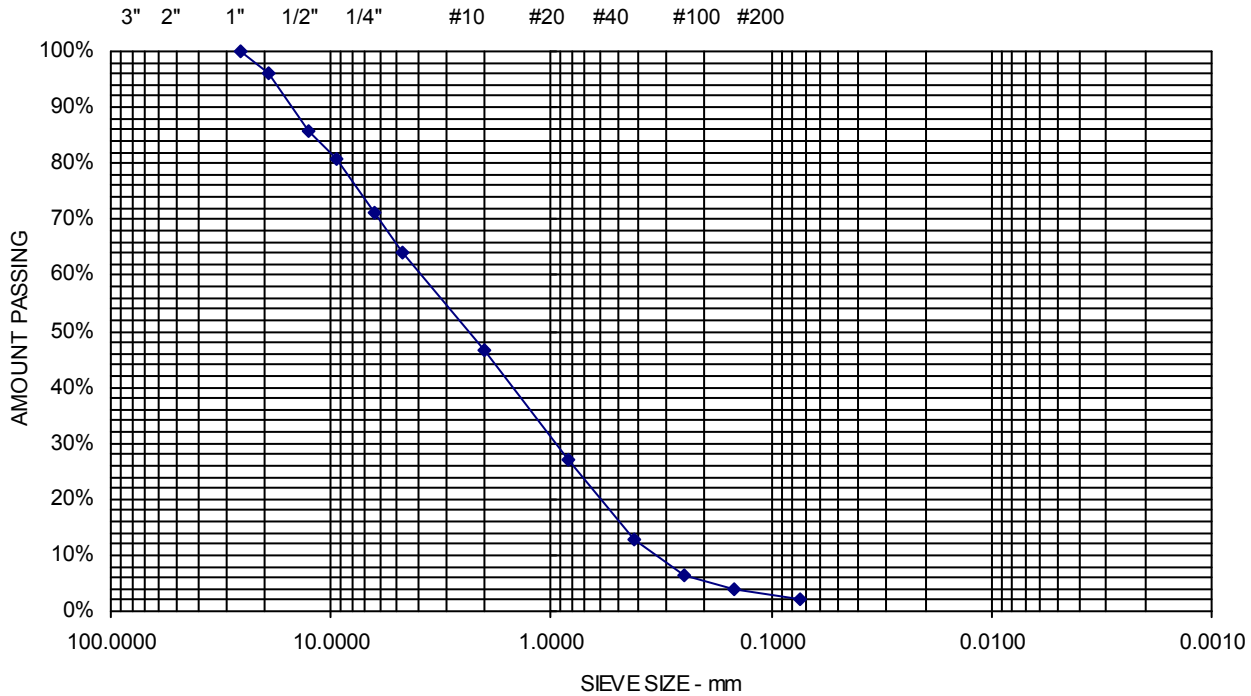
Lab ID **14868S**

Date Received **7/21/2016**

Date Completed **7/23/2016**

Tested By **BRADLEY GERSCHWILER**

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
25.0 mm	1"	100	
19.0 mm	3/4"	96	
12.5 mm	1/2"	86	
9.5 mm	3/8"	81	
6.3 mm	1/4"	71	
4.75 mm	No. 4	64	36% Gravel
2.00 mm	No. 10	47	
850 μm	No. 20	27	
425 μm	No. 40	13	61.8% Sand
250 μm	No. 60	6	
150 μm	No. 100	4	
75 μm	No. 200	2.2	2.2% Fines

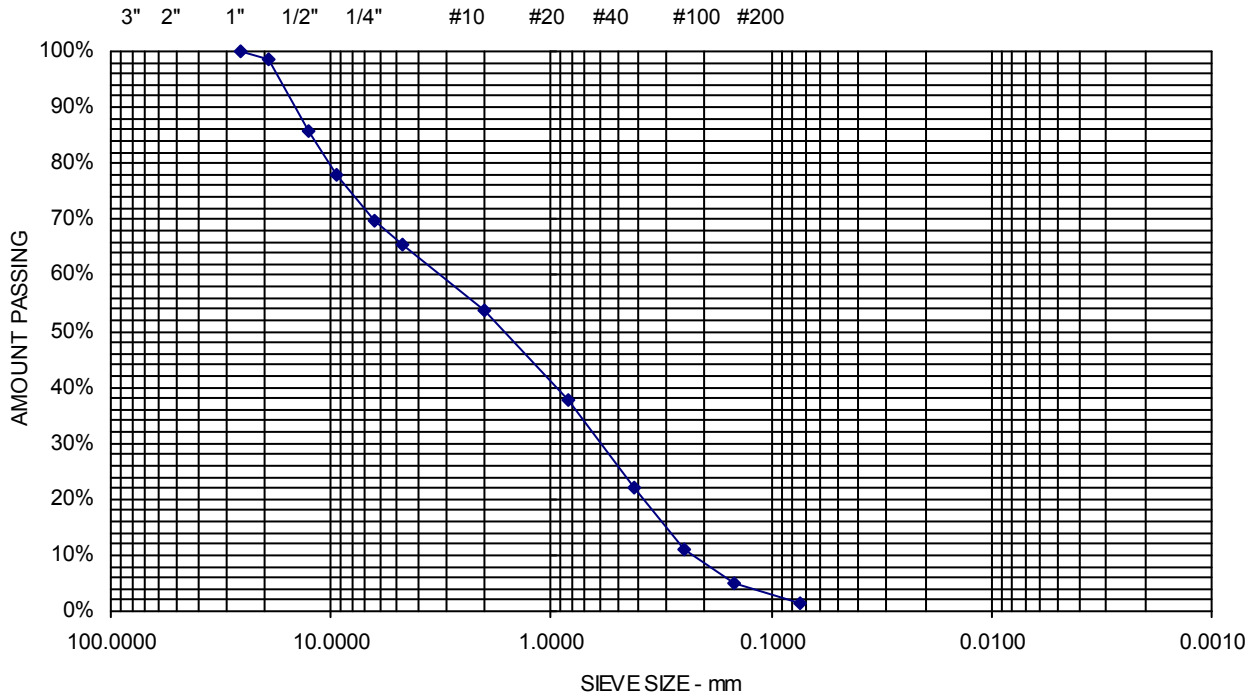


Comments: D50=2.5mm

Project Name **AYERS MA - WEST MAIN STREET AND SHIRLEY STREET BRIDGES OVER WAST BROOK - CONSTRUCTION MATERIALS TESTING**
 Client **HOYLE TANNER & ASSOCIATES, INC.**
 Exploration **2-3' BELOW STREAMBED**
 Material Source **WEST MAIN ST. - UPSTREAM**

Project Number **16-0799**
 Lab ID **14869S**
 Date Received **7/21/2016**
 Date Completed **7/23/2016**
 Tested By **BRADLEY GERSCHWILER**

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
25.0 mm	1"	100	
19.0 mm	3/4"	98	
12.5 mm	1/2"	86	
9.5 mm	3/8"	78	
6.3 mm	1/4"	70	
4.75 mm	No. 4	66	34.4% Gravel
2.00 mm	No. 10	54	
850 μm	No. 20	38	
425 μm	No. 40	22	64% Sand
250 μm	No. 60	11	
150 μm	No. 100	5	
75 μm	No. 200	1.6	1.6% Fines

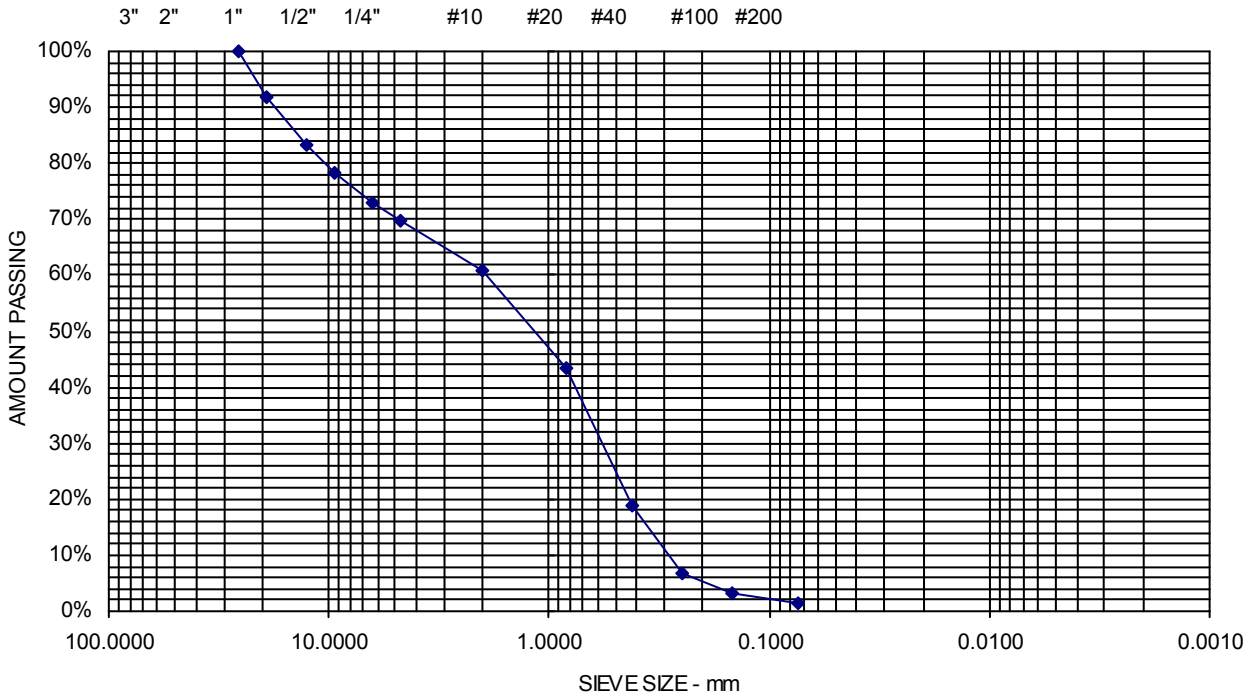


Comments: D50=1.8 mm

Project Name **AYERS MA - WEST MAIN STREET AND SHIRLEY STREET BRIDGES OVER WAST BROOK - CONSTRUCTION MATERIALS TESTING**
 Client **HOYLE TANNER & ASSOCIATES, INC.**
 Exploration **1-2' BELOW STREAMBED**
 Material Source **WEST MAIN ST. - DOWNSTREAM**

Project Number **16-0799**
 Lab ID **14870S**
 Date Received **7/21/2016**
 Date Completed **7/23/2016**
 Tested By **BRADLEY GERSCHWILER**

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
25.0 mm	1"	100	
19.0 mm	3/4"	92	
12.5 mm	1/2"	83	
9.5 mm	3/8"	78	
6.3 mm	1/4"	73	
4.75 mm	No. 4	70	30.1% Gravel
2.00 mm	No. 10	61	
850 μm	No. 20	43	
425 μm	No. 40	19	68.5% Sand
250 μm	No. 60	7	
150 μm	No. 100	3	
75 μm	No. 200	1.4	1.4% Fines



Comments: D50=1.1 mm

APPENDIX D
Bearing Capacity Calculations
of Geotechnical Report

NOTES AND ASSUMPTIONS

- The proposed rigid frame is to be supported on cast-in-place concrete footings and pedestal walls.
- The following calculations are used to determine soil engineering properties using correlations from the SPT-N values and the bearing capacity at the Strength and Service Limit State.
- Boring logs are shown on sheets **BRG-4** and **BRG-5**.
- The exact energy ratio for Northern Test Boring, Inc.'s automatic drill rig is unknown; therefore, use a hammer efficiency (ER) of 80% per BDS Article C10.4.6.2.4.
- Since the soil in the zone of influence below the bottom of footing is mostly medium dense sand and gravel a single soil layer will be used to develop the soil engineering properties.

REFERENCES

1. AASHTO LRFD Bridge Design Specifications, 7th Ed. with 2016 Interims (BDS).
2. MassDOT LRFD Bridge Design Manual, 2013 (BDM).
3. Das, Principles of Foundation Engineering, 5th Edition.
4. ASTM D 1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.
5. Bearing Capacity of Soils, EM 1110-1-1905, US Army Corps of Engineers.
6. Paikowsky et al., NCHRP Report 651.

SUBSTRUCTURE GEOMETRY

Bottom of Footing Elevation: $EL_{BOF} := 204.50 \text{ ft}$

Approximate Existing Ground:

Boring "B-1": $EL_{EG_{B1}} := 220 \text{ ft}$

Distance From FG to Bottom of Footing: $Dist_{BOF_{B1}} := EL_{EG_{B1}} - EL_{BOF} = 15.50 \text{ ft}$

Footing Width: $b_f := 8.5 \text{ ft}$

Zone of Influence for Bearing Capacity: $ZOI_B := 1.5 \cdot b_f = 12.750 \text{ ft}$

Distance From FG to Bottom of Footing: $Dist_{BOZ_{B1}} := Dist_{BOF_{B1}} + ZOI_B = 28.25 \text{ ft}$

Uncorrected N Value: $N := \text{trunc}(\text{mean}(0.67 \cdot 30, 10, 10)) = 13.000$

- The first layer is conservatively weighted to 67%.

SOIL LAYER PROPERTIES

- As seen on Calculation Sheet **BRG-4 to BRG-5**, the in situ soil below the bottom of the footing consists of medium-dense sand and gravel.
- Relative density of the soil, which is used to define average dry unit weight, is a function of the N_{60} value.
- Based on the N_{60} , the soil relative density is likely a medium sand per Table 3-1 of Reference 5.
- Per the ASTM testing requirements, ignore the contribution of the first and last 6" of the SPT N values.
- See Calculation Sheet **BRG-6** for calculations of soil engineering properties.

TABLE 3-1

Angle of Internal Friction of Sands, ϕ'

a. Relative Density and Gradation
(Data from Schmertmann 1978)

Relative Density D_r , Percent	Fine Grained		Medium Grained		Coarse Grained	
	Uniform	Well-graded	Uniform	Well-graded	Uniform	Well-graded
40	34	36	36	38	38	41
60	36	38	38	41	41	43
80	39	41	41	43	43	44
100	42	43	43	44	44	46

b. Relative Density and In Situ Soil Tests

Soil Type	Relative Density D_r , Percent	Standard Penetration Resistance N_{60} (Terzaghi and Peck 1967)	Cone Penetration Resistance q_c , ksf (Meyerhof 1974)	Friction Angle ϕ' , deg		
				Meyerhof (1974)	Peck, Hanson and Thornburn (1974)	Meyerhof (1974)
Very Loose	< 20	< 4	----	< 30	< 29	< 30
Loose	20 - 40	4 - 10	0 - 100	30 - 35	29 - 30	30 - 35
Medium	40 - 60	10 - 30	100 - 300	35 - 38	30 - 36	35 - 40
Dense	60 - 80	30 - 50	300 - 500	38 - 41	36 - 41	40 - 45
Very Dense	> 80	> 50	500 - 800	41 - 44	> 41	> 45

SOIL ENGINEERING PROPERTIES

Backfill Soil Properties

- γ_d (pcf) = 120 Granular Burrow - BDM 3.1.6
- γ_M (pcf) = 133 Das, Principles of Foundation Engineering, 5e, Eq. 1.15 for Dense Uniform Sand

In Situ Soil Properties

- γ_D (pcf) = 104 Das Table 1.4 for average of Loose and Dense angular-grained silty sand
- γ_M (pcf) = 115 (Minimum from tables below)
- e = 0.625 Layer #1 (Das, Table 1.4 - Medium Dense angular-grained silty sand)
- γ_{sat} (pcf) = 128 Modified Das Eq. 1.18

Boring B-1 - Soil Layer 1

- GS Elev. = 220 Existing Ground Surface Elevation
- GW Elev. = 212 Ground Water Elevation

- Top of Soil Layer = 15.5 ft
- Bottom of Soil Layer = 28.25 ft
- Average Depth = 21.875 ft

AVERAGE SOIL PROPERTIES IN BORING B-1 BEARING LAYER 1											
Depth (ft)	Elev. (ft)	N-Value (bpf)	σ'_o (psf)	C_N	ER	N_{60} (bpf)	$(N_1)_{60}$ (bpf)	ϕ'	E_s (ksi)	v	γ_M (pcf)
21.875	198.125	13.00	1830.2	1.031	80	17.3	17.9	33	2.99	0.30	115

N-Value = SPT blow count

σ'_o = Vertical effective soil stress

C_N = Correction factor - AASHTO LRFD Section 10.4.6.2.4

ER = Hammer efficiency - AASHTO LRFD C10.4.6.2.4 An automatic trip hammer was used for this project.

N_{60} = SPT blow count corrected for hammer efficiency - AASHTO LRFD Eqn 10.4.6.2.4-2

$(N_1)_{60}$ = Value on N_{60} corrected to a standard value - AASHTO LRFD Eqn 10.4.6.2.4-3

ϕ' = Soil friction angle - NCHRP Report 651, LRFD Design and Construction of Shallow Foundations for Highway Bridge Structures, Table 30. See below for additional correlation calculations.

E_s = Soil elastic modulus taken as the correlation value from AASHTO LRFD Table C10.4.6.3-1 for Sandy Gravels ($0.167 \cdot N_{160}$). See below for additional correlation calculations.

v = Poisson's Ratio for Sand based on calculated Elastic Modulus from AASHTO LRFD Table C.10.4.6.3-1.

γ_M = moist unit weight of water, NCHRP Report 651, LRFD Design and Construction of Shallow Foundations for Highway Bridge Structures, Section 3.4.2.2 Equation 106.

Ignore any cohesion, assume only soil friction angle ϕ' is present.

Additional ϕ' Correlation Equations

Table 30 from NCHRP 651

Reference	Correlation equation	Equation no.
Peck, Hanson, and Thornburn (PHT) (1974) as mentioned in Kulhawy and Mayne (1990)	$\phi_f \approx 54 - 27.6034 \cdot \exp(-0.014(N_1)_{60})$	(100)
Hatanaka and Uchida (1996)	$\phi_f = \sqrt{20(N_1)_{60}} + 20$ for $3.5 \leq (N_1)_{60} \leq 30$	(101)
PHT (1974) as mentioned by Wolff (1989)	$\phi_f = 27.1 + 0.3(N_1)_{60} - 0.00054(N_1)_{60}^2$	(102)
Mayne et al. (2001) based on data from Hatanaka and Uchida (1996)	$\phi_f = \sqrt{15.4(N_1)_{60}} + 20$	(103)
Specifications for Highway Bridges (SHB) Japan, JRA (1996)	$\phi_f = \sqrt{15(N_1)_{60}} + 15$ for $(N_1)_{60} > 5$ and $\phi_f \leq 45^\circ$	(104)

Equation	ϕ (deg)
101	39
102	32
103	37
104	31

SOIL ENGINEERING PROPERTIES

Additional ϕ Correlation Equations (Cont.)

Table 3-1 From EM 1110-1-1905

b. Relative Density and In Situ Soil Tests

Soil Type	Relative Density D_r , Percent	Standard Penetration Resistance N_{60} (Terzaghi and Peck 1967)	Cone Penetration Resistance q_c , ksf (Meyerhof 1974)	Friction Angle ϕ' , deg		
				Meyerhof (1974)	Peck, Hanson and Thornburn (1974)	Meyerhof (1974)
Very Loose	< 20	< 4	----	< 30	< 29	< 30
Loose	20 - 40	4 - 10	0 - 100	30 - 35	29 - 30	30 - 35
Medium	40 - 60	10 - 30	100 - 300	35 - 38	30 - 36	35 - 40
Dense	60 - 80	30 - 50	300 - 500	38 - 41	36 - 41	40 - 45
Very Dense	> 80	> 50	500 - 800	41 - 44	> 41	> 45

- As such, a ϕ' angle of 33 degrees is reasonable.

Additional E_s Correlation Equations

AASHTO BDS Table C10.4.6.3-1

Soil Type	Typical Range of Young's Modulus Values, E_s (ksi)	Poisson's Ratio, ν (dim)
Clay:		
Soft sensitive	0.347-2.08	0.4-0.5 (undrained)
Medium stiff to stiff	2.08-6.94	
Very stiff	6.94-13.89	
Loess	2.08-8.33	0.1-0.3
Silt	0.278-2.78	0.3-0.35
Fine Sand:		0.25
Loose	1.11-1.67	
Medium dense	1.67-2.78	
Dense	2.78-4.17	
Sand:		0.20-0.36
Loose	1.39-4.17	
Medium dense	4.17-6.94	
Dense	6.94-11.11	0.30-0.40
Gravel:		0.20-0.35
Loose	4.17-11.11	
Medium dense	11.11-13.89	
Dense	13.89-27.78	0.30-0.40

Average of Loose Sand and Loose Gravel
From BDS Table C10.4.6.3-1

2.78 ksi

Table C10.4.6.3-2—Rate of Increase of Soil Modulus with Depth n_h (ksi/ft) for Sand

Consistency	Dry or Moist	Submerged
Loose	0.417	0.208
Medium	1.11	0.556
Dense	2.78	1.39

$E_s = nh * z$

AASHTO BDS Eq. C10.4.6.3-1

nh = 0.208

z = 15.5 ft (to top of bearing layer)

E = 3.224 ksi

- As such, a E_s value of 2.99 ksi is reasonable.

SPREAD FOOTING BEARING RESISTANCE

ASSUMPTIONS AND INPUT

Unit Weight of Bearing Soil, γ =	115	pcf
Friction Angle of Bearing Soil, ϕ =	33	deg
Cohesion of Bearing Soil, c =	0	ksf
Depth of Water Below Bottom of Footing, D_w =	0	ft
Depth of Footing, D_f =	0	ft
Vary Effective Footing Width Between	2	to 11 ft
Abutment Footing Length, L =	47.917	
Eccentricity About Footing Length, eL =	0	ft
Depth correction factor, d_{qf} , in the Strength Limit State, is estimated at	1	

Load Inclination Factors, i_c , i_{qf} , i_{γ} , are taken as 1.0 based on BDS C10.6.3.1.2a.

STRENGTH I LIMIT STATE BEARING CAPACITY

- Use the theoretical estimation from BDS 10.6.3.1.2a

$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma B N_{\gamma m} C_{w\gamma}$$

In Which:

$$N_{cm} = N_c S_c i_c$$

$$N_{qm} = N_q S_q d_{qf} i_{qf}$$

$$N_{\gamma m} = N_\gamma S_\gamma i_\gamma$$

From BDS T.10.6.3.1.2a-1:

N_c	38.6
N_q	26.1
N_γ	35.2

From BDS T.10.6.3.1.2a-2:

C_{wq}	0.5
$C_{w\gamma}$	0.5

Based on D_w = 0

Resistance Factor, ϕ_b = 0.45 BDS 10.5.5.2.2
Effective Footing Length, L' = 47.917

B' (ft)	S_c	S_q	S_γ	N_{cm}	N_{qm}	$N_{\gamma m}$	q_n (ksf)	q_R (ksf)
2.00	1.03	1.03	0.98	39.69	26.79	34.61	2.0	0.9
3.00	1.04	1.04	0.97	40.23	27.14	34.32	3.0	1.3
4.00	1.06	1.05	0.97	40.78	27.49	34.02	3.9	1.8
5.00	1.07	1.07	0.96	41.32	27.84	33.73	4.8	2.2
6.00	1.08	1.08	0.95	41.87	28.18	33.44	5.8	2.6
7.00	1.10	1.09	0.94	42.41	28.53	33.14	6.7	3.0
8.00	1.11	1.11	0.93	42.96	28.88	32.85	7.5	3.4
9.00	1.13	1.12	0.92	43.50	29.22	32.56	8.4	3.8
10.00	1.14	1.13	0.92	44.05	29.57	32.26	9.3	4.2
11.00	1.16	1.15	0.91	44.59	29.92	31.97	10.1	4.5

SPREAD FOOTING BEARING RESISTANCE

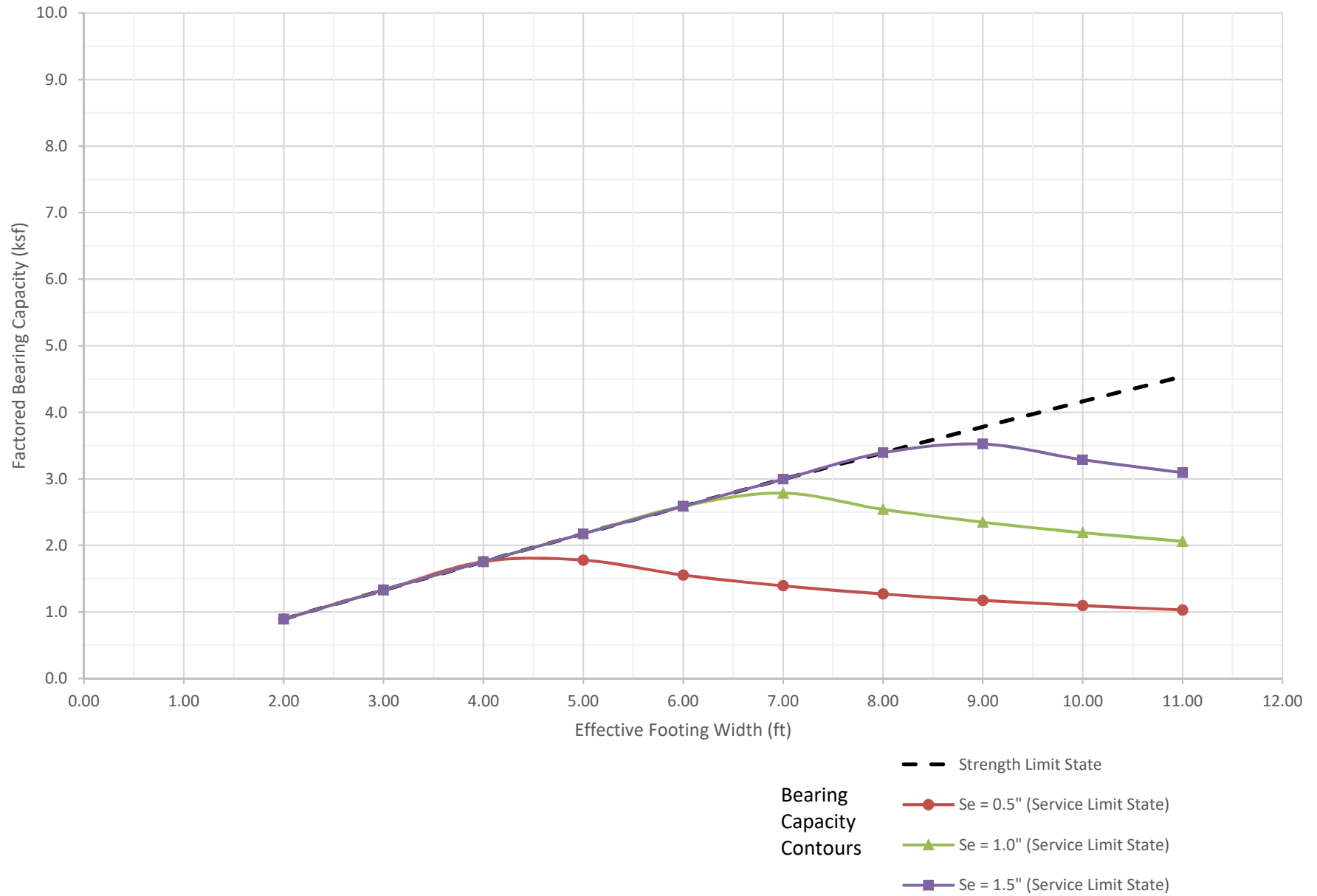
SERVICE I LIMIT STATE BEARING CAPACITY BASED ON ELASTIC SETTLEMENT

- Use the elastic half-space method from BDS 10.6.2.4.2-1

Poissons Ratio, $\nu =$ 0.30
 Elastic Modulus, $E_s =$ 2.99 ksi

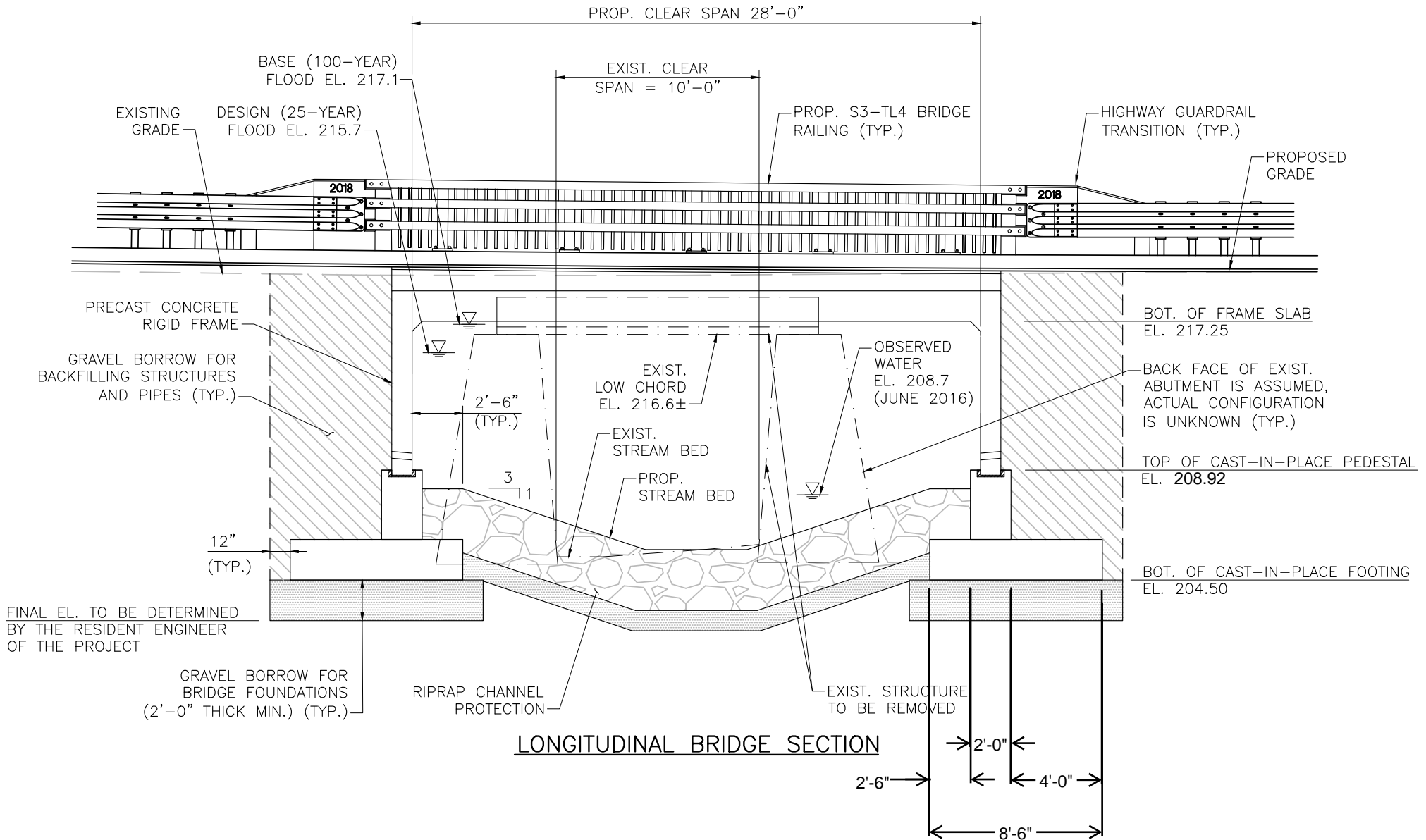
B' (ft)	L/B	A' (ft ²)	β	S_e (in)	q_o (ksf)	Cap off For Plot
2	23.96	95.83	1.94	0.5	3.9	0.9
2	23.96	95.83	1.94	1	7.8	0.9
2	23.96	95.83	1.94	1.5	11.7	0.9
3	15.97	143.75	1.64	0.5	2.7	1.3
3	15.97	143.75	1.64	1	5.4	1.3
3	15.97	143.75	1.64	1.5	8.1	1.3
4	11.98	191.67	1.49	0.5	2.1	1.8
4	11.98	191.67	1.49	1	4.2	1.8
4	11.98	191.67	1.49	1.5	6.4	1.8
5	9.58	239.59	1.40	0.5	1.8	1.8
5	9.58	239.59	1.40	1	3.6	2.2
5	9.58	239.59	1.40	1.5	5.3	2.2
6	7.99	287.50	1.34	0.5	1.6	1.6
6	7.99	287.50	1.34	1	3.1	2.6
6	7.99	287.50	1.34	1.5	4.7	2.6
7	6.85	335.42	1.30	0.5	1.4	1.4
7	6.85	335.42	1.30	1	2.8	2.8
7	6.85	335.42	1.30	1.5	4.2	3.0
8	5.99	383.34	1.26	0.5	1.3	1.3
8	5.99	383.34	1.26	1	2.5	2.5
8	5.99	383.34	1.26	1.5	3.8	3.4
9	5.32	431.25	1.24	0.5	1.2	1.2
9	5.32	431.25	1.24	1	2.3	2.3
9	5.32	431.25	1.24	1.5	3.5	3.5
10	4.79	479.17	1.22	0.5	1.1	1.1
10	4.79	479.17	1.22	1	2.2	2.2
10	4.79	479.17	1.22	1.5	3.3	3.3
11	4.36	527.09	1.20	0.5	1.0	1.0
11	4.36	527.09	1.20	1	2.1	2.1
11	4.36	527.09	1.20	1.5	3.1	3.1

Resistance as a Function of Effective Footing Width



NOTES AND ASSUMPTIONS

- The design of the rigid frame footing and pedestal wall shall be in accordance with the MassDOT LRFD Bridge Manual, 2013 Edition (BM)
- The AASHTO LRFD Bridge Design Specifications (BDS) Eighth Edition will be used for requirements not explicitly covered in the BM.
- The following load effects are considered at the Service I Limit State:
 - Settlement is investigated per BDS Article 10.6.2.2.
- The following load effects are considered at the Strength I Limit State:
 - Bearing resistance of soil is investigated in accordance with BDS Articles 10.6.3.1, 10.6.1.4 and 11.6.3.2.
 - Eccentric load limitations are investigated per BDS Article 10.6.3.3.
 - Sliding at the base of the footing is investigated per BDS Article 10.6.3.4.
- Four load cases will be investigated:
 - LC1 - maximum earth pressure along with maximum live load and corresponding live load thrust.
 - LC2 - maximum earth pressure along with maximum live load thrust and corresponding live load.
 - LC3 - maximum earth pressure with no live load on the bridge.
 - LC4 - minimum earth pressure along with maximum live load thrust and corresponding live load.
- Moment for LC1 to LC4 will be summed with respect to the bottom toe of the footing in the CCW direction.
- The rigid frame walls are detailed to act as pinned at the base, in accordance with BDS Article 12.14.5.1, therefore, no moment is transferred from the wall to the footing pedestal.
- Trapezoidal base pressures based on the applied loading for all of the above cases will be calculated at the Service I and Strength I Limit States for the toe and heel.
- Per BDS Article 10.6.3.3, the maximum limit of eccentricity is $0.33*(b_f)$ when footing is on soils.
- Per BDS Article 10.6.1.4, the distribution of bearing stresses on the effective area shall be assumed to be uniform for footings on soils.



GEOMETRY

- References: "Structure Layout.xmcd".

Skew Angle:	$Skew := 0 \text{ deg}$	
PGL Elevation:	$FG_{EL_final} := 219.77 \text{ ft}$	(Calculation sheet SL-5)
Top of Rigid Frame:	$EL_{TORF} := 218.75 \text{ ft}$	(Calculation sheet SL-5)
Top of Pedestal Elevation:	$EL_{TOP} := 208.92 \text{ ft}$	(Calculation sheet SL-5)
Top of Footing Elevation:	$EL_{TOF} := 206.50 \text{ ft}$	(Calculation sheet SL-5)
Bottom of Footing Elevation:	$EL_{BOF} := 204.50 \text{ ft}$	(Calculation sheet SL-5)
Design (25-Year) Water Elevation:	$EL_{W25} := 215.7 \text{ ft}$	
Design (25-Year) Water Height above the TOF:	$h_{W25} := EL_{W25} - EL_{TOF} = 9.200 \text{ ft}$	
Rigid Frame Leg Thickness:	$t_{leg} := \frac{12 \text{ in}}{\cos(Skew)} = 1.000 \text{ ft}$	
Footing Thickness:	$t_{ftng} := EL_{TOF} - EL_{BOF} = 2.000 \text{ ft}$	
Pedestal Height:	$h_{ped} := EL_{TOP} - EL_{TOF} = 2.420 \text{ ft}$	
Retained Height of Soil Above Heel:	$h_{heel_soil} := FG_{EL_final} - EL_{TOF} = 13.270 \text{ ft}$	
Design Section Width:	$b := 12 \text{ in}$	
Pedestal Width:	$b_{ped} := \frac{2.0 \text{ ft}}{\cos(Skew)} = 2.000 \text{ ft}$	
Footing Toe Width:	$b_{toe} := \frac{2.5 \text{ ft}}{\cos(Skew)} = 2.500 \text{ ft}$	
Footing Heel Width:	$b_{heel} := \frac{4.0 \text{ ft}}{\cos(Skew)} = 4.000 \text{ ft}$	

GEOMETRY (CONT.)

Total Footing Width: $b_f := b_{toe} + b_{heel} + b_{ped} = 8.500 \text{ ft}$

Length of footing equals out-
out width of rigid frame: $L := 47 \text{ ft} + 11 \text{ in} = 47.917 \text{ ft}$ (Calculation sheet SL-6)

Area of Footing: $A_{ft} := L \cdot b_f = 407.292 \text{ ft}^2$

DESIGN PARAMETERS

Unit Weight of Saturated Backfill $\gamma_{soil} := 0.120 \text{ kcf}$ (BM Section 3.1.6)

Concrete Unit Weight
(Including Reinforcement) $\gamma_{conc} := 0.150 \text{ kcf}$ (BDS Article C3.5.1)

28 Day Concrete Strength $F'_c := 4000 \text{ psi}$ (BM Drawing No. 3.1.6)

Steel Yield Strength: $F_y := 60 \text{ ksi}$

Flexure Resistance Factor: $\phi_m := 0.90$ (BDS Table 5.5.4.2.2-1)

Beta Factor: $\beta_1 := \min\left(0.85 - 0.05 \cdot \left(\frac{F'_c}{\text{ksi}} - 4\right), 0.85\right) = 0.850$ (BDS Article 5.7.2.2)

Shear Resistance Factor: $\phi_v := 0.90$ (BDS Article 5.5.4.2.2)

DESIGN PARAMETERS (CONT.)

Geotechnical Parameters

- The backfill consists of gravel borrow for backfilling structures and pipes in accordance with BM Drawing No. 3.6.13.
- The active earth pressure is determined using the Rankine Theory permitted by BDS Article C3.11.5.3; simplified equation modified for level backfill angle.

Friction Angle of Backfill: $\phi_f := 32 \text{ deg}$ (Conservative)

At-Rest Earth Pressure: $k_o := 1 - (\sin(\phi_f)) = 0.470$ (BDS Eq. 3.11.5.2-1)

Active Earth Pressure: $k_a := \tan\left(45 \text{ deg} - \frac{\phi_f}{2}\right)^2 = 0.307$

Load Factors (BDS Table):

At-Rest: $\gamma_{EH.o} := 1.35$

Active: $\gamma_{EH.a} := 1.50$

Earth Pressure Coefficient: $k := \begin{cases} \gamma_{EH.o} \cdot k_o > \gamma_{EH.a} \cdot k_a \\ k_o \\ \text{else} \\ k_a \end{cases} = 0.470$

- Factored at-rest earth pressure is greater than the factored active earth pressure, therefore, it is conservative to use the at-rest earth pressure to determine the maximum load effects acting on the structure.
- The lateral earth pressure and the live load surcharge will be calculated using the at-rest earth pressure coefficient, therefore, the active earth pressure coefficient will not be used.

Friction Angle: $\delta := 37 \text{ deg}$ (BM Section 3.2.5.1)

Coefficient of Friction: $\tan(\delta) = 0.754$ (BDS Table 3.11.5.3-1)

Bearing Resistance Factor: $\phi_b := 0.45$ (BDS Table 10.5.5.2.2-1)

Sliding Resistance Factor: $\phi_\tau := 0.80$ (BDS Table 10.5.5.2.2-1)

DESIGN PARAMETERS (CONT.)

Bearing Capacity

- Footings are bearing gravel borrow for bridge foundations in accordance with BM Drawing No. 3.6.2.
- The factored bearing resistance used for the Service I Limit State will be calculated in accordance with BDS Equation 10.6.2.4.2-2; the empirical Hough method.
- The factored bearing resistance used for the Strength I Limit State will be calculated in accordance with BDS Equation 10.6.3.1.3-1. Refer to the Soil Bearing Strength calculations for input factors listed below.

Service Bearing Resistance

Elastic Settlement:
$$S_e = \sum_{i=1}^n \Delta H_i$$
 (BDS Eqn 10.6.2.4.2-2)

Elastic Settlement:
$$\Delta H_i = H_c \cdot \frac{1}{C'} \cdot \log \left(\frac{\sigma'_o + \Delta \sigma_v}{\sigma'_o} \right)$$
 (BDS Eqn 10.6.2.4.2-3)

Strength Bearing Resistance

Nominal Bearing Resistance:
$$q_n = \frac{N1_{60} \cdot B}{5} \cdot \left(C_{wq} \cdot \frac{D_f}{B} + C_{w\gamma} \right)$$
 (BDS Eqn 10.6.3.1.3-1)

Corrected Average SPT Blow Count: $N1_{60} := 17.9$ (Calculation Sheet BRG-6)

Correction Factors to Account for Location of Groundwater: $C_{wq} := 0.5$ (Calculation Sheet BRG-7)

$C_{w\gamma} := 0.5$

Anticipated Depth to Bottom of Footing: $D_f := 0 \text{ ft}$ (Calculation Sheet BRG-7)

DESIGN PARAMETERS (CONT.)

Summary of Load Factors used for Design (BDS Tables 3.4.1-1 and 3.4.1-2)

Service I Load Factors:

DC - Component and Attachments:	$\gamma_{DC_ServI} := 1.0$
DW - Wearing Surfaces and Utilities:	$\gamma_{DW_ServI} := 1.0$
EH - Horizontal Earth Pressure:	$\gamma_{EH_ServI} := 1.0$
EV - Vertical Earth Pressure:	$\gamma_{EV_ServI} := 1.0$
LL - Live Load:	$\gamma_{LL_ServI} := 1.0$
LS - Live Load Surcharge:	$\gamma_{LS_ServI} := 1.0$

Strength I Load Factors:

DC - Component and Attachments:	$\gamma_{DC_StrI_max} := 1.25$	$\gamma_{DC_StrI_min} := 0.9$
DW - Wearing Surfaces and Utilities:	$\gamma_{DW_StrI_max} := 1.5$	$\gamma_{DW_StrI_min} := 0.65$
EH - Horizontal Earth Pressure:		
At-rest earth pressure:	$\gamma_{EH_StrI_max} := 1.35$	$\gamma_{EH_StrI_min} := 0.5$
EV - Vertical Earth Pressure:	$\gamma_{EV_StrI_max} := 1.35$	$\gamma_{EV_StrI_min} := 1.0$
Retaining Walls and Abutments:	$\gamma_{EV_StrI_max_buried} := 1.35$	$\gamma_{EV_StrI_min_buried} := 0.9$
LL - Live Load:	$\gamma_{LL_StrI} := 1.75$	
LS - Live Load Surcharge:	$\gamma_{LS_StrI} := 1.75$	

DESIGN PARAMETERS (CONT.)

Effect of Water Level on Design of Footing

- Horizontal forces acting on the frame due to water loads are ignored for design because of the addition of weepholes to the rigid frame.
- However, the water table at time of borings is above the top of the footing, therefore, the inclusion of the ground water will be accounted for in design.
- Contribution of the groundwater table will be ignored for bearing resistance because it is conservative to ignore the buoyant force of the concrete footing and the effective weight of the soil.
- Contribution of the groundwater table will be considered for sliding and overturning of the footing because it reduces the corresponding resistances.
- Contribution of the groundwater table will be ignored for determining the maximum shears and moments, to be conservative.

Unit Weight of Water: $\gamma_{H_2O} := 62.4 \text{ pcf}$

Effective Unit Weight of Soil: $\gamma'_{soil} := \gamma_{soil} - \gamma_{H_2O} = 0.058 \text{ kcf}$

$$Ratio_{soil} := \frac{\gamma'_{soil}}{\gamma_{soil}} = 0.48$$

Effective Unit Weight of Concrete: $\gamma'_{conc} := \gamma_{conc} - \gamma_{H_2O} = 0.088 \text{ kcf}$

$$Ratio_{conc} := \frac{\gamma'_{conc}}{\gamma_{conc}} = 0.584$$

Effective Unit Weight of Wearing Surface: $\gamma'_{ws} := 140 \text{ pcf} - \gamma_{H_2O} = 0.078 \text{ kcf}$

$$Ratio_{ws} := \frac{\gamma'_{ws}}{140 \text{ pcf}} = 0.554$$

DESIGN PARAMETERS (CONT.)

Live Load Surcharge

- A live load surcharge is applied on the surface of the backfill within a distance equal to one-half the wall height behind the back face of the wall.
- The increase in horizontal pressure due to live load surcharge is computed below:
- Active lateral earth pressure as follows:

Live Load Surcharge:
$$\Delta_p = k_o_{LRFD} \cdot \gamma_{soil} \cdot h_{eq} \quad (\text{BDS Eq. 3.11.6.4-1})$$

where: h_{eq} = Equivalent height of soil which, for highway loadings, may be taken from Tables 3.11.6.4-1 and 3.11.6.4-2.

Distance from Top of Backfill to Bottom of Footing:
$$D := FG_{EL_final} - EL_{BOF} = 15.270 \text{ ft}$$

Equiv. Height of Soil: (Linear Interpolation of BDS Table 3.11.6.4-1)
$$h_{eq} := 3 \text{ ft} - \frac{(3 \text{ ft} - 2 \text{ ft}) \cdot (10 \text{ ft} - D)}{(10 \text{ ft} - 20 \text{ ft})} = 2.473 \text{ ft}$$

Live Load Surcharge:
$$\Delta_p := \frac{k \cdot \gamma_{soil} \cdot h_{eq}}{\cos(Skew)} = 0.140 \text{ ksf}$$

LOADS ACTING ON RIGID FRAME

- The rigid frame, with assumed geometry, is modeled in STAAD. The loads applied to the rigid frame are input into the STAAD model to determine the reactions applied to the pedestal wall and footing.
- See Appendix A for loads acting on the Rigid Frame.
 - Dead load (DC):
 - Cast-in-place concrete overlay
 - Sidewalk
 - Bridge Rail
 - Wearing Surface (DW)
 - Lateral Earth Pressure (EH)
- The calculated loads are input into STAAD and are unfactored.
- STAAD files for this analysis are titled "West Main St Footing", see Appendix A for output report of reactions.

Live Load Surcharge

Live Load Surcharge:
$$\Delta_{p.RF} := \frac{k \cdot \gamma_{soil} \cdot h_{eq}}{\cos(Skew)} \cdot b = 0.140 \text{ klf}$$

LOADS ACTING ON RIGID FRAME (CONT.)

Live Load

- The live load for the design of the pedestal wall and footings shall be distributed based on the full width of the frame.
- Per AASHTO LRFD Section 3.6.2.1, the dynamic load allowance need not be applied to foundation components that are entirely below ground level. This is applicable to the footing design; including stability checks. Dynamic load allowance shall be applied to the design of the pedestal wall.
- Multiple presence factors from Article 3.6.1.1 apply.
- The live load will be input into STAAD to determine the force effects.

Dynamic Load Allowance: $IM := 0.33$ (BDS Table 3.6.2.1-1)

Roadway Width: $W_{tl} := 32 \text{ ft}$

Maximum Number of Design Lanes: $N_L := \text{Floor} \left(\frac{W_{tl}}{12 \text{ ft}}, 1 \right) = 2$ (BDS Article 3.6.1.1.1)

Multiple Presence Factors: (BDS Table 3.6.1.1.2-1)

One Lane: $m_1 := 1.20$

Two Lanes: $m_2 := 1.00$

Distribution Factor:

One Lane: $DF_1 := \frac{1 (m_1)}{L} = 0.025 \frac{1}{\text{ft}}$

Two Lanes: $DF_2 := \frac{N_L (m_2)}{L} = 0.042 \frac{1}{\text{ft}}$

Controlling: $DF := \max (DF_1, DF_2) = 0.042 \frac{1}{\text{ft}}$

Lane Load: $W_{lane_load} := (0.640 \text{ klf} \cdot DF) \cdot b = 0.027 \text{ klf}$

LOADS ACTING ON RIGID FRAME (CONT.)

Live Load (Cont.)

Truck Load:

Weight of Axle 1: $F_{axle1} := 8 \text{ kip}$ (BDS Article 3.6.1.2.2)

Weight of Axles 2 and 3: $F_{axle2_3} := 32 \text{ kip}$ (BDS Article 3.6.1.2.2)

Equivalent Forces:

Axle 1: $P_{axle1} := (F_{axle1} \cdot DF) \cdot b = 0.334 \text{ kip}$

Axles 2 and 3: $P_{axle2_3} := (F_{axle2_3} \cdot DF) \cdot b = 1.336 \text{ kip}$

Tandem Load:

Weight of Axle: $F_{tandem} := 25 \text{ kip}$ (BDS Article 3.6.1.2.3)

Equivalent Force: $P_{tandem} := (F_{tandem} \cdot DF) \cdot b = 1.043 \text{ kip}$

FOUNDATION LOADS

- Value of all forces that are listed as positive indicate that they produce positive moment and for all forces that produce negative moment are listed as negative.
- The weight of soil above toe is neglected.

Vertical Loads

Moment Arm

Footing Selfweight (DC):

Weight of Footing: $DC_{ftng} := t_{ftng} \cdot b_f \cdot \gamma_{conc}$ $arm_{ftng} := \frac{b_f}{2} = 4.250 \text{ ft}$

$$DC_{ftng} = 2.550 \text{ klf}$$

Weight of Heel: $DC_{heel} := t_{ftng} \cdot b_{heel} \cdot \gamma_{conc}$ $arm_{heel2} := \frac{b_{heel}}{2} = 2.000 \text{ ft}$

$$DC_{heel} = 1.200 \text{ klf}$$

Weight of Toe: $DC_{toe} := t_{ftng} \cdot b_{toe} \cdot \gamma_{conc}$ $arm_{toe_1} := \frac{b_{toe}}{2} = 1.250 \text{ ft}$

$$DC_{toe} = 0.750 \text{ klf}$$

Pedestal Selfweight (DC):

Weight of Pedestal: $DC_{ped} := h_{ped} \cdot b_{ped} \cdot \gamma_{conc}$ $arm_{ped} := \frac{b_{ped}}{2} + b_{toe} = 3.500 \text{ ft}$

$$DC_{ped} = 0.726 \text{ klf}$$

Soil Above Heel (EV):

Weight: $EV_{heel} := b_{heel} \cdot h_{heel_soil} \cdot \gamma_{soil}$ $arm_{heel} := b_f - \frac{b_{heel}}{2} = 6.500 \text{ ft}$

$$EV_{heel} = 6.370 \text{ klf}$$

Soil Above Pedestal (EV):

Weight: $EV_{ped} := \left(\frac{b_{ped} - t_{leg}}{2} \right) \cdot (h_{heel_soil} - h_{ped}) \cdot \gamma_{soil}$

$$EV_{ped} = 0.651 \text{ klf}$$

$$arm_{ped.soil} := b_{toe} + b_{ped} \cdot \left(-0.5 \cdot \left(\frac{b_{ped} - t_{leg}}{2} \right) \right) = 4.250 \text{ ft}$$

FOUNDATION LOADS (CONT.)

Vertical Loads (Cont.)

Soil Above Toe (EV):

Weight: $EV_{toe} := 0 \text{ klf}$ $arm_{toe} := \frac{b_{toe}}{2} = 1.250 \text{ ft}$

Live Load Surcharge Over Heel (LS):

- Per BDS Article C11.5.6, the live load surcharge is generally included over the backfill immediately above the wall only for evaluation of foundation bearing resistance and structure design. Live load surcharge is not included over the backfill for evaluation of eccentricity, sliding, or other failure mechanisms for which such surcharge would represent added resistance to failure.

Vertical Live Load Surcharge: $LS_{heel} := \gamma_{soil} \cdot h_{eq} \cdot \left(b_{heel} + \left(\frac{b_{ped} - t_{leg}}{2} \right) \right) = 1.335 \text{ klf}$

Moment Arm: $arm_{LS_{heel}} := b_f - 0.5 \cdot \left(b_{heel} + \left(\frac{b_{ped} - t_{leg}}{2} \right) \right) = 6.250 \text{ ft}$

Vertical Reaction from Rigid Frame:

- See attached STAAD Output in Appendix A, "West Main St Footing.std".

Dead Load on Rigid Frame Structure: $DC_{arch_vert} := 6.811 \text{ klf}$

Weight of Wearing Surface Above Rigid Frame: $DW_{arch_vert} := 0.348 \text{ klf}$

Maximum Live Load (STAAD LC 70): $LL_{arch_vert1} := 2.430 \text{ klf}$

Live Load Corresponding to Maximum Thrust Force (STAAD LC 77): $LL_{arch_vert2} := 1.774 \text{ klf}$

Moment Arm: $arm_{arch_vert} := b_{toe} + \frac{b_{ped}}{2} = 3.500 \text{ ft}$

FOUNDATION LOADS (CONT.)

Horizontal Loads

Soil Earth Pressure (EH):

At Top of Pedestal: $w_{soil_TOP} := (FG_{EL_final} - EL_{TOP}) \cdot \gamma_{soil} \cdot k = 0.612 \text{ ksf}$

At Top of Footing: $w_{soil_TOF} := (FG_{EL_final} - EL_{TOF}) \cdot \gamma_{soil} \cdot k = 0.749 \text{ ksf}$

At Bottom of Footing: $w_{soil_BOF} := (FG_{EL_final} - EL_{BOF}) \cdot \gamma_{soil} \cdot k = 0.861 \text{ ksf}$

Rectangular Soil Earth Pressure:

Force: $EH_{rect} := -w_{soil_TOP} \cdot (EL_{TOP} - EL_{BOF}) = -2.705 \text{ klf}$

Moment Arm: $arm_{rect} := \frac{EL_{TOP} - EL_{BOF}}{2} = 2.210 \text{ ft}$

Triangular Soil Earth Pressure:

Force: $EH_{tri} := -(w_{soil_BOF} - w_{soil_TOP}) \cdot \frac{(EL_{TOP} - EL_{BOF})}{2} = -0.551 \text{ klf}$

Moment Arm: $arm_{tri} := \frac{EL_{TOP} - EL_{BOF}}{3} = 1.473 \text{ ft}$

Live Load Surcharge (LS):

Force: $LS := -\Delta_p \cdot (EL_{TOP} - EL_{BOF}) = -0.617 \text{ klf}$

Moment Arm: $arm_{LS} := \frac{EL_{TOP} - EL_{BOF}}{2} = 2.210 \text{ ft}$

FOUNDATION LOADS (CONT.)

Horizontal Loads (Cont.)

Horizontal Thrust from Rigid Frame:

- See attached STAAD Output in Appendix A, "West Main St Footing.std".

Dead Load on Rigid Frame Structure: $DC_{arch_hor} := 1.642 \text{ klf}$

Wearing Surface: $DW_{arch_hor} := 0.105 \text{ klf}$

Live Load Corresponding to Maximum Vertical Load (STAAD LC 70): $LL_{arch_hor1} := 0.432 \text{ klf}$

Maximum Live Load Thrust Force (STAAD LC 77): $LL_{arch_hor2} := 0.583 \text{ klf}$

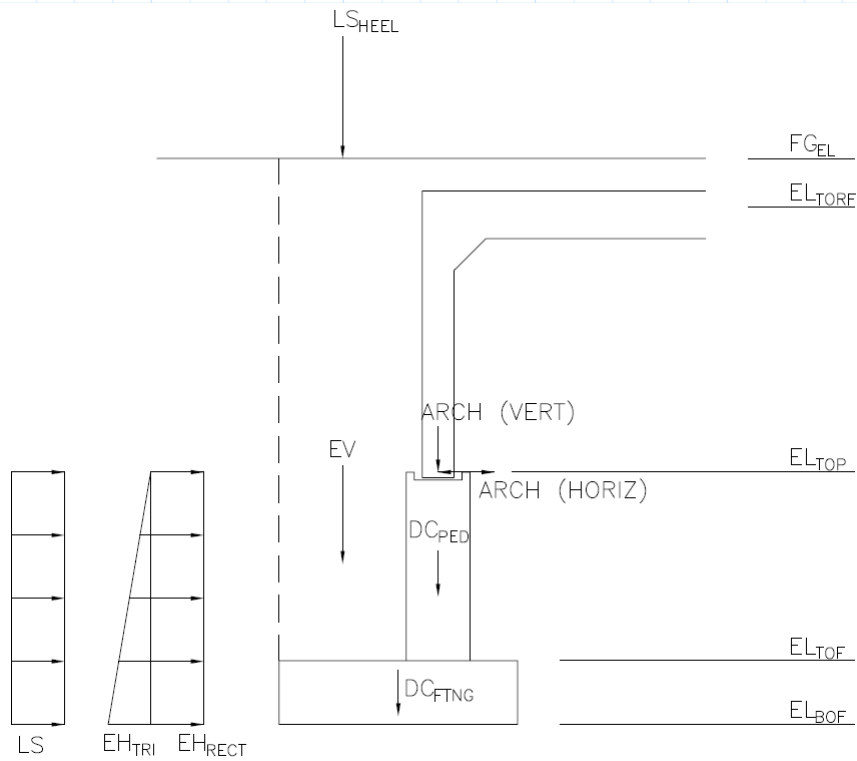
Earth Pressure Behind Rigid Frame Legs: $EH_{arch_hor} := -2.638 \text{ klf} \downarrow = -1.947 \text{ klf} + 0.691 \text{ klf}$

Live Load Surcharge Behind Rigid Frame Legs: $LS_{arch_hor} := -0.938 \text{ klf}$

Moment Arm: $arm_{arch_horiz} := t_{ftng} + h_{ped} = 4.420 \text{ ft}$

FOUNDATION LOADS (CONT.)

- Foundation Loads Diagram



Loads That Create Positive Moments (+M)

Loads That Create Negative Moments (-M)

$DC_{ftng} = 2.550 \text{ klf}$

$DC_{ped} = 0.726 \text{ klf}$

$EH_{rect} = -2.705 \text{ klf}$

$EV_{heel} = 6.370 \text{ klf}$

$EV_{ped} = 0.651 \text{ klf}$

$EH_{tri} = -0.551 \text{ klf}$

$EV_{toe} = 0.000 \text{ klf}$

$LS_{heel} = 1.335 \text{ klf}$

$LS = -0.617 \text{ klf}$

$DC_{arch_vert} = 6.811 \text{ klf}$

$DW_{arch_vert} = 0.348 \text{ klf}$

$EH_{arch_hor} = -1.947 \text{ klf}$

$LL_{arch_vert1} = 2.430 \text{ klf}$

$LL_{arch_vert2} = 1.774 \text{ klf}$

$LS_{arch_hor} = -0.938 \text{ klf}$

$DC_{arch_hor} = 1.642 \text{ klf}$

$DW_{arch_hor} = 0.105 \text{ klf}$

$LL_{arch_hor1} = 0.432 \text{ klf}$

$LL_{arch_hor2} = 0.583 \text{ klf}$

FOUNDATION LOADS (CONT.)

Summary of Positive Moment (+M)

$$M_{DC_ftng} := DC_{ftng} \cdot (arm_{ftng}) \cdot b = 10.838 \text{ kip} \cdot \text{ft}$$

$$M_{DC_ped} := DC_{ped} \cdot (arm_{ped}) \cdot b = 2.541 \text{ kip} \cdot \text{ft}$$

$$M_{EV_heel} := EV_{heel} \cdot (arm_{heel}) \cdot b = 41.402 \text{ kip} \cdot \text{ft}$$

$$M_{EV_ped} := EV_{ped} \cdot (arm_{ped.soil}) \cdot b = 2.767 \text{ kip} \cdot \text{ft}$$

$$M_{EV_toe} := EV_{toe} \cdot (arm_{toe}) \cdot b = 0.000 \text{ kip} \cdot \text{ft}$$

$$M_{LS_heel} := LS_{heel} \cdot (arm_{LS_heel}) \cdot b = 8.346 \text{ kip} \cdot \text{ft}$$

$$M_{DC_arch_vert} := DC_{arch_vert} \cdot (arm_{arch_vert}) \cdot b = 23.839 \text{ kip} \cdot \text{ft}$$

$$M_{DW_arch_vert} := DW_{arch_vert} \cdot (arm_{arch_vert}) \cdot b = 1.218 \text{ kip} \cdot \text{ft}$$

$$M_{LL_arch_vert1} := LL_{arch_vert1} \cdot (arm_{arch_vert}) \cdot b = 8.505 \text{ kip} \cdot \text{ft}$$

$$M_{LL_arch_vert2} := LL_{arch_vert2} \cdot (arm_{arch_vert}) \cdot b = 6.209 \text{ kip} \cdot \text{ft}$$

$$M_{DC_arch_hor} := DC_{arch_hor} \cdot (arm_{arch_horiz}) \cdot b = 7.258 \text{ kip} \cdot \text{ft}$$

$$M_{DW_arch_hor} := DW_{arch_hor} \cdot (arm_{arch_horiz}) \cdot b = 0.464 \text{ kip} \cdot \text{ft}$$

$$M_{LL_arch_hor1} := LL_{arch_hor1} \cdot (arm_{arch_horiz}) \cdot b = 1.909 \text{ kip} \cdot \text{ft}$$

$$M_{LL_arch_hor2} := LL_{arch_hor2} \cdot (arm_{arch_horiz}) \cdot b = 2.577 \text{ kip} \cdot \text{ft}$$

Summary of Negative Moment (-M)

$$M_{EH_rect} := EH_{rect} \cdot (arm_{rect}) \cdot b = -5.979 \text{ kip} \cdot \text{ft}$$

$$M_{EH_tri} := EH_{tri} \cdot (arm_{tri}) \cdot b = -0.812 \text{ kip} \cdot \text{ft}$$

$$M_{LS} := LS \cdot (arm_{LS}) \cdot b = -1.363 \text{ kip} \cdot \text{ft}$$

$$M_{EH_arch_hor} := EH_{arch_hor} \cdot (arm_{arch_horiz}) \cdot b = -8.606 \text{ kip} \cdot \text{ft}$$

$$M_{LS_arch_hor} := LS_{arch_hor} \cdot (arm_{arch_horiz}) \cdot b = -4.146 \text{ kip} \cdot \text{ft}$$

DESIGN OF FOOTING (CONT.)

Sliding Resistance (Strength I):

- Check Sliding Failure Mode per BDS Article 10.6.3.4.

$$R_R = \phi_\tau \cdot R_t \quad (\text{BDS Eq. 10.6.3.4-1})$$

- Note that the contribution of passive resistance to soil is conservatively neglected when calculating the horizontal force per BM Section 3.3.1.1.
- Check if Factored Resistance against failure by sliding based on Strength I Limit State is greater than the maximum total horizontal force acting on the footing.
- Use resistance factors for Strength I Limit State per BDS Article 10.5.3.2.
- If a reduction in the unit weight of soil and concrete due to buoyant force of water is needed, it is accounted for using previously calculated ratios.

Load Case without the Bouyance Effects:

- Minimum Vertical Load (without vertical LS over the Heel and vertical LL on Rigid Frame):

$$P_{minServ1_LCB} := \left(\begin{array}{l} (DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ + (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ + DW_{arch_vert} \cdot \gamma_{DW_StrI_min} \end{array} \right) \cdot b = 16.325 \text{ kip}$$

Sliding Resistance: $R_{t_LCB} := P_{minServ1_LCB} \cdot \tan(\delta) \quad (\text{BDS Eq. 10.6.3.4-2})$

$$R_{t_LCB} = 12.302 \text{ kip}$$

- Maximum Total Horizontal Force:

$$R_{H_LCB} := \left| \begin{array}{l} (EH_{rect} + EH_{tri}) \cdot \gamma_{EH_StrI_max} + LS \cdot \gamma_{LS_StrI} \downarrow \\ + DC_{arch_hor} \cdot \gamma_{DC_StrI_min} + DW_{arch_hor} \cdot \gamma_{DW_StrI_min} \downarrow \\ + EH_{arch_hor} \cdot \gamma_{EH_StrI_max} + LS_{arch_hor} \cdot \gamma_{LS_StrI} \end{array} \right| \cdot b = 8.199 \text{ kip}$$

Performance Ratio of Factored
Sliding Resistance to Maximum
Total Factored Horizontal Force:

$$Ratio_{sliding_LCB} := \frac{\phi_\tau \cdot R_{t_LCB}}{R_{H_LCB}} = 1.200$$

$Check_{slide} := \text{if}(Ratio_{sliding_LCB} > 1, \text{"Sliding OK"}, \text{"Sliding NG"})$

$Check_{slide} = \text{"Sliding OK"}$

DESIGN OF FOOTING (CONT.)

Sliding Resistance (Strength I):

Load Case with the Bouyance Effects (Water Elevation Topping Roadway; no LS):

- Minimum Vertical Load (without vertical LLS over the Heel and vertical LL on Rigid Frame):

$$P_{minServ1_LCB} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot Ratio_{conc} \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot Ratio_{soil} \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ DW_{arch_vert} \cdot \gamma_{DW_StrI_min} \cdot Ratio_{ws} \end{aligned} \right) \cdot b = 8.797 \text{ kip}$$

Sliding Resistance: $R_{t_LCB} := P_{minServ1_LCB} \cdot \tan(\delta)$ (BDS Eq. 10.6.3.4-2)

$$R_{t_LCB} = 6.629 \text{ kip}$$

- Maximum Total Horizontal Force:

$$R_{H_LCB} := \left| \begin{aligned} &(EH_{rect} + EH_{tri}) \cdot \gamma_{EH_StrI_max} \cdot Ratio_{soil} \downarrow \\ &+ DC_{arch_hor} \cdot Ratio_{conc} \cdot \gamma_{DC_StrI_min} + DW_{arch_hor} \cdot Ratio_{ws} \cdot \gamma_{DW_StrI_min} \downarrow \\ &+ EH_{arch_hor} \cdot Ratio_{soil} \cdot \gamma_{EH_StrI_max} \end{aligned} \right| \cdot b = 2.471 \text{ kip}$$

Performance Ratio of Factored
Sliding Resistance to Maximum
Total Factored Horizontal Force:

$$Ratio_{sliding_LCB} := \frac{\phi_{\tau} \cdot R_{t_LCB}}{R_{H_LCB}} = 2.146$$

$Check_{slide} := \text{if}(Ratio_{sliding_LCB} > 1, \text{"Sliding OK"}, \text{"Sliding NG"})$

$Check_{slide} = \text{"Sliding OK"}$

DESIGN OF FOOTING (CONT.)

Load Case #1:

Bearing Pressure - Service I:

Total Vertical Load:

- Maximum Vertical Load (with LS over the Heel):

$$P_{maxServ1_LC1} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LL_{arch_vert1} \cdot \gamma_{LL_ServI} + LS_{heel} \cdot \gamma_{LS_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 21.221 \text{ kip}$$

- Minimum Vertical Load (without LS over the Heel):

$$P_{minServ1_LC1} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LL_{arch_vert1} \cdot \gamma_{LL_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 19.886 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Horizontal Earth Pressure acting on the structure:

$$M_{maxServ1_LC1} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} + (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ M_{LL_arch_vert1} \cdot \gamma_{LL_ServI} + M_{LS_heel} \cdot \gamma_{LS_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{LL_arch_hor1} \cdot \gamma_{LL_ServI} + M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} \downarrow \\ &+ M_{DW_arch_hor} \cdot \gamma_{DW_ServI} + M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{maxServ1_LC1} = 88.182 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Horizontal Earth Pressure acting on the structure (without LS over the Heel):

$$M_{minServ1_LC1} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} + (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ M_{LL_arch_vert1} \cdot \gamma_{LL_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{LL_arch_hor1} \cdot \gamma_{LL_ServI} + M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{minServ1_LC1} = 79.836 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #1 (Cont.):

Bearing Pressure - Service I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Serv1_LC1} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxServ1_LC1}}{P_{maxServ1_LC1}} \right) = 0.095 \text{ ft}$$

$$Check_{LC1_SERV1_E1} := \text{if} \left(|e_{1Serv1_LC1}| < \frac{1}{3} \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

$$Check_{LC1_SERV1_E1} = \text{"OK"}$$

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Serv1_LC1} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minServ1_LC1}}{P_{minServ1_LC1}} \right) = 0.235 \text{ ft}$$

$$Check_{LC1_SERV1_E2} := \text{if} \left(|e_{2Serv1_LC1}| < \frac{1}{3} \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

$$Check_{LC1_SERV1_E2} = \text{"OK"}$$

DESIGN OF FOOTING (CONT.)

Load Case #1 (Cont):

Bearing Pressure - Service I (Cont.):

- Eccentricity shall not exceed $(1/3) \cdot b_f$ for footings on soil per BDS Article 10.6.3.3. Since the resultant does not exceed $(1/3)$ of the footing width use BDS Equations 11.6.3.2-1.
- Pressure (Max. Vertical and Horizontal)

$$\sigma_{1_{Serv1_LC1}} := \frac{P_{max_{Serv1_LC1}}}{(b_f - 2 \cdot e_{1_{Serv1_LC1}}) \cdot b} = 2.553 \text{ ksf} \qquad b_{f1_{Serv1_LC1}} := b_f - 2 \cdot |e_{1_{Serv1_LC1}}| = 8.311 \text{ ft}$$

$$\sigma_{2_{Serv1_LC1}} := \frac{P_{min_{Serv1_LC1}}}{(b_f - 2 \cdot e_{2_{Serv1_LC1}}) \cdot b} = 2.477 \text{ ksf} \qquad b_{f2_{Serv1_LC1}} := b_f - 2 \cdot |e_{2_{Serv1_LC1}}| = 8.029 \text{ ft}$$

DESIGN OF FOOTING (CONT.)

Load Case #1 (Cont):

Bearing Pressure - Strength I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxStr1_LC1} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_max} \downarrow \\ &+ LL_{arch_vert1} \cdot \gamma_{LL_StrI} + LS_{heel} \cdot \gamma_{LS_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_max} \end{aligned} \right) \cdot b = 29.198 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minStr1_LC1} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ LL_{arch_vert1} \cdot \gamma_{LL_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_min} \end{aligned} \right) \cdot b = 20.578 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure:

$$M_{maxStr1_LC1} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_max} + M_{LL_arch_vert1} \cdot \gamma_{LL_StrI} \downarrow \\ &+ M_{LS_heel} \cdot \gamma_{LL_StrI} + M_{EH_rect} \cdot \gamma_{EH_StrI_max} + M_{EH_tri} \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS} \cdot \gamma_{LL_StrI} + M_{DC_arch_hor} \cdot \gamma_{DC_StrI_max} + M_{DW_arch_hor} \cdot \gamma_{DW_StrI_max} \downarrow \\ &+ M_{LL_arch_hor1} \cdot \gamma_{LL_StrI} + M_{DW_arch_vert} \cdot \gamma_{DW_StrI_max} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{maxStr1_LC1} = 120.151 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure (without LLS over the Heel):

$$M_{minStr1_LC1} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ M_{LL_arch_vert1} \cdot \gamma_{LL_StrI} + (M_{EH_rect} \cdot \gamma_{EH_StrI_max} + M_{EH_tri} \cdot \gamma_{EH_StrI_max}) \downarrow \\ &+ M_{LS} \cdot \gamma_{LL_StrI} + M_{DC_arch_hor} \cdot \gamma_{DC_StrI_min} + M_{DW_arch_hor} \cdot \gamma_{DW_StrI_min} \downarrow \\ &+ M_{LL_arch_hor1} \cdot \gamma_{LL_StrI} + M_{DW_arch_vert} \cdot \gamma_{DW_StrI_min} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{minStr1_LC1} = 73.090 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #1 (Cont):

Bearing Pressure - Strength I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Str1_LC1} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxStr1_LC1}}{P_{maxStr1_LC1}} \right) = 0.135 \text{ ft}$$

$$Check_{LC1_STR1_E1} := \text{if} \left(|e_{1Str1_LC1}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC1_STR1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Str1_LC1} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minStr1_LC1}}{P_{minStr1_LC1}} \right) = 0.698 \text{ ft}$$

$$Check_{LC1_STR1_E2} := \text{if} \left(|e_{2Str1_LC1}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC1_STR1_E2} = "OK"

DESIGN OF FOOTING (CONT.)

Load Case #1 (Cont):

Bearing Pressure - Strength I (Cont.):

- Eccentricity shall not exceed $0.45 \cdot b_f$ for footings on rock per BDS Article 10.6.3.3. Since the resultant does not exceed 0.45 of the footing width use BDS Equations 11.6.3.2-2, 11.6.3.2-3, 11.6.3.2-4 and 11.6.3.2-5.
- Pressure (Max. Vertical and Max. Horizontal)

$$\sigma_{1Str1_LC1} := \frac{P_{maxStr1_LC1}}{(b_f - 2 \cdot e_{1Str1_LC1}) \cdot b} = 3.548 \text{ ksf} \quad b_{f1Str1_LC1} := b_f - 2 \cdot |e_{1Str1_LC1}| = 8.230 \text{ ft}$$

$$\sigma_{2Str1_LC1} := \frac{P_{minStr1_LC1}}{(b_f - 2 \cdot e_{2Str1_LC1}) \cdot b} = 2.897 \text{ ksf} \quad b_{f2Str1_LC1} := b_f - 2 \cdot |e_{2Str1_LC1}| = 7.104 \text{ ft}$$

Bearing Capacity:

$$q_{r.1Str1_LC1} := \phi_b \cdot \left(\frac{N1_{60} \cdot (b_f - 2 \cdot e_{1Str1_LC1})}{5 \cdot ft} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{1Str1_LC1})} + C_{w\gamma} \right) \cdot ksf \right) = 6.629 \text{ ksf}$$

$$q_{r.2Str1_LC1} := \phi_b \cdot \left(\frac{N1_{60} \cdot (b_f - 2 \cdot e_{2Str1_LC1})}{5 \cdot ft} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{2Str1_LC1})} + C_{w\gamma} \right) \cdot ksf \right) = 5.722 \text{ ksf}$$

Check Bearing Capacity:

$$check_{LC1_STR1_s1} := \text{if}(\sigma_{1Str1_LC1} \leq q_{r.1Str1_LC1}, \text{"OK"}, \text{"NG"})$$

$$check_{LC1_STR1_s1} = \text{"OK"}$$

$$check_{LC1_STR1_s2} := \text{if}(\sigma_{2Str1_LC1} \leq q_{r.2Str1_LC1}, \text{"OK"}, \text{"NG"})$$

$$check_{LC1_STR1_s2} = \text{"OK"}$$

DESIGN OF FOOTING (CONT.)

Load Case #2:

Bearing Pressure - Service I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxServ1_LC2} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_ServI} + LS_{heel} \cdot \gamma_{LS_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 20.565 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minServ1_LC2} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 19.230 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Horizontal Earth Pressure acting on the structure:

$$M_{maxServ1_LC2} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ M_{LL_arch_vert2} \cdot \gamma_{LL_ServI} + M_{LS_heel} \cdot \gamma_{LS_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} + M_{LL_arch_hor2} \cdot \gamma_{LL_ServI} \downarrow \\ &+ M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} + M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{maxServ1_LC2} = 86.553 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Horizontal Earth Pressure acting on the structure (without LLS over the Heel):

$$M_{minServ1_LC2} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ M_{LL_arch_vert2} \cdot \gamma_{LL_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} + M_{LL_arch_hor2} \cdot \gamma_{LL_ServI} \downarrow \\ &+ M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} + M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{minServ1_LC2} = 78.207 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #2 (Cont.):

Bearing Pressure - Service I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Serv1_LC2} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxServ1_LC2}}{P_{maxServ1_LC2}} \right) = 0.041 \text{ ft}$$

$$Check_{LC2_SERV1_E1} := \text{if} \left(|e_{1Serv1_LC2}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC2_SERV1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Serv1_LC2} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minServ1_LC2}}{P_{minServ1_LC2}} \right) = 0.183 \text{ ft}$$

$$Check_{LC2_SERV1_E2} := \text{if} \left(|e_{2Serv1_LC2}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC2_SERV1_E2} = "OK"

DESIGN OF FOOTING (CONT.)

Load Case #2 (Cont.):

Bearing Pressure - Service I (Cont.):

- Eccentricity shall not exceed $(1/3) \cdot b_f$ for footings on soil per BDS Article 10.6.3.3. Since the resultant does not exceed $(1/3)$ of the footing width use BDS Equations 11.6.3.2-1.
- Pressure (Max. Vertical and Horizontal)

$$\sigma_{1_{Serv1_LC2}} := \frac{P_{max_{Serv1_LC2}}}{(b_f - 2 \cdot e_{1_{Serv1_LC2}}) \cdot b} = 2.443 \text{ ksf} \quad b_{f1_{Serv1_LC2}} := b_f - 2 \cdot |e_{1_{Serv1_LC2}}| = 8.418 \text{ ft}$$

$$\sigma_{2_{Serv1_LC2}} := \frac{P_{min_{Serv1_LC2}}}{(b_f - 2 \cdot e_{2_{Serv1_LC2}}) \cdot b} = 2.364 \text{ ksf} \quad b_{f2_{Serv1_LC2}} := b_f - 2 \cdot |e_{2_{Serv1_LC2}}| = 8.134 \text{ ft}$$

DESIGN OF FOOTING (CONT.)

Load Case #2 (Cont.):

Bearing Pressure - Strength I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxStr1_LC2} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_max} + LL_{arch_vert2} \cdot \gamma_{LL_StrI} \downarrow \\ &+ LS_{heel} \cdot \gamma_{LS_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_max} \end{aligned} \right) \cdot b = 28.050 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minStr1_LC2} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_min} \end{aligned} \right) \cdot b = 19.430 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure:

$$M_{maxStr1_LC2} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_max} \downarrow \\ &+ M_{LL_arch_vert2} \cdot \gamma_{LL_StrI} + M_{LS_heel} \cdot \gamma_{LS_StrI} + (M_{EH_rect} + M_{EH_tri}) \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_StrI} + M_{DC_arch_hor} \cdot \gamma_{DC_StrI_max} + M_{DW_arch_vert} \cdot \gamma_{DW_StrI_max} + M_{LL_arch_hor2} \cdot \gamma_{LL_StrI} \\ &+ M_{DW_arch_hor} \cdot \gamma_{DW_StrI_max} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_max} + M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{maxStr1_LC2} = 117.301 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure (without LLS over the Heel):

$$M_{minStr1_LC2} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ M_{LL_arch_vert2} \cdot \gamma_{LL_StrI} + (M_{EH_rect} + M_{EH_tri}) \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_StrI} + M_{DC_arch_hor} \cdot \gamma_{DC_StrI_min} + M_{DW_arch_vert} \cdot \gamma_{DW_StrI_min} + M_{LL_arch_hor2} \cdot \gamma_{LL_StrI} \\ &+ M_{DW_arch_hor} \cdot \gamma_{DW_StrI_min} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_max} + M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{minStr1_LC2} = 70.240 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #2 (Cont.):

Bearing Pressure - Strength I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Str1_LC2} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxStr1_LC2}}{P_{maxStr1_LC2}} \right) = 0.068 \text{ ft}$$

$$Check_{LC2_STR1_E1} := \text{if} \left(|e_{1Str1_LC2}| < \left(\frac{1}{3} \right) b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC2_STR1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Str1_LC2} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minStr1_LC2}}{P_{minStr1_LC2}} \right) = 0.635 \text{ ft}$$

$$Check_{LC2_STR1_E2} := \text{if} \left(|e_{2Str1_LC2}| < \left(\frac{1}{3} \right) b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC2_STR1_E2} = "OK"

DESIGN OF FOOTING (CONT.)

Load Case #2 (Cont.):

Bearing Pressure - Strength I (Cont.):

- Eccentricity shall not exceed $0.45 \cdot b_f$ for footings on rock per BDS Article 10.6.3.3. Since the resultant does not exceed 0.45 of the footing width use BDS Equations 11.6.3.2-2, 11.6.3.2-3, 11.6.3.2-4 and 11.6.3.2-5.
- Pressure (Max. Vertical and Max. Horizontal)

$$\sigma_{1Str1_LC2} := \frac{P_{maxStr1_LC2}}{(b_f - 2 \cdot e_{1Str1_LC2}) \cdot b} = 3.354 \text{ ksf} \quad b_{f1Str1_LC2} := b_f - 2 \cdot |e_{1Str1_LC2}| = 8.364 \text{ ft}$$

$$\sigma_{2Str1_LC2} := \frac{P_{minStr1_LC2}}{(b_f - 2 \cdot e_{2Str1_LC2}) \cdot b} = 2.687 \text{ ksf} \quad b_{f2Str1_LC2} := b_f - 2 \cdot |e_{2Str1_LC2}| = 7.230 \text{ ft}$$

Bearing Capacity:

$$q_{r.1Str1_LC2} := \phi_b \cdot \left(\frac{N1_{60} \cdot (b_f - 2 \cdot e_{1Str1_LC2})}{5 \cdot ft} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{1Str1_LC2})} + C_{w\gamma} \right) \cdot ksf \right) = 6.737 \text{ ksf}$$

$$q_{r.2Str1_LC2} := \phi_b \cdot \left(\frac{N1_{60} \cdot (b_f - 2 \cdot e_{2Str1_LC2})}{5 \cdot ft} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{2Str1_LC2})} + C_{w\gamma} \right) \cdot ksf \right) = 5.824 \text{ ksf}$$

Check Bearing Capacity:

$$check_{LC2_STR1_s1} := \text{if} \left(\sigma_{1Str1_LC2} \leq q_{r.1Str1_LC2}, \text{"OK"}, \text{"NG"} \right)$$

$check_{LC2_STR1_s1} = \text{"OK"}$

$$check_{LC2_STR1_s2} := \text{if} \left(\sigma_{2Str1_LC2} \leq q_{r.2Str1_LC2}, \text{"OK"}, \text{"NG"} \right)$$

$check_{LC2_STR1_s2} = \text{"OK"}$

DESIGN OF FOOTING (CONT.)

Load Case #3:

Bearing Pressure - Service I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxServ1_LC3} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LS_{heel} \cdot \gamma_{LS_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 18.791 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minServ1_LC3} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 17.456 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Horizontal Earth Pressure acting on the structure:

$$M_{maxServ1_LC3} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ M_{LS_heel} \cdot \gamma_{LS_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} + M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{maxServ1_LC3} = 77.767 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Horizontal Earth Pressure acting on the structure (without LLS over the Heel):

$$M_{minServ1_LC3} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{EH_tri} \cdot \gamma_{EH_ServI} + M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} \downarrow \\ &+ M_{DW_arch_vert} \cdot \gamma_{DW_ServI} + M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{minServ1_LC3} = 69.421 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #3 (Cont.):

Bearing Pressure - Service I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Serv1_LC3} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxServ1_LC3}}{P_{maxServ1_LC3}} \right) = 0.111 \text{ ft}$$

$$Check_{LC3_SERV1_E1} := \text{if} \left(|e_{1Serv1_LC3}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC3_SERV1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Serv1_LC3} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minServ1_LC3}}{P_{minServ1_LC3}} \right) = 0.273 \text{ ft}$$

$$Check_{LC3_SERV1_E2} := \text{if} \left(|e_{2Serv1_LC3}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC3_SERV1_E2} = "OK"

DESIGN OF FOOTING (CONT.)

Load Case #3 (Cont.):

Bearing Pressure - Service I (Cont.):

- Eccentricity shall not exceed $(1/3) \cdot b_f$ for footings on soil per BDS Article 10.6.3.3. Since the resultant does not exceed $(1/3)$ of the footing width use BDS Equations 11.6.3.2-1.
- Pressure (Max. Vertical and Horizontal)

$$\sigma_{1_{Serv1_LC3}} := \frac{P_{max_{Serv1_LC3}}}{(b_f - 2 \cdot e_{1_{Serv1_LC3}}) \cdot b} = 2.270 \text{ ksf} \qquad b_{f1_{Serv1_LC3}} := b_f - 2 \cdot |e_{1_{Serv1_LC3}}| = 8.277 \text{ ft}$$

$$\sigma_{2_{Serv1_LC3}} := \frac{P_{min_{Serv1_LC3}}}{(b_f - 2 \cdot e_{2_{Serv1_LC3}}) \cdot b} = 2.195 \text{ ksf} \qquad b_{f2_{Serv1_LC3}} := b_f - 2 \cdot |e_{2_{Serv1_LC3}}| = 7.954 \text{ ft}$$

DESIGN OF FOOTING (CONT.)

Load Case #3 (Cont.):

Bearing Pressure - Strength I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxStr1_LC3} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_max} \downarrow \\ &+ LS_{heel} \cdot \gamma_{LS_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_max} \end{aligned} \right) \cdot b = 24.946 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minStr1_LC3} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ DW_{arch_vert} \cdot \gamma_{DW_StrI_min} \end{aligned} \right) \cdot b = 16.325 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure:

$$M_{maxStr1_LC3} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_max} \downarrow \\ &+ M_{LS_heel} \cdot \gamma_{LS_StrI} + M_{EH_rect} \cdot \gamma_{EH_StrI_max} + M_{EH_tri} \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_StrI} + M_{DC_arch_hor} \cdot \gamma_{DC_StrI_max} + M_{DW_arch_hor} \cdot \gamma_{DW_StrI_max} \downarrow \\ &+ M_{DW_arch_vert} \cdot \gamma_{DW_StrI_max} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_max} + M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{maxStr1_LC3} = 101.926 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure:

$$M_{minStr1_LC3} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_min} + (M_{EH_rect} + M_{EH_tri}) \cdot \gamma_{EH_StrI_max} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_StrI} + M_{DC_arch_hor} \cdot \gamma_{DC_StrI_min} + M_{DW_arch_hor} \cdot \gamma_{DW_StrI_min} \downarrow \\ &+ M_{DW_arch_vert} \cdot \gamma_{DW_StrI_min} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_max} + M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{minStr1_LC3} = 54.865 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #3 (Cont.):

Bearing Pressure - Strength I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Str1_LC3} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxStr1_LC3}}{P_{maxStr1_LC3}} \right) = 0.164 \text{ ft}$$

$$Check_{LC3_STR1_E1} := \text{if} \left(|e_{1Str1_LC3}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC3_STR1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Str1_LC3} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minStr1_LC3}}{P_{minStr1_LC3}} \right) = 0.889 \text{ ft}$$

$$Check_{LC3_STR1_E2} := \text{if} \left(|e_{2Str1_LC3}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC3_STR1_E2} = "OK"

DESIGN OF FOOTING (CONT.)

Load Case #3 (Cont.):

Bearing Pressure - Strength I (Cont.):

- Eccentricity shall not exceed $(1/3) \cdot b_f$ for footings on soil per BDS Article 10.6.3.3. Since the resultant does not exceed $(1/3)$ of the footing width use BDS Equations 11.6.3.2-1.
- Pressure (Max. Vertical and Horizontal)

$$\sigma_{1Str1_LC3} := \frac{P_{maxStr1_LC3}}{(b_f - 2 \cdot e_{1Str1_LC3}) \cdot b} = 3.053 \text{ ksf} \quad b_{f1Str1_LC3} := b_f - 2 \cdot |e_{1Str1_LC3}| = 8.172 \text{ ft}$$

$$\sigma_{2Str1_LC3} := \frac{P_{minStr1_LC3}}{(b_f - 2 \cdot e_{2Str1_LC3}) \cdot b} = 2.429 \text{ ksf} \quad b_{f2Str1_LC3} := b_f - 2 \cdot |e_{2Str1_LC3}| = 6.722 \text{ ft}$$

Bearing Capacity:

$$q_{r.1Str1_LC3} := \phi_b \cdot \left(\frac{N_{160} \cdot (b_f - 2 \cdot e_{1Str1_LC3})}{5 \cdot \text{ft}} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{1Str1_LC3})} + C_{w\gamma} \right) \cdot \text{ksf} \right) = 6.582 \text{ ksf}$$

$$q_{r.2Str1_LC3} := \phi_b \cdot \left(\frac{N_{160} \cdot (b_f - 2 \cdot e_{2Str1_LC3})}{5 \cdot \text{ft}} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{2Str1_LC3})} + C_{w\gamma} \right) \cdot \text{ksf} \right) = 5.414 \text{ ksf}$$

Check Bearing Capacity:

$$check_{LC3_STR1_s1} := \text{if}(\sigma_{1Str1_LC3} \leq q_{r.1Str1_LC3}, \text{"OK"}, \text{"NG"})$$

$$check_{LC3_STR1_s1} = \text{"OK"}$$

$$check_{LC3_STR1_s2} := \text{if}(\sigma_{2Str1_LC3} \leq q_{r.2Str1_LC3}, \text{"OK"}, \text{"NG"})$$

$$check_{LC3_STR1_s2} = \text{"OK"}$$

DESIGN OF FOOTING (CONT.)

Load Case #4:

Bearing Pressure - Service I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxServ1_LC4} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_ServI} + LS_{heel} \cdot \gamma_{LS_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 20.565 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minServ1_LC4} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_ServI} + DW_{arch_vert} \cdot \gamma_{DW_ServI} \end{aligned} \right) \cdot b = 19.230 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Horizontal Earth Pressure acting on the structure:

$$M_{maxServ1_LC4} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow + M_{LL_arch_vert2} \cdot \gamma_{LL_ServI} \downarrow \\ &+ M_{LS_heel} \cdot \gamma_{LS_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{LS} \cdot \gamma_{LS_ServI} + M_{DC_arch_hor} \cdot \gamma_{DC_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{LL_arch_hor2} \cdot \gamma_{LL_ServI} + M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} \downarrow \\ &+ M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{maxServ1_LC4} = 86.553 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Horizontal Earth Pressure acting on the structure (without LLS):

$$M_{minServ1_LC4} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_ServI} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_ServI} \downarrow \\ &+ M_{LL_arch_vert2} \cdot \gamma_{LL_ServI} + M_{EH_rect} \cdot \gamma_{EH_ServI} + M_{EH_tri} \cdot \gamma_{EH_ServI} \downarrow \\ &+ M_{DC_arch_hor} \cdot \gamma_{DC_ServI} + M_{DW_arch_hor} \cdot \gamma_{DW_ServI} + M_{LL_arch_hor2} \cdot \gamma_{LL_ServI} \downarrow \\ &+ M_{EH_arch_hor} \cdot \gamma_{EH_ServI} + M_{DW_arch_vert} \cdot \gamma_{DW_ServI} + M_{LS_arch_hor} \cdot \gamma_{LS_ServI} \end{aligned} \right)$$

$$M_{minServ1_LC4} = 79.570 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #4:

Bearing Pressure - Service I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Serv1_LC4} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxServ1_LC4}}{P_{maxServ1_LC4}} \right) = 0.041 \text{ ft}$$

$$Check_{LC4_SERV1_E1} := \text{if} \left(|e_{1Serv1_LC4}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC4_SERV1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Serv1_LC4} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minServ1_LC4}}{P_{minServ1_LC4}} \right) = 0.112 \text{ ft}$$

$$Check_{LC4_SERV1_E2} := \text{if} \left(|e_{2Serv1_LC4}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC4_SERV1_E2} = "OK"

$$M_{minServ1_LC4} = 79.570 \text{ kip} \cdot \text{ft}$$

DESIGN OF FOOTING (CONT.)

Load Case #4:

Bearing Pressure - Service I (Cont.):

- Eccentricity shall not exceed $(1/3) \cdot b_f$ for footings on soil per BDS Article 10.6.3.3. Since the resultant does not exceed $(1/3)$ of the footing width use BDS Equations 11.6.3.2-1.
- Pressure (Max. Vertical and Horizontal)

$$\sigma_{1_{Serv1_LC4}} := \frac{P_{max_{Serv1_LC4}}}{(b_f - 2 \cdot e_{1_{Serv1_LC4}}) \cdot b} = 2.443 \text{ ksf} \qquad b_{f1_{Serv1_LC4}} := b_f - 2 \cdot |e_{1_{Serv1_LC4}}| = 8.418 \text{ ft}$$

$$\sigma_{2_{Serv1_LC4}} := \frac{P_{min_{Serv1_LC4}}}{(b_f - 2 \cdot e_{2_{Serv1_LC4}}) \cdot b} = 2.324 \text{ ksf} \qquad b_{f2_{Serv1_LC4}} := b_f - 2 \cdot |e_{2_{Serv1_LC4}}| = 8.276 \text{ ft}$$

DESIGN OF FOOTING (CONT.)

Load Case #4:

Bearing Pressure - Strength I:

Total Vertical Load:

- Maximum Vertical Load (with LLS over the Heel):

$$P_{maxStr1_LC4} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_max} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_StrI} + LS_{heel} \cdot \gamma_{LS_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_max} \end{aligned} \right) \cdot b = 28.050 \text{ kip}$$

- Minimum Vertical Load (without LLS over the Heel):

$$P_{minStr1_LC4} := \left(\begin{aligned} &(DC_{ftng} + DC_{ped} + DC_{arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (EV_{toe} + EV_{heel} + EV_{ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ LL_{arch_vert2} \cdot \gamma_{LL_StrI} + DW_{arch_vert} \cdot \gamma_{DW_StrI_min} \end{aligned} \right) \cdot b = 19.430 \text{ kip}$$

Moment:

- Moment Corresponding to Maximum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure:

$$M_{maxStr1_LC4} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_max} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_max} + M_{LL_arch_vert2} \cdot \gamma_{LL_StrI} \downarrow \\ &+ M_{LS_heel} \cdot \gamma_{LS_StrI} + (M_{EH_rect} + M_{EH_tri}) \cdot \gamma_{EH_StrI_min} + M_{LS} \cdot \gamma_{LS_StrI} \downarrow \\ &+ M_{DC_arch_hor} \cdot \gamma_{DC_StrI_max} + M_{DW_arch_hor} \cdot \gamma_{DW_StrI_max} + M_{LL_arch_hor2} \cdot \gamma_{LL_StrI} \downarrow \\ &+ M_{DW_arch_vert} \cdot \gamma_{DW_StrI_max} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_min} + M_{LS_arch_hor} \cdot \gamma_{LS_StrI} \end{aligned} \right)$$

$$M_{maxStr1_LC4} = 130.388 \text{ ft} \cdot \text{kip}$$

- Moment Corresponding to Minimum Vertical Reaction and Maximum Net Horizontal Pressure acting on the structure (without LLS over the Heel):

$$M_{minStr1_LC4} := \left(\begin{aligned} &(M_{DC_ftng} + M_{DC_ped} + M_{DC_arch_vert}) \cdot \gamma_{DC_StrI_min} \downarrow \\ &+ (M_{EV_toe} + M_{EV_heel} + M_{EV_ped}) \cdot \gamma_{EV_StrI_min} \downarrow \\ &+ M_{LL_arch_vert2} \cdot \gamma_{LL_StrI} + (M_{EH_rect} + M_{EH_tri}) \cdot \gamma_{EH_StrI_min} \downarrow \\ &+ M_{DC_arch_hor} \cdot \gamma_{DC_StrI_min} + M_{DW_arch_hor} \cdot \gamma_{DW_StrI_min} + M_{LL_arch_hor2} \cdot \gamma_{LL_StrI} \downarrow \\ &+ M_{DW_arch_vert} \cdot \gamma_{DW_StrI_min} + M_{EH_arch_hor} \cdot \gamma_{EH_StrI_min} \end{aligned} \right)$$

$$M_{minStr1_LC4} = 92.967 \text{ ft} \cdot \text{kip}$$

DESIGN OF FOOTING (CONT.)

Load Case #4:

Bearing Pressure - Strength I (Cont.):

- Eccentricity (Max. Vertical and Horizontal Loads)

$$e_{1Str1_LC4} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{maxStr1_LC4}}{P_{maxStr1_LC4}} \right) = -0.398 \text{ ft}$$

$$Check_{LC4_STR1_E1} := \text{if} \left(|e_{1Str1_LC4}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC4_STR1_E1} = "OK"

- Eccentricity (Min. Vertical and Horizontal Loads)

$$e_{2Str1_LC4} := \left(\frac{b_f}{2} \right) - \left(\frac{M_{minStr1_LC4}}{P_{minStr1_LC4}} \right) = -0.535 \text{ ft}$$

$$Check_{LC4_STR1_E2} := \text{if} \left(|e_{2Str1_LC4}| < \left(\frac{1}{3} \right) \cdot b_f, \text{"OK"}, \text{"NG"} \right)$$

Check_{LC4_STR1_E2} = "OK"

DESIGN OF FOOTING (CONT.)

Load Case #4:

Bearing Pressure - Strength I (Cont.):

- Eccentricity shall not exceed $(1/3) \cdot b_f$ for footings on soil per BDS Article 10.6.3.3. Since the resultant does not exceed $(1/3)$ of the footing width use BDS Equations 11.6.3.2-1.
- Pressure (Max. Vertical and Horizontal)

$$\sigma_{1Str1_LC4} := \frac{P_{maxStr1_LC4}}{(b_f - 2 \cdot e_{1Str1_LC4}) \cdot b} = 3.017 \text{ ksf} \quad b_{f1Str1_LC4} := b_f - 2 \cdot |e_{1Str1_LC4}| = 7.703 \text{ ft}$$

$$\sigma_{2Str1_LC4} := \frac{P_{minStr1_LC4}}{(b_f - 2 \cdot e_{2Str1_LC4}) \cdot b} = 2.030 \text{ ksf} \quad b_{f2Str1_LC4} := b_f - 2 \cdot |e_{2Str1_LC4}| = 7.430 \text{ ft}$$

Bearing Capacity:

$$q_{r.1Str1_LC4} := \phi_b \cdot \left(\frac{N1_{60} \cdot (b_f - 2 \cdot e_{1Str1_LC4})}{5 \cdot \text{ft}} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{1Str1_LC4})} + C_{w\gamma} \right) \cdot \text{ksf} \right) = 7.489 \text{ ksf}$$

$$q_{r.2Str1_LC4} := \phi_b \cdot \left(\frac{N1_{60} \cdot (b_f - 2 \cdot e_{2Str1_LC4})}{5 \cdot \text{ft}} \cdot \left(C_{wq} \cdot \frac{D_f}{(b_f - 2 \cdot e_{2Str1_LC4})} + C_{w\gamma} \right) \cdot \text{ksf} \right) = 7.708 \text{ ksf}$$

Check Bearing Capacity:

$$check_{LC4_STR1_s1} := \text{if}(\sigma_{1Str1_LC4} \leq q_{r.1Str1_LC4}, \text{"OK"}, \text{"NG"})$$

$$check_{LC4_STR1_s1} = \text{"OK"}$$

$$check_{LC4_STR1_s2} := \text{if}(\sigma_{2Str1_LC4} \leq q_{r.2Str1_LC4}, \text{"OK"}, \text{"NG"})$$

$$check_{LC4_STR1_s2} = \text{"OK"}$$

SUMMARY OF FOUNDATION ECCENTRICITY (LC1 - LC4)

- Service I Load (Max. Vertical and Horizontal Loads)

Eccentricity

Check Eccentricity

$$e_{1Serv1_LC1} = 0.095 \text{ ft}$$

$$Check_{LC1_SERV1_E1} = \text{"OK"}$$

$$e_{1Serv1_LC2} = 0.041 \text{ ft}$$

$$Check_{LC2_SERV1_E1} = \text{"OK"}$$

$$e_{1Serv1_LC3} = 0.111 \text{ ft}$$

$$Check_{LC3_SERV1_E1} = \text{"OK"}$$

$$e_{1Serv1_LC4} = 0.041 \text{ ft}$$

$$Check_{LC4_SERV1_E1} = \text{"OK"}$$

- Strength I Load (Max. Vertical and Horizontal Loads)

Eccentricity

Check Eccentricity

$$e_{1Str1_LC1} = 0.135 \text{ ft}$$

$$Check_{LC1_STR1_E1} = \text{"OK"}$$

$$e_{1Str1_LC2} = 0.068 \text{ ft}$$

$$Check_{LC2_STR1_E1} = \text{"OK"}$$

$$e_{1Str1_LC3} = 0.164 \text{ ft}$$

$$Check_{LC3_STR1_E1} = \text{"OK"}$$

$$e_{1Str1_LC4} = -0.398 \text{ ft}$$

$$Check_{LC4_STR1_E1} = \text{"OK"}$$

- Service I Load (Min. Vertical and Horizontal Loads)

Eccentricity

Check Eccentricity

$$e_{2Serv1_LC1} = 0.235 \text{ ft}$$

$$Check_{LC1_SERV1_E2} = \text{"OK"}$$

$$e_{2Serv1_LC2} = 0.183 \text{ ft}$$

$$Check_{LC2_SERV1_E2} = \text{"OK"}$$

$$e_{2Serv1_LC3} = 0.273 \text{ ft}$$

$$Check_{LC3_SERV1_E2} = \text{"OK"}$$

$$e_{2Serv1_LC4} = 0.112 \text{ ft}$$

$$Check_{LC4_SERV1_E2} = \text{"OK"}$$

- Strength I Load (Min. Vertical and Horizontal Loads)

Eccentricity

Check Eccentricity

$$e_{2Str1_LC1} = 0.698 \text{ ft}$$

$$Check_{LC1_STR1_E2} = \text{"OK"}$$

$$e_{2Str1_LC2} = 0.635 \text{ ft}$$

$$Check_{LC2_STR1_E2} = \text{"OK"}$$

$$e_{2Str1_LC3} = 0.889 \text{ ft}$$

$$Check_{LC3_STR1_E2} = \text{"OK"}$$

$$e_{2Str1_LC4} = -0.535 \text{ ft}$$

$$Check_{LC4_STR1_E2} = \text{"OK"}$$

Note: Maximum Limit of Eccentricity is (1/3) x bf, for footing on soil per BDS Article 10.6.3.3.

$$Limit := \frac{1}{3} \cdot b_f = 2.833 \text{ ft}$$

SUMMARY OF FOUNDATION BEARING CAPACITY (LC1 - LC4)

- Service I Load (Max. Vertical and Horizontal Loads)

Applied Bearing Stress

$$\begin{aligned}\sigma_{1Serv1_LC1} &= 2.553 \text{ ksf} \\ \sigma_{1Serv1_LC2} &= 2.443 \text{ ksf} \\ \sigma_{1Serv1_LC3} &= 2.270 \text{ ksf} \\ \sigma_{1Serv1_LC4} &= 2.443 \text{ ksf}\end{aligned}$$

Effective Width

$$\begin{aligned}b_{f1Serv1_LC1} &= 8.311 \text{ ft} \\ b_{f1Serv1_LC2} &= 8.418 \text{ ft} \\ b_{f1Serv1_LC3} &= 8.277 \text{ ft} \\ b_{f1Serv1_LC4} &= 8.418 \text{ ft}\end{aligned}$$

$$\max(\sigma_{1Serv1_LC1}, \sigma_{1Serv1_LC2}, \sigma_{1Serv1_LC3}, \sigma_{1Serv1_LC4}) = 2.553 \text{ ksf}$$

- Strength I Load (Max. Vertical and Horizontal Loads)

Applied Bearing Stress

$$\begin{aligned}\sigma_{1Str1_LC1} &= 3.548 \text{ ksf} \\ \sigma_{1Str1_LC2} &= 3.354 \text{ ksf} \\ \sigma_{1Str1_LC3} &= 3.053 \text{ ksf} \\ \sigma_{1Str1_LC4} &= 3.017 \text{ ksf}\end{aligned}$$

Allowable Bearing Stress

$$\begin{aligned}q_{r.1Str1_LC1} &= 7.489 \text{ ksf} \\ q_{r.1Str1_LC2} &= 6.737 \text{ ksf} \\ q_{r.1Str1_LC3} &= 6.582 \text{ ksf} \\ q_{r.1Str1_LC4} &= 7.489 \text{ ksf}\end{aligned}$$

Check Bearing

$$\begin{aligned}check_{LC1_STR1_s1} &= \text{"OK"} \\ check_{LC2_STR1_s1} &= \text{"OK"} \\ check_{LC3_STR1_s1} &= \text{"OK"} \\ check_{LC4_STR1_s1} &= \text{"OK"}\end{aligned}$$

Effective Width

$$\begin{aligned}b_{f1Str1_LC1} &= 8.230 \text{ ft} \\ b_{f1Str1_LC2} &= 8.364 \text{ ft} \\ b_{f1Str1_LC3} &= 8.172 \text{ ft} \\ b_{f1Str1_LC4} &= 7.703 \text{ ft}\end{aligned}$$

- Service I Load (Min. Vertical and Horizontal Loads)

Applied Bearing Stress

$$\begin{aligned}\sigma_{2Serv1_LC1} &= 2.477 \text{ ksf} \\ \sigma_{2Serv1_LC2} &= 2.364 \text{ ksf} \\ \sigma_{2Serv1_LC3} &= 2.195 \text{ ksf} \\ \sigma_{2Serv1_LC4} &= 2.324 \text{ ksf}\end{aligned}$$

Effective Width

$$\begin{aligned}b_{f2Serv1_LC1} &= 8.029 \text{ ft} \\ b_{f2Serv1_LC2} &= 8.134 \text{ ft} \\ b_{f2Serv1_LC3} &= 7.954 \text{ ft} \\ b_{f2Serv1_LC4} &= 8.276 \text{ ft}\end{aligned}$$

$$\max(\sigma_{2Serv1_LC1}, \sigma_{2Serv1_LC2}, \sigma_{2Serv1_LC3}, \sigma_{2Serv1_LC4}) = 2.477 \text{ ksf}$$

- Strength I Load (Min. Vertical and Horizontal Loads)

Applied Bearing Stress

$$\begin{aligned}\sigma_{2Str1_LC1} &= 2.897 \text{ ksf} \\ \sigma_{2Str1_LC2} &= 2.687 \text{ ksf} \\ \sigma_{2Str1_LC3} &= 2.429 \text{ ksf} \\ \sigma_{2Str1_LC4} &= 2.030 \text{ ksf}\end{aligned}$$

Allowable Bearing Stress

$$\begin{aligned}q_{r.2Str1_LC1} &= 7.708 \text{ ksf} \\ q_{r.2Str1_LC2} &= 5.824 \text{ ksf} \\ q_{r.2Str1_LC3} &= 5.414 \text{ ksf} \\ q_{r.2Str1_LC4} &= 7.708 \text{ ksf}\end{aligned}$$

Check Bearing

$$\begin{aligned}check_{LC1_STR1_s2} &= \text{"OK"} \\ check_{LC2_STR1_s2} &= \text{"OK"} \\ check_{LC3_STR1_s2} &= \text{"OK"} \\ check_{LC4_STR1_s2} &= \text{"OK"}\end{aligned}$$

Effective Width

$$\begin{aligned}b_{f2Str1_LC1} &= 7.104 \text{ ft} \\ b_{f2Str1_LC2} &= 7.230 \text{ ft} \\ b_{f2Str1_LC3} &= 6.722 \text{ ft} \\ b_{f2Str1_LC4} &= 7.430 \text{ ft}\end{aligned}$$

SUMMARY OF FOUNDATION BEARING CAPACITY (LC1- LC4) (CONT.)

Service Bearing Resistance - Hough Method

- Settlement analysis is in accordance with the Hough method as described in BDS Article 10.6.2.4.2 and C10.6.2.4.2.

Backfill Soil Properties

Dry Unit Weight (γ_d) = 120 pcf

Saturated Unit Weight (γ_M) = 130 pcf

In Situ Soil Properties

Dry Unit Weight (γ_D) = 110 pcf Das, Table 1.4 for Loose Angular-Grained Silty Sand

Footing Dimensions

Footing Width = 8.5 ft

Footing Length = 47.92 ft

SUMMARY OF FOUNDATION BEARING CAPACITY (LC1- LC4) (CONT.)

Service Bearing Resistance - Hough Method

Boring B-1

Exist. Ground Surface Elev. = 220 ft
 Ground Water Elev. = 212 ft
 Bottom of Footing Elev. = 202 ft

Top of Bearing Soil Layer = 18 ft
 Bottom of Zone of Influence of
 Bearing Layer = 43.5 ft

Applied Bearing Pressure = 2.553 ksf LC1 - maximum earth pressure with maximum live load and corresponding live load thrust (with LS over heel)

BORING B-1												
Depth Below Ground Elev	Elev.	z^1	Δz^2	$\sigma'_o{}^3$	$\Delta \sigma_v{}^4$	N-Value ⁵	$C_N{}^6$	ER ⁷	$N_{60}{}^8$	$(N_1)_{60}{}^9$	C^{10}	$\Delta H_i{}^{11}$
ft	ft	ft	ft	ksf	ksf	bpf			bpf	bpf		in
20	200	2	2	This layer is overexcavated and replaced with gravel borrow.								0.000
25	195	7	5	1.97	1.22	10	1.007	80	13.3	13.4	47.3	0.266
30	190	12	5	2.21	0.85	13	0.969	80	17.3	16.8	52.6	0.161
35	185	17	5	2.45	0.63	12	0.935	80	16.0	15.0	49.7	0.120
40	180	22	5	2.68	0.49	11	0.904	80	14.7	13.3	47.0	0.093
45	175	27	5	2.92	0.39	7	0.875	80	9.3	8.2	39.4	0.083

Resulting Total Settlement (S_e) = 0.722 in BDS Equation 10.6.2.4.2-2

SUMMARY OF FOUNDATION BEARING CAPACITY (LC1- LC4) (CONT.)

Service Bearing Resistance - Hough Method

Boring B-1

Exist. Ground Surface Elev. = 220 ft
 Ground Water Elev. = 212 ft
 Bottom of Footing Elev. = 202 ft

Top of Bearing Soil Layer = 18 ft
 Bottom of Zone of Influence of
 Bearing Layer = 43.5 ft

Applied Bearing Pressure = 2.477 ksf LC1 - maximum earth pressure with no live load

BORING B-1												
Depth Below Ground Elev	Elev.	z^1	Δz^2	$\sigma'_o{}^3$	$\Delta\sigma_v{}^4$	N-Value ⁵	$C_N{}^6$	ER ⁷	$N_{60}{}^8$	$(N_1)_{60}{}^9$	C^{10}	$\Delta H_i{}^{11}$
ft	ft	ft	ft	ksf	ksf	bpf			bpf	bpf		in
20	200	2	2	This layer is overexcavated and replaced with gravel borrow.								0.000
25	195	7	5	1.97	1.19	10	1.007	80	13.3	13.4	47.3	0.260
30	190	12	5	2.21	0.82	13	0.969	80	17.3	16.8	52.6	0.157
35	185	17	5	2.45	0.61	12	0.935	80	16.0	15.0	49.7	0.117
40	180	22	5	2.68	0.47	11	0.904	80	14.7	13.3	47.0	0.090
45	175	27	5	2.92	0.38	7	0.875	80	9.3	8.2	39.4	0.081

Resulting Total Settlement (S_e) = 0.704 in BDS Equation 10.6.2.4.2-2

SUMMARY OF FOUNDATION BEARING CAPACITY (LC1- LC4) (CONT.)

Service Bearing Resistance - Hough Method

Notes:

¹z = Depth below footing bearing elevation to point of interest

²Δz = Layer thickness

³σ'_o = Initial vertical effective soil stress

⁴Δσ_v = Increase in vertical stress

⁵N-Value = SPT blow count

⁶C_N = Correction factor - BDS Article 10.4.6.2.4

⁷ER = Hammer efficiency - BDS Article C10.4.6.2.4; an Autotrip hammer was used for this project.

⁸N₆₀ = SPT blow count corrected for hammer efficiency - BDS Equation Eqn 10.4.6.2.4-2

⁹(N_i)₆₀ = Value on N₆₀ corrected to a standard value - BDS Equation 10.4.6.2.4-1

¹⁰C' = Bearing capacity index - BDS Figure 10.6.2.4.2-1; also taken from Table H-10 of NCHR 24-31 "LRFD Design Specification for Shallow Foundations; Appendix H, Design Examples", dated September 2009

¹¹ΔH_i = Elastic settlement of layer - BDS Equation 10.6.2.4.2-3

NCHRP 24-31 "LRFD Design Specification for Shallow Foundations; Appendix H, Design Examples":

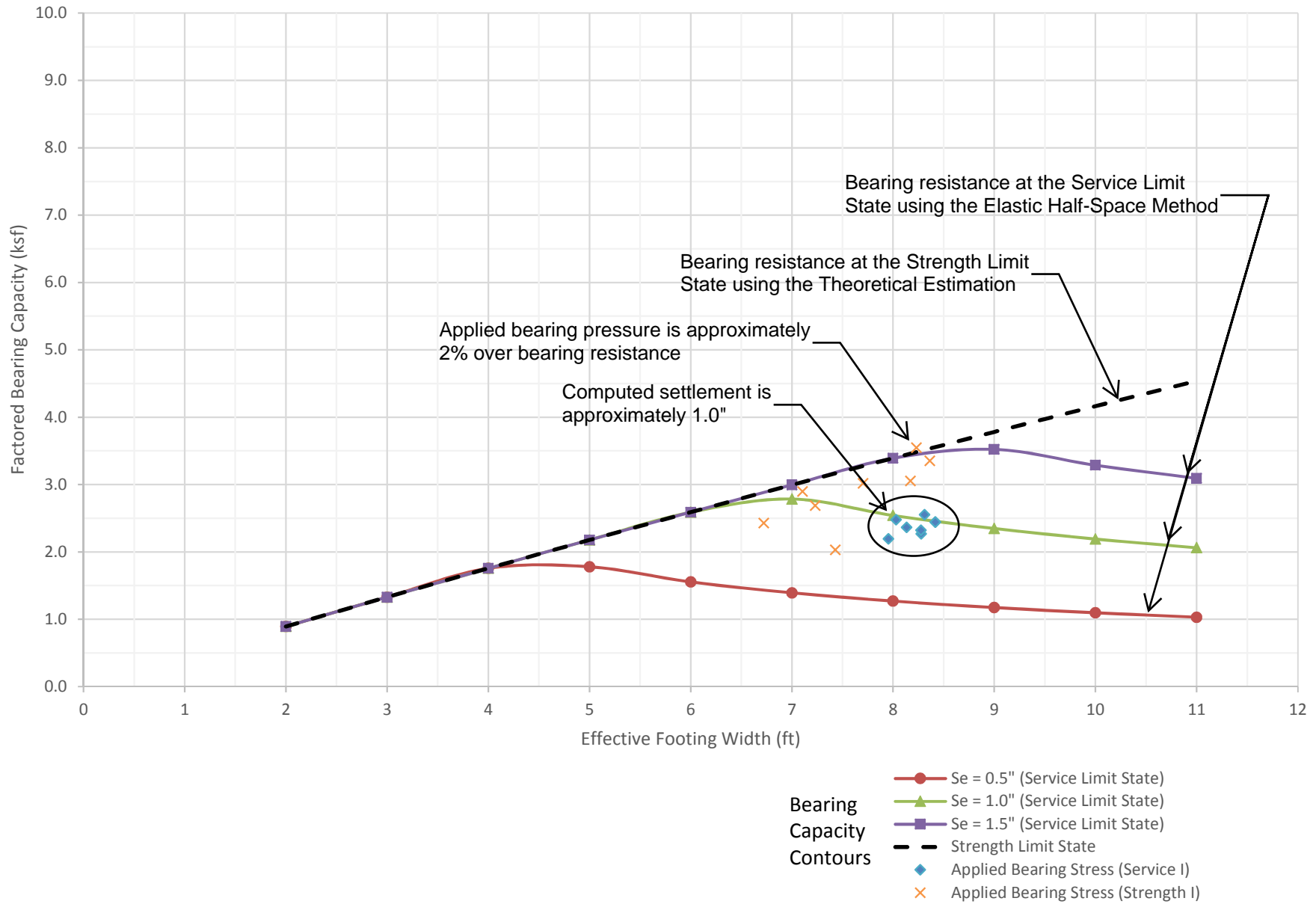
Table H-10. Bearing capacity index from corrected SPT values based on Figure H-3

Soil description	Fitted curve from Figure H-3
Clean uniform med Sand	$C' = 0.0746(N1)_{60}^2 + 0.1313(N1)_{60} + 51.157$
Well graded silty Sand and Gravel	$C' = 0.0335(N1)_{60}^2 + 0.8276(N1)_{60} + 42.86$
Clean well-graded fine to coarse Sand	$C' = 0.0002(N1)_{60}^3 - 0.01(N1)_{60}^2 + 2.1694(N1)_{60} + 27.145$
Well-graded fine to medium silty Sand	$C' = 0.009(N1)_{60}^2 + 1.3134(N1)_{60} + 28.052$
Sandy Clay	$C' = 0.0052(N1)_{60}^2 + 1.1066(N1)_{60} + 24.928$
Inorganic Silt	$C' = 0.0022(N1)_{60}^2 + 1.2166(N1)_{60} + 16.49$

ADDITIONAL BEARING CAPACITY CHECK

- The previous calculations determined the bearing resistance at the service limit state using the Hough Method (BDS Equation 10.6.2.4.2-2) and the bearing resistance at the strength limit state using the semi-empirical method (BDS Article 10.6.3.1.3).
- In an effort to ensure the adequacy of the footing size, additional checks were completed using the more common methods to determine the bearing resistances. The bearing resistance at the service limit state utilized the elastic half-space method (BDS Equation 10.6.2.4.2-1) and the bearing resistance at the strength limit state utilized the theoretical estimation (BDS Article 10.6.3.1.2).
 - These bearing resistances are plotted in a graph as they relate to the effective footing width.
 - The applied bearing pressures are also plotted in this graph to verify the adequacy of the footing.

Resistance as a Function of Effective Footing Width



APPENDIX A
of Geotechnical Report



Software licensed to hta

Job No 924001	Sheet No 1	Rev
Part		
Ref		
By JAS	Date 12/18/2017	Chd
Client Ayer, MA	File West Main St Footing.std	Date/Time 29-Nov-2018 08:55

Reactions

Node	L/C	Horizontal	Vertical	Horizontal	Moment		
		FX (kip)	FY (kip)	FZ (kip)	MX (kip·ft)	MY (kip·ft)	MZ (kip·ft)
1	1:TOTAL DC	1.642	6.811	0.000	0.000	0.000	0.000
	2:EH WEST	-2.638	-0.407	0.000	0.000	0.000	0.000
	3:EH EAST	0.691	0.390	0.000	0.000	0.000	0.000
	4:TOTAL DW	0.105	0.348	0.000	0.000	0.000	0.000
	6:LS WEST	-0.938	-0.207	0.000	0.000	0.000	0.000
	7:LS EAST	0.357	0.207	0.000	0.000	0.000	0.000
	70:LOAD GENI	0.432	2.430	0.000	0.000	0.000	0.000
	77:LOAD GENI	0.583	1.774	0.000	0.000	0.000	0.000
9	1:TOTAL DC	-1.642	6.811	0.000	0.000	0.000	0.000
	2:EH WEST	-0.721	0.407	0.000	0.000	0.000	0.000
	3:EH EAST	2.558	-0.390	0.000	0.000	0.000	0.000
	4:TOTAL DW	-0.105	0.348	0.000	0.000	0.000	0.000
	6:LS WEST	-0.357	0.207	0.000	0.000	0.000	0.000
	7:LS EAST	0.938	-0.207	0.000	0.000	0.000	0.000
	70:LOAD GENI	-0.432	1.359	0.000	0.000	0.000	0.000
	77:LOAD GENI	-0.583	1.681	0.000	0.000	0.000	0.000

Reaction Envelope

Node	Env	Horizontal	Vertical	Horizontal	Moment		
		FX (kip)	FY (kip)	FZ (kip)	MX (kip·ft)	MY (kip·ft)	MZ (kip·ft)
1	+ve	0.583	2.430	0.000	0.000	0.000	0.000
1	+ve	Load: 77	Load: 70	-	-	-	-
1	-ve	0.000	0.000	0.000	0.000	0.000	0.000
1	-ve	-	-	-	-	-	-
9	+ve	0.000	2.430	0.000	0.000	0.000	0.000
9	+ve	-	Load: 130	-	-	-	-
9	-ve	-0.583	0.000	0.000	0.000	0.000	0.000
9	-ve	Load: 77	-	-	-	-	-

LOADS ACTING ON RIGID FRAME:

Calculation of Dead Load (DC & DW):

Weight of Cast-in-Place Overlay on Rigid Frame Top Slab (DC):

- Refer to calculation sheet SL-7 for overlay thicknesses.

West Leg:

At PGL: $t_{overlay.W.PGL} := 11.49 \text{ in}$

At Curb: $t_{overlay.W.curb} := 7.65 \text{ in}$

Average: $t_{overlay.W} := 0.5 \cdot (t_{overlay.W.PGL} + t_{overlay.W.curb}) = 9.570 \text{ in}$

Overlay Weight: $W_{overlay_W} := \frac{\gamma_c \cdot (t_{overlay.W}) \cdot w_{pave}}{w_{frame}} \cdot b = 0.080 \text{ klf}$

East Leg:

At PGL: $t_{overlay.E.PGL} := 9.07 \text{ in}$

At Curb: $t_{overlay.E.curb} := 5.23 \text{ in}$

Average: $t_{overlay.E} := 0.5 \cdot (t_{overlay.E.PGL} + t_{overlay.E.curb}) = 7.150 \text{ in}$

Overlay Weight: $W_{overlay_E} := \frac{\gamma_c \cdot (t_{overlay.E}) \cdot w_{pave}}{w_{frame}} \cdot b = 0.060 \text{ klf}$

LOADS ACTING ON RIGID FRAME (CONT):

Calculation of Dead Load (DC & DW) (Cont.):

Weight of Sidewalks (DC):

- See calculation sheet SL-7 for elevations at top of curbs.
- For ease of stage construction, the southern bridge rail platform will be constructed separately from the sidewalk in Stage 2. The bridge rail platform will be widened to match the face of curb of the Precast Highway Guardrail Transition.

Sidewalk and Bridge Rail Platform Width: $w_{sw.total} := 7 \text{ ft} + 11.5 \text{ in}$

Width of Bridge Rail Platform: $w_{rail} := 20.5 \text{ in}$

Sloped Sidewalk Width: $w_{sw} := w_{sw.total} - w_{rail} = 6.250 \text{ ft}$

Slope of Sidewalk: $X_{sw} := 1.5\%$

West Leg:

Top of Curb Elevation: $EL_{TOC.W} := 220.31 \text{ ft}$

Thickness at Curb: $t_{curb.W} := EL_{TOC.W} - EL_{TORF} = 18.720 \text{ in}$

Thickness at Platform: $t_{pf.W} := t_{curb.W} + X_{sw} \cdot w_{sw} = 19.845 \text{ in}$

Average Thickness of Sidewalk: $t_{sw.W} := 0.5 \cdot (t_{curb.W} + t_{pf.W}) = 19.283 \text{ in}$

Total Sidewalk Weight: $W_{sw.W} := 2 \cdot \left(\frac{\gamma_c \cdot (t_{pf.W} \cdot w_{rail} + t_{sw.W} \cdot w_{sw})}{w_{frame}} \cdot b \right) = 0.081 \text{ klf}$

LOADS ACTING ON RIGID FRAME (CONT):

Calculation of Dead Load (DC & DW) (Cont.):

Weight of Sidewalks (DC) (Cont.):

East Leg:

Top of Curb Elevation: $EL_{TOC.E} := 220.11 \text{ ft}$

Thickness at Curb: $t_{curb.E} := EL_{TOC.E} - EL_{TORF} = 16.320 \text{ in}$

Thickness at Platform: $t_{pf.E} := t_{curb.E} + X_{sw} \cdot w_{sw} = 17.445 \text{ in}$

Average Thickness of Sidewalk: $t_{sw.E} := 0.5 \cdot (t_{curb.E} + t_{pf.E}) = 16.883 \text{ in}$

Total Sidewalk Weight: $W_{sw.E} := 2 \cdot \left(\frac{\gamma_c \cdot (t_{pf.E} \cdot w_{rail} + t_{sw.E} \cdot w_{sw})}{w_{frame}} \cdot b \right) = 0.071 \text{ klf}$

Weight of Rail (DC):

- Bridge rail will be S3-TL4.
- Unit weight of bridge railing is taken from BM Drawing No. 9.1.1. The unit weight is based on a post spacing of 6'-6". Per calculation sheet SL-9, the post spacing is 6'-3", therefore, the unit weight of the railing will be conservatively adjusted.

Unit Weight of S3-TL4 at Sidewalk: $w_{S3} := 90 \text{ plf}$

Actual Post Spacing: $S_{post} := 6.25 \text{ ft}$

Superimposed Rail Load: $W_{rail} := 2 \cdot \left(w_{S3} \cdot \frac{6.5 \text{ ft}}{S_{post}} \right) \cdot \frac{b}{w_{frame}} = 0.00391 \text{ klf}$

LOADS ACTING ON RIGID FRAME (CONT):

Calculation of Dead Load (DC & DW) (Cont.):

Total Weight of DC Loads

West Leg: $DC_W := W_{overlay_W} + W_{sw_W} + W_{rail} = 0.164 \text{ klf}$

East Leg: $DC_E := W_{overlay_E} + W_{sw_E} + W_{rail} = 0.134 \text{ klf}$

- The average loading will be input into STAAD as a uniform load.

Average DC Load: $DC := 0.5 \cdot (DC_W + DC_E) = 0.149 \text{ klf}$

Weight of Pavement on Rigid Frame Top Slab (DW):

Pavement Thickness: $t_{pave} = 3.125 \text{ in}$ (Including membrane)

Pavement Width: $w_{pave} = 32 \text{ ft}$

Weight of Pavement Above Frame: $DW := \frac{\gamma_p \cdot t_{pave} \cdot w_{pave}}{w_{frame}} \cdot b = 0.024 \text{ klf}$

Calculation of Lateral Earth Pressure (EH):

- The earth pressure load is applied at both legs of the structure. the centerline of the top slab is used to model the frame in the STAAD program.
- The backfill consists of gravel borrow for backfilling structures and pipes in accordance with BM Drawing No. 3.6.13.
- The active earth pressure is determined using the Rankine Theory permitted by BDS Article C3.11.5.3; simplified equation modified for level backfill angle.

Friction Angle of Backfill: $\phi_{fric} := 32 \text{ deg}$ (Conservatively use a friction angle of 32 degrees)

At-Rest Earth Pressure: $k_o := 1 - (\sin(\phi_{fric})) = 0.470$ (BDS Eq. 3.11.5.2-1)

Active Earth Pressure: $k_a := \tan\left(45 \text{ deg} - \frac{\phi_{fric}}{2}\right)^2 = 0.307$

Load Factors (BDS Table):

At-Rest: $\gamma_{EH.o} := 1.35$

Active: $\gamma_{EH.a} := 1.50$

Earth Pressure Coefficient: $k := \begin{cases} \gamma_{EH.o} \cdot k_o > \gamma_{EH.a} \cdot k_a \\ k_o \\ \text{else} \\ k_a \end{cases} = 0.470$

- Factored at-rest earth pressure is greater than the factored active earth pressure, therefore, it is conservative to use the at-rest earth pressure to determine the maximum load effects acting on the structure.
- The lateral earth pressure and the live load surcharge will be calculated using the at-rest earth pressure coefficient, therefore, the active earth pressure coefficient will not be used.
- This design assumes that the frame wall does not tip and will not engage the passive earth pressure in front of the legs.

LOADS ACTING ON RIGID FRAME (CONT):

Calculation of Lateral Earth Pressure (EH) (Cont.):

Average Fill Depth at Centerline of Rigid Frame Slab:

West Leg: $H_{1,W} := (t_{overlay,W} + t_{pave}) + 0.5 \cdot t_{top_slab} = 1.808 \text{ ft}$

East Leg: $H_{1,E} := (t_{overlay,E} + t_{pave}) + 0.5 \cdot t_{top_slab} = 1.606 \text{ ft}$

Average Fill Depth at Bottom of Rigid Frame Wall:

West Leg: $H_{2,W} := (H_{1,W}) + Rise = 11.058 \text{ ft}$

East Leg: $H_{2,E} := (H_{1,E}) + Rise = 10.856 \text{ ft}$

West Approach

Lateral Earth Pressure at Top of Wall: $EH_{W,top} := \frac{(k \cdot \gamma_{soil} \cdot H_{1,W} \cdot b)}{\cos(Skew)} = 0.102 \text{ klf}$ (BDS Eq. 3.11.5.1-1)

Lateral Earth Pressure at Bottom of Wall: $EH_{W,bot} := \frac{(k \cdot \gamma_{soil} \cdot H_{2,W} \cdot b)}{\cos(Skew)} = 0.624 \text{ klf}$ (BDS Eq. 3.11.5.1-1)

Lateral Earth Pressure at Bottom of Fillet : $EH_{W,fillet} := EH_{W,top} - \frac{\left(l_{fillet} + \frac{t_{top_slab}}{2} \right) \cdot (EH_{W,top} - EH_{W,bot})}{(Rise)} = 0.201 \text{ klf}$

East Approach

Lateral Earth Pressure at Top of Wall: $EH_{E,top} := \frac{(k \cdot \gamma_{soil} \cdot H_{1,E} \cdot b)}{\cos(Skew)} = 0.091 \text{ klf}$ (BDS Eq. 3.11.5.1-1)

Lateral Earth Pressure at Bottom of Wall: $EH_{E,bot} := \frac{(k \cdot \gamma_{soil} \cdot H_{2,E} \cdot b)}{\cos(Skew)} = 0.612 \text{ klf}$ (BDS Eq. 3.11.5.1-1)

Lateral Earth Pressure at Bottom of Fillet : $EH_{E,fillet} := EH_{E,top} - \frac{\left(l_{fillet} + \frac{t_{top_slab}}{2} \right) \cdot (EH_{E,top} - EH_{E,bot})}{(Rise)} = 0.189 \text{ klf}$



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Job No
924001

Sheet No
1

Rev

Part

Ref

By JAS

Date 12/18/2017

Chd

File West Main St Footing.std

Date/Time 27-Nov-2018 08:51

Job Title West Main Street

Client Ayer, MA



Beam Numbering

Load 8



Software licensed to hta

Job No

924001

Sheet No

1

Rev

Part

Ref

By JAS

Date 12/18/2017

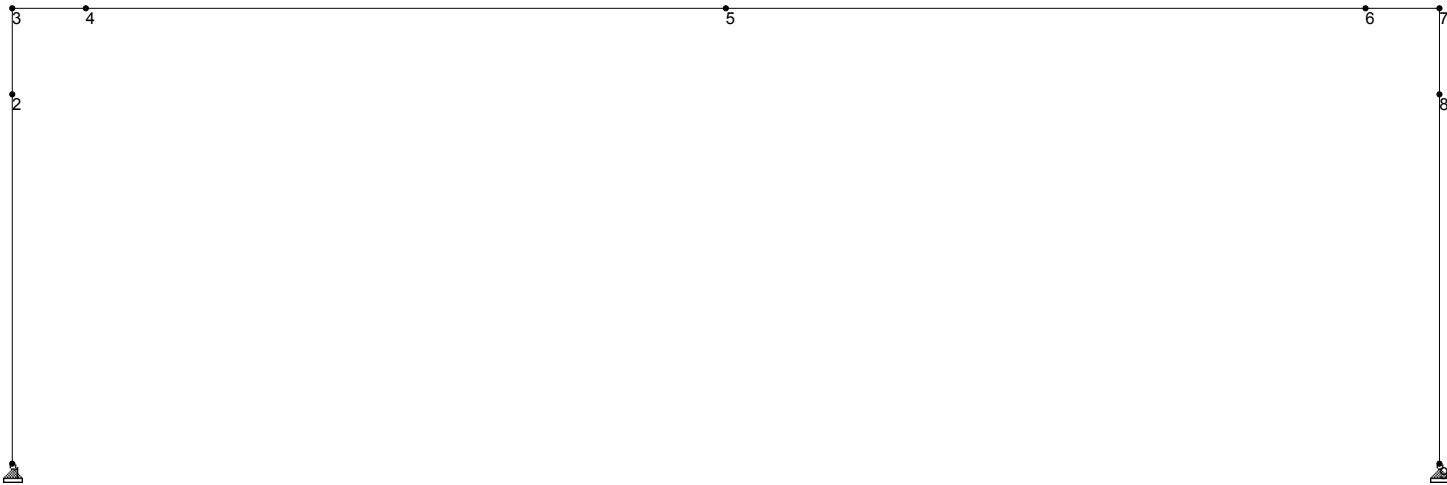
Chd

File West Main St Footing.std

Date/Time 27-Nov-2018 08:51

Job Title West Main Street

Client Ayer, MA



Node Numbering

Load 8

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*****
*
*          STAAD.Pro V8i SELECTseries6          *
*          Version  20.07.11.82                 *
*          Proprietary Program of              *
*          Bentley Systems, Inc.               *
*          Date=    NOV 29, 2018               *
*          Time=    8:53:44                   *
*
*          USER ID: hta                       *
*****

```

1. STAAD SPACE
- INPUT FILE: K:\924001\4-Design\Bridge\Substructure\STAAD\West Main St Footing.STD
2. START JOB INFORMATION
3. ENGINEER DATE 12/18/2017
4. JOB NAME WEST MAIN STREET
5. JOB CLIENT AYER, MA
6. JOB NO 924001
7. ENGINEER NAME JAS
8. END JOB INFORMATION
9. INPUT WIDTH 79
10. UNIT FEET KIP
11. JOINT COORDINATES
12. 1 0 0 0; 2 0 7.5 0; 3 0 9.25 0; 4 1.5 9.25 0; 5 14.5 9.25 0; 6 27.5 9.25 0
13. 7 29 9.25 0; 8 29 7.5 0; 9 29 0 0
14. MEMBER INCIDENCES
15. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 7 8; 8 8 9
16. DEFINE MATERIAL START
17. ISOTROPIC CONCRETE5000
18. E 586029
19. POISSON 0.2
20. DENSITY 0.15
21. ALPHA 6E-006
22. DAMP 0.02
23. END DEFINE MATERIAL
24. MEMBER PROPERTY AMERICAN
25. 3 TO 6 PRIS YD 1.5 ZD 1
26. 1 2 7 8 PRIS YD 1 ZD 1
27. CONSTANTS
28. MATERIAL CONCRETE5000 ALL
29. SUPPORTS
30. 1 9 PINNED
31. DEFINE MOVING LOAD
32. TYPE 1 LOAD 1.043 1.043
33. DIST -4
34. TYPE 2 LOAD 0.334 1.336 1.336
35. DIST -14 -14
36. LOAD 1 TOTAL DC
37. SELFWEIGHT Y -1
38. MEMBER LOAD

STAAD SPACE

-- PAGE NO. 2

39. 3 TO 6 UNI GY -0.149
 40. LOAD 2 EH WEST
 41. MEMBER LOAD
 42. 1 TRAP GX 0.624 0.201
 43. 2 TRAP GX 0.201 0.102
 44. LOAD 3 EH EAST
 45. MEMBER LOAD
 46. 7 TRAP GX -0.091 -0.189
 47. 8 TRAP GX -0.189 -0.612
 48. LOAD 4 TOTAL DW
 49. MEMBER LOAD
 50. 3 TO 6 UNI GY -0.024
 51. LOAD 5 LANE LOAD
 52. MEMBER LOAD
 53. 3 TO 6 UNI GY -0.027
 54. LOAD 6 LS WEST
 55. MEMBER LOAD
 56. 1 2 UNI GX 0.140
 57. LOAD 7 LS EAST
 58. MEMBER LOAD
 59. 7 8 UNI GX -0.140
 60. LOAD GENERATION 34 ADD LOAD 5
 61. TYPE 1 0 9.25 0 XINC 1
 62. LOAD GENERATION 59 ADD LOAD 5
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 8 WHEEL 2 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 9 WHEEL 2 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 10 WHEEL 2 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 11 WHEEL 2 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 38 WHEEL 1 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 39 WHEEL 1 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 40 WHEEL 1 OF 2
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 41 WHEEL 1 OF 2
 63. TYPE 2 0 9.25 0 XINC 1
 64. LOAD GENERATION 59 ADD LOAD 5
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 42 WHEEL 2 OF 3
 **WARNING-A MOVING LOAD THAT WOULD HAVE BEEN APPLIED BEYOND THE X AND Z RANGES
 OF THE STRUCTURE HAS BEEN IGNORED. CASE= 42 WHEEL 3 OF 3
 *ADDITIONAL MOVING LOAD MESSAGES SUPPRESSED
 *ADDITIONAL MOVING LOAD MESSAGES SUPPRESSED
 65. TYPE 2 30 9.25 0 XINC -1.
 66. PERFORM ANALYSIS

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS	9	NUMBER OF MEMBERS	8
NUMBER OF PLATES	0	NUMBER OF SOLIDS	0
NUMBER OF SURFACES	0	NUMBER OF SUPPORTS	2

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINAL BAND-WIDTH=	1/	1/	12 DOF	
TOTAL PRIMARY LOAD CASES =	159,	TOTAL DEGREES OF FREEDOM =		48
TOTAL LOAD COMBINATION CASES =	0	SO FAR.		
SIZE OF STIFFNESS MATRIX =	1	DOUBLE KILO-WORDS		
REQRD/AVAIL. DISK SPACE =	12.2/	104709.1 MB		

***WARNING - INSTABILITY AT JOINT 9 DIRECTION = MX
 PROBABLE CAUSE SINGULAR-ADDING WEAK SPRING
 K-MATRIX DIAG= 3.0134465E+05 L-MATRIX DIAG= 8.9057721E-09 EQN NO 46
 ***NOTE - VERY WEAK SPRING ADDED FOR STABILITY

***NOTE** STAAD DETECTS INSTABILITIES AS EXCESSIVE LOSS OF SIGNIFICANT DIGITS
 DURING DECOMPOSITION. WHEN A DECOMPOSED DIAGONAL IS LESS THAN THE
 BUILT-IN REDUCTION FACTOR TIMES THE ORIGINAL STIFFNESS MATRIX DIAGONAL,
 STAAD PRINTS A SINGULARITY NOTICE. THE BUILT-IN REDUCTION FACTOR
 IS 1.000E-09

THE ABOVE CONDITIONS COULD ALSO BE CAUSED BY VERY STIFF OR VERY WEAK
 ELEMENTS AS WELL AS TRUE SINGULARITIES.

67. FINISH

***** END OF THE STAAD.Pro RUN *****

**** DATE= NOV 29,2018 TIME= 8:55:16 ****

```
*****  
*   For technical assistance on STAAD.Pro, please visit   *  
*   http://selectservices.bentley.com/en-US/             *  
*                                                         *  
*   Details about additional assistance from              *  
*   Bentley and Partners can be found at program menu   *  
*   Help->Technical Support                             *  
*                                                         *  
*   Copyright (c) 1997-2016 Bentley Systems, Inc.       *  
*   http://www.bentley.com                               *  
*****
```

APPENDIX E
Seismic Design Category
of Geotechnical Report

Design Maps Summary Report

User-Specified Input

Report Title West Main Street, Ayer, MA
Mon April 16, 2018 12:13:17 UTC

Building Code Reference Document 2009 AASHTO Guide Specifications for LRFD Seismic Bridge Design
(which utilizes USGS hazard data available in 2002)

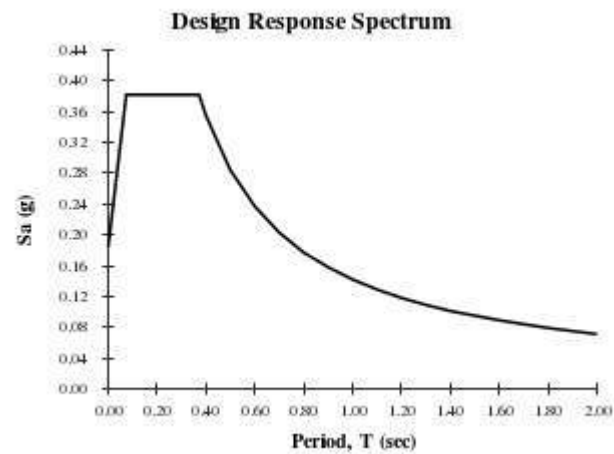
Site Coordinates 42.55938°N, 71.59281°W

Site Soil Classification Site Class E – “Soft Clay Soil”



USGS-Provided Output

PGA = 0.074 g	A_s = 0.184 g
S_s = 0.153 g	S_{DS} = 0.382 g
S₁ = 0.041 g	S_{D1} = 0.142 g



Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

APPENDIX G

REQUEST FOR TAXPAYER IDENTIFICATION NUMBER AND CERTIFICATION
(W-9 FORM)

Request for Taxpayer Identification Number and Certification

Go to www.irs.gov/FormW9 for instructions and the latest information.

**Give form to the
 requester. Do not
 send to the IRS.**

Before you begin. For guidance related to the purpose of Form W-9, see *Purpose of Form*, below.

Print or type. See Specific Instructions on page 3.	1	Name of entity/individual. An entry is required. (For a sole proprietor or disregarded entity, enter the owner's name on line 1, and enter the business/disregarded entity's name on line 2.)	
	2	Business name/disregarded entity name, if different from above.	
	3a	Check the appropriate box for federal tax classification of the entity/individual whose name is entered on line 1. Check only one of the following seven boxes. <input type="checkbox"/> Individual/sole proprietor <input type="checkbox"/> C corporation <input type="checkbox"/> S corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Trust/estate <input type="checkbox"/> LLC. Enter the tax classification (C = C corporation, S = S corporation, P = Partnership) _____ Note: Check the "LLC" box above and, in the entry space, enter the appropriate code (C, S, or P) for the tax classification of the LLC, unless it is a disregarded entity. A disregarded entity should instead check the appropriate box for the tax classification of its owner. <input type="checkbox"/> Other (see instructions) _____	4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3): Exempt payee code (if any) _____ Exemption from Foreign Account Tax Compliance Act (FATCA) reporting code (if any) _____ <i>(Applies to accounts maintained outside the United States.)</i>
	3b	If on line 3a you checked "Partnership" or "Trust/estate," or checked "LLC" and entered "P" as its tax classification, and you are providing this form to a partnership, trust, or estate in which you have an ownership interest, check this box if you have any foreign partners, owners, or beneficiaries. See instructions _____ <input type="checkbox"/>	
	5	Address (number, street, and apt. or suite no.). See instructions.	Requester's name and address (optional)
	6	City, state, and ZIP code	
	7	List account number(s) here (optional)	

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN*, later.

Social security number									
				-					
or									
Employer identification number									

Note: If the account is in more than one name, see the instructions for line 1. See also *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and, generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here	Signature of U.S. person	Date
------------------	--------------------------	------

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to www.irs.gov/FormW9.

What's New

Line 3a has been modified to clarify how a disregarded entity completes this line. An LLC that is a disregarded entity should check the appropriate box for the tax classification of its owner. Otherwise, it should check the "LLC" box and enter its appropriate tax classification.

New line 3b has been added to this form. A flow-through entity is required to complete this line to indicate that it has direct or indirect foreign partners, owners, or beneficiaries when it provides the Form W-9 to another flow-through entity in which it has an ownership interest. This change is intended to provide a flow-through entity with information regarding the status of its indirect foreign partners, owners, or beneficiaries, so that it can satisfy any applicable reporting requirements. For example, a partnership that has any indirect foreign partners may be required to complete Schedules K-2 and K-3. See the Partnership Instructions for Schedules K-2 and K-3 (Form 1065).

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS is giving you this form because they

must obtain your correct taxpayer identification number (TIN), which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid).
- Form 1099-DIV (dividends, including those from stocks or mutual funds).
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds).
- Form 1099-NEC (nonemployee compensation).
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers).
- Form 1099-S (proceeds from real estate transactions).
- Form 1099-K (merchant card and third-party network transactions).
- Form 1098 (home mortgage interest), 1098-E (student loan interest), and 1098-T (tuition).
- Form 1099-C (canceled debt).
- Form 1099-A (acquisition or abandonment of secured property).

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

Caution: If you don't return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See *What is backup withholding*, later.

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued);
2. Certify that you are not subject to backup withholding; or
3. Claim exemption from backup withholding if you are a U.S. exempt payee; and
4. Certify to your non-foreign status for purposes of withholding under chapter 3 or 4 of the Code (if applicable); and
5. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting is correct. See *What Is FATCA Reporting*, later, for further information.

Note: If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Establishing U.S. status for purposes of chapter 3 and chapter 4 withholding. Payments made to foreign persons, including certain distributions, allocations of income, or transfers of sales proceeds, may be subject to withholding under chapter 3 or chapter 4 of the Code (sections 1441–1474). Under those rules, if a Form W-9 or other certification of non-foreign status has not been received, a withholding agent, transferee, or partnership (payor) generally applies presumption rules that may require the payor to withhold applicable tax from the recipient, owner, transferor, or partner (payee). See Pub. 515, *Withholding of Tax on Nonresident Aliens and Foreign Entities*.

The following persons must provide Form W-9 to the payor for purposes of establishing its non-foreign status.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the disregarded entity.
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the grantor trust.
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust and not the beneficiaries of the trust.

See Pub. 515 for more information on providing a Form W-9 or a certification of non-foreign status to avoid withholding.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person (under Regulations section 1.1441-1(b)(2)(iv) or other applicable section for chapter 3 or 4 purposes), do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515). If you are a qualified foreign pension fund under Regulations section 1.897(l)-1(d), or a partnership that is wholly owned by qualified foreign pension funds, that is treated as a non-foreign person for purposes of section 1445 withholding, do not use Form W-9. Instead, use Form W-8EXP (or other certification of non-foreign status).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a saving clause. Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.
2. The treaty article addressing the income.
3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.
4. The type and amount of income that qualifies for the exemption from tax.
5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if their stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first Protocol) and is relying on this exception to claim an exemption from tax on their scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 24% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include, but are not limited to, interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third-party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester;
2. You do not certify your TIN when required (see the instructions for Part II for details);
3. The IRS tells the requester that you furnished an incorrect TIN;
4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only); or
5. You do not certify to the requester that you are not subject to backup withholding, as described in item 4 under "*By signing the filled-out form*" above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code*, later, and the separate Instructions for the Requester of Form W-9 for more information.

See also *Establishing U.S. status for purposes of chapter 3 and chapter 4 withholding*, earlier.

What Is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all U.S. account holders that are specified U.S. persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code*, later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you are no longer tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account, for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of \$50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a \$500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to an FFI to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

• **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note for ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040 you filed with your application.

• **Sole proprietor.** Enter your individual name as shown on your Form 1040 on line 1. Enter your business, trade, or “doing business as” (DBA) name on line 2.

• **Partnership, C corporation, S corporation, or LLC, other than a disregarded entity.** Enter the entity’s name as shown on the entity’s tax return on line 1 and any business, trade, or DBA name on line 2.

• **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. Enter any business, trade, or DBA name on line 2.

• **Disregarded entity.** In general, a business entity that has a single owner, including an LLC, and is not a corporation, is disregarded as an entity separate from its owner (a disregarded entity). See Regulations section 301.7701-2(c)(2). A disregarded entity should check the appropriate box for the tax classification of its owner. Enter the owner’s name on line 1. The name of the owner entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For

example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner’s name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity’s name on line 2. If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, enter it on line 2.

Line 3a

Check the appropriate box on line 3a for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3a.

IF the entity/individual on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation.
• Individual or • Sole proprietorship	Individual/sole proprietor.
• LLC classified as a partnership for U.S. federal tax purposes or • LLC that has filed Form 8832 or 2553 electing to be taxed as a corporation	Limited liability company and enter the appropriate tax classification: P = Partnership, C = C corporation, or S = S corporation.
• Partnership	Partnership.
• Trust/estate	Trust/estate.

Line 3b

Check this box if you are a partnership (including an LLC classified as a partnership for U.S. federal tax purposes), trust, or estate that has any foreign partners, owners, or beneficiaries, and you are providing this form to a partnership, trust, or estate, in which you have an ownership interest. You must check the box on line 3b if you receive a Form W-8 (or documentary evidence) from any partner, owner, or beneficiary establishing foreign status or if you receive a Form W-9 from any partner, owner, or beneficiary that has checked the box on line 3b.

Note: A partnership that provides a Form W-9 and checks box 3b may be required to complete Schedules K-2 and K-3 (Form 1065). For more information, see the Partnership Instructions for Schedules K-2 and K-3 (Form 1065).

If you are required to complete line 3b but fail to do so, you may not receive the information necessary to file a correct information return with the IRS or furnish a correct payee statement to your partners or beneficiaries. See, for example, sections 6698, 6722, and 6724 for penalties that may apply.

Line 4 Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third-party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys’ fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space on line 4.

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2).

- 2—The United States or any of its agencies or instrumentalities.
- 3—A state, the District of Columbia, a U.S. commonwealth or territory, or any of their political subdivisions or instrumentalities.
- 4—A foreign government or any of its political subdivisions, agencies, or instrumentalities.
- 5—A corporation.
- 6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or territory.
- 7—A futures commission merchant registered with the Commodity Futures Trading Commission.
- 8—A real estate investment trust.
- 9—An entity registered at all times during the tax year under the Investment Company Act of 1940.
- 10—A common trust fund operated by a bank under section 584(a).
- 11—A financial institution as defined under section 581.
- 12—A middleman known in the investment community as a nominee or custodian.
- 13—A trust exempt from tax under section 664 or described in section 4947.

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
• Interest and dividend payments	All exempt payees except for 7.
• Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
• Barter exchange transactions and patronage dividends	Exempt payees 1 through 4.
• Payments over \$600 required to be reported and direct sales over \$5,000 ¹	Generally, exempt payees 1 through 5. ²
• Payments made in settlement of payment card or third-party network transactions	Exempt payees 1 through 4.

¹ See Form 1099-MISC, Miscellaneous Information, and its instructions.

² However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) entered on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37).

B—The United States or any of its agencies or instrumentalities.

C—A state, the District of Columbia, a U.S. commonwealth or territory, or any of their political subdivisions or instrumentalities.

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i).

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i).

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state.

G—A real estate investment trust.

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940.

I—A common trust fund as defined in section 584(a).

J—A bank as defined in section 581.

K—A broker.

L—A trust exempt from tax under section 664 or described in section 4947(a)(1).

M—A tax-exempt trust under a section 403(b) plan or section 457(g) plan.

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, enter "NEW" at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have, and are not eligible to get, an SSN, your TIN is your IRS ITIN. Enter it in the entry space for the Social security number. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester*, later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at www.SSA.gov. You may also get this form by calling 800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at www.irs.gov/EIN. Go to www.irs.gov/Forms to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to www.irs.gov/OrderForms to place an order and have Form W-7 and/or Form SS-4 mailed to you within 15 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and enter "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, you will generally have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon. See also *Establishing U.S. status for purposes of chapter 3 and chapter 4 withholding*, earlier, for when you may instead be subject to withholding under chapter 3 or 4 of the Code.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code*, earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third-party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account) other than an account maintained by an FFI	The actual owner of the account or, if combined funds, the first individual on the account ¹
3. Two or more U.S. persons (joint account maintained by an FFI)	Each holder of the account
4. Custodial account of a minor (Uniform Gift to Minors Act)	The minor ²
5. a. The usual revocable savings trust (grantor is also trustee)	The grantor-trustee ¹
b. So-called trust account that is not a legal or valid trust under state law	The actual owner ¹
6. Sole proprietorship or disregarded entity owned by an individual	The owner ³
7. Grantor trust filing under Optional Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))**	The grantor*

For this type of account:	Give name and EIN of:
8. Disregarded entity not owned by an individual	The owner
9. A valid trust, estate, or pension trust	Legal entity ⁴
10. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
11. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
12. Partnership or multi-member LLC	The partnership
13. A broker or registered nominee	The broker or nominee
14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
15. Grantor trust filing Form 1041 or under the Optional Filing Method 2, requiring Form 1099 (see Regulations section 1.671-4(b)(2)(i)(B))**	The trust

¹ List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

² Circle the minor's name and furnish the minor's SSN.

³ You must show your individual name on line 1, and enter your business or DBA name, if any, on line 2. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

⁴ List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.)

* **Note:** The grantor must also provide a Form W-9 to the trustee of the trust.

** For more information on optional filing methods for grantor trusts, see the Instructions for Form 1041.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information, such as your name, SSN, or other identifying information, without your permission to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax return preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity, or a questionable credit report, contact the IRS Identity Theft Hotline at 800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 877-777-4778 or TTY/TDD 800-829-4059.

Protect yourself from suspicious emails or phishing schemes.

Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to phishing@irs.gov. You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 800-366-4484. You can forward suspicious emails to the Federal Trade Commission at spam@uce.gov or report them at www.ftc.gov/complaint. You can contact the FTC at www.ftc.gov/idtheft or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see www.IdentityTheft.gov and Pub. 5027.

Go to www.irs.gov/IdentityTheft to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and territories for use in administering their laws. The information may also be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payors must generally withhold a percentage of taxable interest, dividends, and certain other payments to a payee who does not give a TIN to the payor. Certain penalties may also apply for providing false or fraudulent information.

APPENDIX H

PREVAILING WAGE RATES



MAURA HEALEY
Governor

KIM DRISCOLL
Lt. Governor

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF LABOR AND WORKFORCE DEVELOPMENT
DEPARTMENT OF LABOR STANDARDS

Prevailing Wage Rates

As determined by the Director under the provisions of the
Massachusetts General Laws, Chapter 149, Sections 26 to 27H

LAUREN JONES
Secretary

MICHAEL FLANAGAN
Director

Awarding Authority: Town of Ayer - DPW
Contract Number: 25DPW14 **City/Town:** AYER
Description of Work: Staged replacement of the existing West Main Street bridge structure carrying traffic over the Nonacoicus Brook with a three-sided precast concrete rigid frame with clear span length of 28-feet.
Job Location: West Main Street, Ayer, MA 01432

Information about Prevailing Wage Schedules for Awarding Authorities and Contractors

- The wage rates will remain in effect for the duration of the project, except in the case of multi-year public construction projects. For construction projects lasting longer than one year, awarding authorities must request an updated wage schedule no later than two weeks before the anniversary of the date the contract was executed by the awarding authority and the general contractor. For multi-year CM AT RISK projects, the awarding authority must request an annual update no later than two weeks before the anniversary date, determined as the earlier of: (a) the execution date of the GMP Amendment, or (b) the execution date of the first amendment to permit procurement of construction services. The updated wage schedule must be provided to all contractors, including general and sub-contractors, working on the construction project.
- This annual update requirement is generally not applicable to 27F "rental of equipment" contracts. For such contracts, the prevailing wage rates issued by DLS shall remain in effect for the duration of the contract term. However, if the prevailing wage rate sheet issued does not contain wage rates for each year covered by the contract term, the Awarding Authority must request updated rate sheets from DLS and provide them to the contractor to ensure the correct rates are being paid throughout the duration of the contract. Additionally, if an Awarding Authority exercises an option to renew or extend the contract term, they must request updated rate sheets from DLS and provide them to the contractor.
- This wage schedule applies only to the specific project referenced at the top of this page and uniquely identified by the "Wage Request Number" on all pages of this schedule.
- An Awarding Authority must request an updated wage schedule if it has not opened bids or selected a contractor within 90 days of the date of issuance of the wage schedule. For CM AT RISK projects (bid pursuant to G.L. c.149A), the earlier of: (a) the execution date of the GMP Amendment, or (b) the bid for the first construction scope of work must be within 90-days of the wage schedule issuance date.
- The wage schedule shall be incorporated in any advertisement or call for bids for the project as required by M.G.L. c. 149, § 27. The wage schedule shall be made a part of the contract awarded for the project. The wage schedule must be posted in a conspicuous place at the work site for the life of the project in accordance with M.G.L. c. 149 § 27. The wages listed on the wage schedule must be paid to employees performing construction work on the project whether they are employed by the prime contractor, a filed sub-bidder, or a sub-contractor.
- Apprentices working on the project are required to be registered with the Massachusetts Division of Apprentice Standards (DAS). Apprentices must keep their apprentice identification card on their persons during all work hours on the project. An apprentice registered with DAS may be paid the lower apprentice wage rate at the applicable step as provided on the prevailing wage schedule. **Any apprentice not registered with DAS regardless of whether they are registered with another federal, state, local, or private agency must be paid the journeyworker's rate.**
- Every contractor or subcontractor working on the construction project must submit weekly payroll reports and a Statement of Compliance directly to the awarding authority by mail or email and keep them on file for three years. Each weekly payroll report must contain: the employee's name, address, occupational classification, hours worked, and wages paid. Do not submit weekly payroll reports to DLS. For a sample payroll reporting form go to <http://www.mass.gov/dols/pw>.
- Contractors with questions about the wage rates or classifications included on the wage schedule have an affirmative obligation to inquire with DLS at (617) 626-6953.
- Contractors must obtain the wage schedules from awarding authorities. Failure of a contractor or subcontractor to pay the prevailing wage rates listed on the wage schedule to all employees who perform construction work on the project is a violation of the law and subjects the contractor or subcontractor to civil and criminal penalties.
- Employees not receiving the prevailing wage rate set forth on the wage schedule may file a complaint with the Fair Labor Division of the office of the Attorney General at (617) 727-3465.

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
Construction						
(2 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2024	\$39.95	\$15.07	\$20.17	\$0.00	\$75.19
	01/01/2025	\$39.95	\$15.57	\$20.17	\$0.00	\$75.69
	06/01/2025	\$40.95	\$15.57	\$20.17	\$0.00	\$76.69
	12/01/2025	\$40.95	\$15.57	\$21.78	\$0.00	\$78.30
	01/01/2026	\$40.95	\$16.17	\$21.78	\$0.00	\$78.90
	06/01/2026	\$41.95	\$16.17	\$21.78	\$0.00	\$79.90
	12/01/2026	\$41.95	\$16.17	\$23.52	\$0.00	\$81.64
	01/01/2027	\$41.95	\$16.77	\$23.52	\$0.00	\$82.24
(3 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2024	\$40.02	\$15.07	\$20.17	\$0.00	\$75.26
	01/01/2025	\$40.02	\$15.57	\$20.17	\$0.00	\$75.76
	06/01/2025	\$41.02	\$15.57	\$20.17	\$0.00	\$76.76
	12/01/2025	\$41.02	\$15.57	\$21.78	\$0.00	\$78.37
	01/01/2026	\$41.02	\$16.17	\$21.78	\$0.00	\$78.97
	06/01/2026	\$42.02	\$16.17	\$21.78	\$0.00	\$79.97
	12/01/2026	\$42.02	\$16.17	\$23.52	\$0.00	\$81.71
	01/01/2027	\$42.02	\$16.77	\$23.52	\$0.00	\$82.31
(4 & 5 AXLE) DRIVER - EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2024	\$40.14	\$15.07	\$20.17	\$0.00	\$75.38
	01/01/2025	\$40.14	\$15.57	\$20.17	\$0.00	\$75.88
	06/01/2025	\$41.14	\$15.57	\$20.17	\$0.00	\$76.88
	12/01/2025	\$41.14	\$15.57	\$21.78	\$0.00	\$78.49
	01/01/2026	\$41.14	\$16.17	\$21.78	\$0.00	\$79.09
	06/01/2026	\$42.14	\$16.17	\$21.78	\$0.00	\$80.09
	12/01/2026	\$42.14	\$16.17	\$23.52	\$0.00	\$81.83
	01/01/2027	\$42.14	\$16.77	\$23.52	\$0.00	\$82.43
ADS/SUBMERSIBLE PILOT <i>PILE DRIVER LOCAL 56 (ZONE 2)</i>	08/01/2024	\$117.16	\$10.08	\$24.29	\$0.00	\$151.53
For apprentice rates see "Apprentice- PILE DRIVER"						
AIR TRACK OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.61	\$9.65	\$17.70	\$0.00	\$67.96
	06/01/2025	\$42.00	\$9.65	\$17.70	\$0.00	\$69.35
	12/01/2025	\$43.38	\$9.65	\$17.70	\$0.00	\$70.73
	06/01/2026	\$44.82	\$9.65	\$17.70	\$0.00	\$72.17
	12/01/2026	\$46.26	\$9.65	\$17.70	\$0.00	\$73.61
	06/01/2027	\$47.71	\$9.65	\$17.70	\$0.00	\$75.06
	12/01/2027	\$49.16	\$9.65	\$17.70	\$0.00	\$76.51
	06/01/2028	\$50.66	\$9.65	\$17.70	\$0.00	\$78.01
	12/01/2028	\$52.16	\$9.65	\$17.70	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"						
AIR TRACK OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.61	\$9.65	\$17.80	\$0.00	\$68.06
	06/01/2025	\$42.00	\$9.65	\$17.80	\$0.00	\$69.45
	12/01/2025	\$43.38	\$9.65	\$17.80	\$0.00	\$70.83
	06/01/2026	\$44.82	\$9.65	\$17.80	\$0.00	\$72.27
	12/01/2026	\$46.26	\$9.65	\$17.80	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
ASBESTOS REMOVER - PIPE / MECH. EQUIPT. <i>HEAT & FROST INSULATORS LOCAL 6 (BOSTON)</i>	12/01/2024	\$42.80	\$14.50	\$11.05	\$0.00	\$68.35
	06/01/2025	\$43.80	\$14.50	\$11.05	\$0.00	\$69.35
	12/01/2025	\$44.80	\$14.50	\$11.05	\$0.00	\$70.35
ASPHALT RAKER <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01	
For apprentice rates see "Apprentice- LABORER"						
ASPHALT RAKER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
ASPHALT/CONCRETE/CRUSHER PLANT-ON SITE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$57.03	\$15.55	\$16.50	\$0.00	\$89.08
	06/01/2025	\$58.33	\$15.55	\$16.50	\$0.00	\$90.38
	12/01/2025	\$59.78	\$15.55	\$16.50	\$0.00	\$91.83
	06/01/2026	\$61.08	\$15.55	\$16.50	\$0.00	\$93.13
	12/01/2026	\$62.53	\$15.55	\$16.50	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BACKHOE/FRONT-END LOADER <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$57.03	\$15.55	\$16.50	\$0.00	\$89.08
	06/01/2025	\$58.33	\$15.55	\$16.50	\$0.00	\$90.38
	12/01/2025	\$59.78	\$15.55	\$16.50	\$0.00	\$91.83
	06/01/2026	\$61.08	\$15.55	\$16.50	\$0.00	\$93.13
	12/01/2026	\$62.53	\$15.55	\$16.50	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
BARCO-TYPE JUMPING TAMPER <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01	
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
BLOCK PAVER, RAMMER / CURB SETTER <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.61	\$9.65	\$17.70	\$0.00	\$67.96
	06/01/2025	\$42.00	\$9.65	\$17.70	\$0.00	\$69.35
	12/01/2025	\$43.38	\$9.65	\$17.70	\$0.00	\$70.73
	06/01/2026	\$44.82	\$9.65	\$17.70	\$0.00	\$72.17
	12/01/2026	\$46.26	\$9.65	\$17.70	\$0.00	\$73.61
	06/01/2027	\$47.71	\$9.65	\$17.70	\$0.00	\$75.06
	12/01/2027	\$49.16	\$9.65	\$17.70	\$0.00	\$76.51
	06/01/2028	\$50.66	\$9.65	\$17.70	\$0.00	\$78.01
	12/01/2028	\$52.16	\$9.65	\$17.70	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"						
BLOCK PAVER, RAMMER / CURB SETTER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.61	\$9.65	\$17.80	\$0.00	\$68.06
	06/01/2025	\$42.00	\$9.65	\$17.80	\$0.00	\$69.45
	12/01/2025	\$43.38	\$9.65	\$17.80	\$0.00	\$70.83
	06/01/2026	\$44.82	\$9.65	\$17.80	\$0.00	\$72.27
	12/01/2026	\$46.26	\$9.65	\$17.80	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
BOILER MAKER <i>BOILERMAKERS LOCAL 29</i>	01/01/2024	\$48.12	\$7.07	\$20.60	\$0.00	\$75.79

Apprentice - BOILERMAKER - Local 29

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	65	\$31.28	\$7.07	\$13.22	\$0.00	\$51.57
2	65	\$31.28	\$7.07	\$13.22	\$0.00	\$51.57
3	70	\$33.68	\$7.07	\$14.23	\$0.00	\$54.98
4	75	\$36.09	\$7.07	\$15.24	\$0.00	\$58.40
5	80	\$38.50	\$7.07	\$16.25	\$0.00	\$61.82
6	85	\$40.90	\$7.07	\$17.28	\$0.00	\$65.25
7	90	\$43.31	\$7.07	\$18.28	\$0.00	\$68.66
8	95	\$45.71	\$7.07	\$19.32	\$0.00	\$72.10

Notes:

Apprentice to Journeyworker Ratio:1:4

BRICK/STONE/ARTIFICIAL MASONRY (INCL. MASONRY WATERPROOFING) <i>BRICKLAYERS LOCAL 3 (LOWELL)</i>	08/01/2024	\$62.36	\$11.49	\$22.90	\$0.00	\$96.75
	02/01/2025	\$63.66	\$11.49	\$22.90	\$0.00	\$98.05
	08/01/2025	\$65.81	\$11.49	\$22.90	\$0.00	\$100.20
	02/01/2026	\$67.16	\$11.49	\$22.90	\$0.00	\$101.55
	08/01/2026	\$69.36	\$11.49	\$22.90	\$0.00	\$103.75
	02/01/2027	\$70.76	\$11.49	\$22.90	\$0.00	\$105.15

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - BRICK/PLASTER/CEMENT MASON - Local 3 Lowell

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.18	\$11.49	\$22.90	\$0.00	\$65.57
2	60	\$37.42	\$11.49	\$22.90	\$0.00	\$71.81
3	70	\$43.65	\$11.49	\$22.90	\$0.00	\$78.04
4	80	\$49.89	\$11.49	\$22.90	\$0.00	\$84.28
5	90	\$56.12	\$11.49	\$22.90	\$0.00	\$90.51

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.83	\$11.49	\$22.90	\$0.00	\$66.22
2	60	\$38.20	\$11.49	\$22.90	\$0.00	\$72.59
3	70	\$44.56	\$11.49	\$22.90	\$0.00	\$78.95
4	80	\$50.93	\$11.49	\$22.90	\$0.00	\$85.32
5	90	\$57.29	\$11.49	\$22.90	\$0.00	\$91.68

Notes:

Apprentice to Journeyworker Ratio:1:5

BULLDOZER/GRADER/SCRAPER	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
<i>OPERATING ENGINEERS LOCAL 4</i>	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

CAISSON & UNDERPINNING BOTTOM MAN	12/01/2024	\$48.10	\$9.65	\$18.22	\$0.00	\$75.97
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2025	\$49.60	\$9.65	\$18.22	\$0.00	\$77.47
	12/01/2025	\$51.10	\$9.65	\$18.22	\$0.00	\$78.97
	06/01/2026	\$52.65	\$9.65	\$18.22	\$0.00	\$80.52
	12/01/2026	\$54.15	\$9.65	\$18.22	\$0.00	\$82.02

For apprentice rates see "Apprentice- LABORER"

CAISSON & UNDERPINNING LABORER	12/01/2024	\$46.95	\$9.65	\$18.22	\$0.00	\$74.82
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2025	\$48.45	\$9.65	\$18.22	\$0.00	\$76.32
	12/01/2025	\$49.95	\$9.65	\$18.22	\$0.00	\$77.82
	06/01/2026	\$51.50	\$9.65	\$18.22	\$0.00	\$79.37
	12/01/2026	\$53.00	\$9.65	\$18.22	\$0.00	\$80.87

For apprentice rates see "Apprentice- LABORER"

CAISSON & UNDERPINNING TOP MAN	12/01/2024	\$47.28	\$9.65	\$18.22	\$0.00	\$75.15
<i>LABORERS - FOUNDATION AND MARINE</i>	06/01/2025	\$48.78	\$9.65	\$18.22	\$0.00	\$76.65
	12/01/2025	\$50.28	\$9.65	\$18.22	\$0.00	\$78.15
	06/01/2026	\$51.83	\$9.65	\$18.22	\$0.00	\$79.70
	12/01/2026	\$53.33	\$9.65	\$18.22	\$0.00	\$81.20

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARBIDE CORE DRILL OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01

For apprentice rates see "Apprentice- LABORER"

CARPENTER <i>CARPENTERS -ZONE 2 (Eastern Massachusetts)</i>	09/01/2024	\$48.37	\$9.83	\$19.97	\$0.00	\$78.17
	03/01/2025	\$49.62	\$9.83	\$19.97	\$0.00	\$79.42
	09/01/2025	\$50.87	\$9.83	\$19.97	\$0.00	\$80.67
	03/01/2026	\$52.12	\$9.83	\$19.97	\$0.00	\$81.92
	09/01/2026	\$53.37	\$9.83	\$19.97	\$0.00	\$83.17
	03/01/2027	\$54.62	\$9.83	\$19.97	\$0.00	\$84.42

Apprentice - CARPENTER - Zone 2 Eastern MA

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$21.77	\$9.83	\$1.73	\$0.00	\$33.33
2	45	\$21.77	\$9.83	\$1.73	\$0.00	\$33.33
3	55	\$26.60	\$9.83	\$3.40	\$0.00	\$39.83
4	55	\$26.60	\$9.83	\$3.40	\$0.00	\$39.83
5	70	\$33.86	\$9.83	\$16.51	\$0.00	\$60.20
6	70	\$33.86	\$9.83	\$16.51	\$0.00	\$60.20
7	80	\$38.70	\$9.83	\$18.24	\$0.00	\$66.77
8	80	\$38.70	\$9.83	\$18.24	\$0.00	\$66.77

Effective Date - 03/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$22.33	\$9.83	\$1.73	\$0.00	\$33.89
2	45	\$22.33	\$9.83	\$1.73	\$0.00	\$33.89
3	55	\$27.29	\$9.83	\$3.40	\$0.00	\$40.52
4	55	\$27.29	\$9.83	\$3.40	\$0.00	\$40.52
5	70	\$34.73	\$9.83	\$16.51	\$0.00	\$61.07
6	70	\$34.73	\$9.83	\$16.51	\$0.00	\$61.07
7	80	\$39.70	\$9.83	\$18.24	\$0.00	\$67.77
8	80	\$39.70	\$9.83	\$18.24	\$0.00	\$67.77

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
CARPENTER WOOD FRAME <i>CARPENTERS-ZONE 3 (Wood Frame)</i>	10/01/2024	\$26.65	\$7.02	\$4.80	\$0.00	\$38.47
	10/01/2025	\$27.75	\$7.02	\$4.80	\$0.00	\$39.57
	10/01/2026	\$28.85	\$7.02	\$4.80	\$0.00	\$40.67

All Aspects of New Wood Frame Work

Apprentice - CARPENTER (Wood Frame) - Zone 3

Effective Date - 10/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$15.99	\$7.02	\$0.00	\$0.00	\$23.01
2	60	\$15.99	\$7.02	\$0.00	\$0.00	\$23.01
3	65	\$17.32	\$7.02	\$1.00	\$0.00	\$25.34
4	70	\$18.66	\$7.02	\$1.00	\$0.00	\$26.68
5	75	\$19.99	\$7.02	\$4.80	\$0.00	\$31.81
6	80	\$21.32	\$7.02	\$4.80	\$0.00	\$33.14
7	85	\$22.65	\$7.02	\$4.80	\$0.00	\$34.47
8	90	\$23.99	\$7.02	\$4.80	\$0.00	\$35.81

Effective Date - 10/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$16.65	\$7.02	\$0.00	\$0.00	\$23.67
2	60	\$16.65	\$7.02	\$0.00	\$0.00	\$23.67
3	65	\$18.04	\$7.02	\$1.00	\$0.00	\$26.06
4	70	\$19.43	\$7.02	\$1.00	\$0.00	\$27.45
5	75	\$20.81	\$7.02	\$4.80	\$0.00	\$32.63
6	80	\$22.20	\$7.02	\$4.80	\$0.00	\$34.02
7	85	\$23.59	\$7.02	\$4.80	\$0.00	\$35.41
8	90	\$24.98	\$7.02	\$4.80	\$0.00	\$36.80

Notes:

Apprentice to Journeyworker Ratio:1:5

CEMENT MASONRY/PLASTERING <i>BRICKLAYERS LOCAL 3 (LOWELL)</i>	01/01/2024	\$49.33	\$13.00	\$23.57	\$1.30	\$87.20
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Apprentice - CEMENT MASONRY/PLASTERING - Lowell

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.67	\$13.00	\$15.93	\$0.00	\$53.60
2	60	\$29.60	\$13.00	\$18.57	\$1.30	\$62.47
3	65	\$32.06	\$13.00	\$19.57	\$1.30	\$65.93
4	70	\$34.53	\$13.00	\$20.57	\$1.30	\$69.40
5	75	\$37.00	\$13.00	\$21.57	\$1.30	\$72.87
6	80	\$39.46	\$13.00	\$22.57	\$1.30	\$76.33
7	90	\$44.40	\$13.00	\$23.57	\$1.30	\$82.27

Notes:
Steps 3,4 are 500 hrs. All other steps are 1,000 hrs.

Apprentice to Journeyworker Ratio:1:3

CHAIN SAW OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01

For apprentice rates see "Apprentice- LABORER"

CLAM SHELLS/SLURRY BUCKETS/HEADING MACHINES <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$58.18	\$15.55	\$16.50	\$0.00	\$90.23
	06/01/2025	\$59.51	\$15.55	\$16.50	\$0.00	\$91.56
	12/01/2025	\$60.98	\$15.55	\$16.50	\$0.00	\$93.03
	06/01/2026	\$62.31	\$15.55	\$16.50	\$0.00	\$94.36
	12/01/2026	\$63.79	\$15.55	\$16.50	\$0.00	\$95.84

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

COMPRESSOR OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$36.67	\$15.55	\$16.50	\$0.00	\$68.72
	06/01/2025	\$37.52	\$15.55	\$16.50	\$0.00	\$69.57
	12/01/2025	\$38.47	\$15.55	\$16.50	\$0.00	\$70.52
	06/01/2026	\$39.33	\$15.55	\$16.50	\$0.00	\$71.38
	12/01/2026	\$40.28	\$15.55	\$16.50	\$0.00	\$72.33

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

DELEADER (BRIDGE) <i>PAINTERS LOCAL 35 - ZONE 2</i>	07/01/2024	\$57.26	\$9.95	\$23.95	\$0.00	\$91.16
	01/01/2025	\$58.46	\$9.95	\$23.95	\$0.00	\$92.36

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 - BRIDGES/TANKS

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.63	\$9.95	\$0.00	\$0.00	\$38.58
2	55	\$31.49	\$9.95	\$6.66	\$0.00	\$48.10
3	60	\$34.36	\$9.95	\$7.26	\$0.00	\$51.57
4	65	\$37.22	\$9.95	\$7.87	\$0.00	\$55.04
5	70	\$40.08	\$9.95	\$20.32	\$0.00	\$70.35
6	75	\$42.95	\$9.95	\$20.93	\$0.00	\$73.83
7	80	\$45.81	\$9.95	\$21.53	\$0.00	\$77.29
8	90	\$51.53	\$9.95	\$22.74	\$0.00	\$84.22

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$29.23	\$9.95	\$0.00	\$0.00	\$39.18
2	55	\$32.15	\$9.95	\$6.66	\$0.00	\$48.76
3	60	\$35.08	\$9.95	\$7.26	\$0.00	\$52.29
4	65	\$38.00	\$9.95	\$7.87	\$0.00	\$55.82
5	70	\$40.92	\$9.95	\$20.32	\$0.00	\$71.19
6	75	\$43.85	\$9.95	\$20.93	\$0.00	\$74.73
7	80	\$46.77	\$9.95	\$21.53	\$0.00	\$78.25
8	90	\$52.61	\$9.95	\$22.74	\$0.00	\$85.30

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

DEMO: ADZEMAN	12/02/2024	\$47.00	\$9.65	\$18.40	\$0.00	\$75.05
LABORERS - ZONE 2	06/02/2025	\$48.50	\$9.65	\$18.40	\$0.00	\$76.55
	12/01/2025	\$50.00	\$9.65	\$18.40	\$0.00	\$78.05
	06/01/2026	\$51.55	\$9.65	\$18.40	\$0.00	\$79.60
	12/07/2026	\$53.05	\$9.65	\$18.40	\$0.00	\$81.10
	06/07/2027	\$54.65	\$9.65	\$18.40	\$0.00	\$82.70
	12/06/2027	\$56.25	\$9.65	\$18.40	\$0.00	\$84.30
	06/05/2028	\$57.93	\$9.65	\$18.40	\$0.00	\$85.98
	12/04/2028	\$59.60	\$9.65	\$18.40	\$0.00	\$87.65

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: BACKHOE/LOADER/HAMMER OPERATOR <i>LABORERS - ZONE 2</i>	12/02/2024	\$48.00	\$9.65	\$18.40	\$0.00	\$76.05
	06/02/2025	\$49.50	\$9.65	\$18.40	\$0.00	\$77.55
	12/01/2025	\$51.00	\$9.65	\$18.40	\$0.00	\$79.05
	06/01/2026	\$52.55	\$9.65	\$18.40	\$0.00	\$80.60
	12/07/2026	\$54.05	\$9.65	\$18.40	\$0.00	\$82.10
	06/07/2027	\$55.65	\$9.65	\$18.40	\$0.00	\$83.70
	12/06/2027	\$57.25	\$9.65	\$18.40	\$0.00	\$85.30
	06/05/2028	\$58.93	\$9.65	\$18.40	\$0.00	\$86.98
	12/04/2028	\$60.60	\$9.65	\$18.40	\$0.00	\$88.65
For apprentice rates see "Apprentice- LABORER"						
DEMO: BURNERS <i>LABORERS - ZONE 2</i>	12/02/2024	\$47.75	\$9.65	\$18.40	\$0.00	\$75.80
	06/02/2025	\$49.25	\$9.65	\$18.40	\$0.00	\$77.30
	12/01/2025	\$50.75	\$9.65	\$18.40	\$0.00	\$78.80
	06/01/2026	\$52.30	\$9.65	\$18.40	\$0.00	\$80.35
	12/07/2026	\$53.80	\$9.65	\$18.40	\$0.00	\$81.85
	06/07/2027	\$55.40	\$9.65	\$18.40	\$0.00	\$83.45
	12/06/2027	\$57.00	\$9.65	\$18.40	\$0.00	\$85.05
	06/05/2028	\$58.68	\$9.65	\$18.40	\$0.00	\$86.73
	12/04/2028	\$60.35	\$9.65	\$18.40	\$0.00	\$88.40
For apprentice rates see "Apprentice- LABORER"						
DEMO: CONCRETE CUTTER/SAWYER <i>LABORERS - ZONE 2</i>	12/02/2024	\$48.00	\$9.65	\$18.40	\$0.00	\$76.05
	06/02/2025	\$49.50	\$9.65	\$18.40	\$0.00	\$77.55
	12/01/2025	\$51.00	\$9.65	\$18.40	\$0.00	\$79.05
	06/01/2026	\$52.55	\$9.65	\$18.40	\$0.00	\$80.60
	12/07/2026	\$54.05	\$9.65	\$18.40	\$0.00	\$82.10
	06/07/2027	\$55.65	\$9.65	\$18.40	\$0.00	\$83.70
	12/06/2027	\$57.25	\$9.65	\$18.40	\$0.00	\$85.30
	06/05/2028	\$58.93	\$9.65	\$18.40	\$0.00	\$86.98
	12/04/2028	\$60.60	\$9.65	\$18.40	\$0.00	\$88.65
For apprentice rates see "Apprentice- LABORER"						
DEMO: JACKHAMMER OPERATOR <i>LABORERS - ZONE 2</i>	12/02/2024	\$47.75	\$9.65	\$18.40	\$0.00	\$75.80
	06/02/2025	\$49.25	\$9.65	\$18.40	\$0.00	\$77.30
	12/01/2025	\$50.75	\$9.65	\$18.40	\$0.00	\$78.80
	06/01/2026	\$52.30	\$9.65	\$18.40	\$0.00	\$80.35
	12/07/2026	\$53.80	\$9.65	\$18.40	\$0.00	\$81.85
	06/07/2027	\$55.40	\$9.65	\$18.40	\$0.00	\$83.45
	12/06/2027	\$57.00	\$9.65	\$18.40	\$0.00	\$85.05
	06/05/2028	\$58.68	\$9.65	\$18.40	\$0.00	\$86.73
	12/04/2028	\$60.35	\$9.65	\$18.40	\$0.00	\$88.40
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
DEMO: WRECKING LABORER <i>LABORERS - ZONE 2</i>	12/02/2024	\$47.00	\$9.65	\$18.40	\$0.00	\$75.05
	06/02/2025	\$48.50	\$9.65	\$18.40	\$0.00	\$76.55
	12/01/2025	\$50.00	\$9.65	\$18.40	\$0.00	\$78.05
	06/01/2026	\$51.55	\$9.65	\$18.40	\$0.00	\$79.60
	12/07/2026	\$53.05	\$9.65	\$18.40	\$0.00	\$81.10
	06/07/2027	\$54.65	\$9.65	\$18.40	\$0.00	\$82.70
	12/06/2027	\$56.25	\$9.65	\$18.40	\$0.00	\$84.30
	06/05/2028	\$57.93	\$9.65	\$18.40	\$0.00	\$85.98
	12/04/2028	\$59.60	\$9.65	\$18.40	\$0.00	\$87.65
For apprentice rates see "Apprentice- LABORER"						
DIRECTIONAL DRILL MACHINE OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
DIVER <i>PILE DRIVER LOCAL 56 (ZONE 2)</i>	08/01/2024	\$78.11	\$10.08	\$24.29	\$0.00	\$112.48
	as of 8-1-24, Apprentices with diving licenses begin at second year. % of Diver wage 70/80/90 2A \$69.83, 3A \$91.79,4A \$102.14 Total Rate					
DIVER TENDER <i>PILE DRIVER LOCAL 56 (ZONE 2)</i>	08/01/2024	\$51.97	\$10.08	\$24.29	\$0.00	\$86.34
	as of 8-1-24, Apprentices with diving licenses begin at second year. % of Piledriver wage 70/80/90 2A \$54.20, 3A \$73.93,4A \$82.05 Total Rate					
DIVER TENDER (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 2)</i>	08/01/2024	\$83.69	\$10.08	\$24.29	\$0.00	\$118.06
	For apprentice rates see "Apprentice- PILE DRIVER"					
DIVER/SLURRY (EFFLUENT) <i>PILE DRIVER LOCAL 56 (ZONE 2)</i>	08/01/2024	\$117.16	\$10.08	\$24.29	\$0.00	\$151.53
	For apprentice rates see "Apprentice- PILE DRIVER"					
DRAWBRIDGE OPERATOR (Construction) <i>DRAWBRIDGE - SEIU LOCAL 888</i>	07/01/2020	\$26.77	\$6.67	\$3.93	\$0.16	\$37.53
ELECTRICIAN <i>ELECTRICIANS LOCAL 96</i>	09/01/2024	\$47.05	\$13.99	\$19.22	\$0.00	\$80.26
	09/07/2025	\$48.16	\$14.98	\$19.60	\$0.00	\$82.74
	09/06/2026	\$49.38	\$15.96	\$20.00	\$0.00	\$85.34

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - ELECTRICIAN - Local 96

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$18.82	\$13.99	\$0.56	\$0.00	\$33.37
2	45	\$21.17	\$13.99	\$0.64	\$0.00	\$35.80
3	48	\$22.58	\$13.99	\$15.79	\$0.00	\$52.36
4	55	\$25.88	\$13.99	\$16.26	\$0.00	\$56.13
5	65	\$30.58	\$13.99	\$16.91	\$0.00	\$61.48
6	80	\$37.64	\$13.99	\$17.90	\$0.00	\$69.53

Effective Date - 09/07/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$19.26	\$14.98	\$0.58	\$0.00	\$34.82
2	45	\$21.67	\$14.98	\$0.65	\$0.00	\$37.30
3	48	\$23.12	\$14.98	\$16.09	\$0.00	\$54.19
4	55	\$26.49	\$14.98	\$16.57	\$0.00	\$58.04
5	65	\$31.30	\$14.98	\$17.25	\$0.00	\$63.53
6	80	\$38.53	\$14.98	\$18.26	\$0.00	\$71.77

Notes:

Steps 1-2 are 1000 hrs; Steps 3-6 are 1500 hrs.

Apprentice to Journeyworker Ratio:2:3***

ELEVATOR CONSTRUCTOR	01/01/2024	\$61.98	\$16.18	\$20.96	\$0.00	\$99.12
ELEVATOR CONSTRUCTORS LOCAL 41	01/01/2025	\$62.83	\$16.28	\$21.36	\$0.00	\$100.47
	01/01/2026	\$63.68	\$16.38	\$21.76	\$0.00	\$101.82
	01/01/2027	\$64.53	\$16.48	\$22.16	\$0.00	\$103.17

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - ELEVATOR CONSTRUCTOR - Local 41

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$30.99	\$16.18	\$0.00	\$0.00	\$47.17
2	55	\$34.09	\$16.18	\$20.96	\$0.00	\$71.23
3	65	\$40.29	\$16.18	\$20.96	\$0.00	\$77.43
4	70	\$43.39	\$16.18	\$20.96	\$0.00	\$80.53
5	80	\$49.58	\$16.18	\$20.96	\$0.00	\$86.72

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.42	\$16.28	\$0.00	\$0.00	\$47.70
2	55	\$34.56	\$16.28	\$21.36	\$0.00	\$72.20
3	65	\$40.84	\$16.28	\$21.36	\$0.00	\$78.48
4	70	\$43.98	\$16.28	\$21.36	\$0.00	\$81.62
5	80	\$50.26	\$16.28	\$21.36	\$0.00	\$87.90

Notes:

Steps 1-2 are 6 mos.; Steps 3-5 are 1 year

Apprentice to Journeyworker Ratio:1:1

ELEVATOR CONSTRUCTOR HELPER <i>ELEVATOR CONSTRUCTORS LOCAL 41</i>	01/01/2024	\$43.39	\$16.18	\$20.96	\$0.00	\$80.53
	01/01/2025	\$43.98	\$16.28	\$21.36	\$0.00	\$81.62
	01/01/2026	\$44.58	\$16.38	\$21.76	\$0.00	\$82.72
	01/01/2027	\$45.17	\$16.48	\$22.16	\$0.00	\$83.81

For apprentice rates see "Apprentice - ELEVATOR CONSTRUCTOR"

FENCE & GUARD RAIL ERECTOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"

FIELD ENG.INST.PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2024	\$51.78	\$15.30	\$16.40	\$0.00	\$83.48
	05/01/2025	\$53.22	\$15.30	\$16.40	\$0.00	\$84.92
	11/01/2025	\$54.51	\$15.30	\$16.40	\$0.00	\$86.21
	05/01/2026	\$55.95	\$15.30	\$16.40	\$0.00	\$87.65
	11/01/2026	\$57.24	\$15.30	\$16.40	\$0.00	\$88.94
	05/01/2027	\$58.67	\$15.30	\$16.40	\$0.00	\$90.37

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

FIELD ENG.PARTY CHIEF-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2024	\$53.37	\$15.30	\$16.40	\$0.00	\$85.07
	05/01/2025	\$54.82	\$15.30	\$16.40	\$0.00	\$86.52
	11/01/2025	\$56.12	\$15.30	\$16.40	\$0.00	\$87.82
	05/01/2026	\$57.57	\$15.30	\$16.40	\$0.00	\$89.27
	11/01/2026	\$58.87	\$15.30	\$16.40	\$0.00	\$90.57
	05/01/2027	\$60.32	\$15.30	\$16.40	\$0.00	\$92.02

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
FIELD ENG.ROD PERSON-BLDG,SITE,HVY/HWY <i>OPERATING ENGINEERS LOCAL 4</i>	11/01/2024	\$25.37	\$15.30	\$16.40	\$0.00	\$57.07
	05/01/2025	\$26.22	\$15.30	\$16.40	\$0.00	\$57.92
	11/01/2025	\$26.98	\$15.30	\$16.40	\$0.00	\$58.68
	05/01/2026	\$27.83	\$15.30	\$16.40	\$0.00	\$59.53
	11/01/2026	\$28.59	\$15.30	\$16.40	\$0.00	\$60.29
	05/01/2027	\$29.44	\$15.30	\$16.40	\$0.00	\$61.14
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FIRE ALARM INSTALLER <i>ELECTRICIANS LOCAL 96</i>	09/01/2024	\$47.05	\$13.99	\$19.22	\$0.00	\$80.26
	09/07/2025	\$48.16	\$14.98	\$19.60	\$0.00	\$82.74
	09/06/2026	\$49.38	\$15.96	\$20.00	\$0.00	\$85.34
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIRE ALARM REPAIR / MAINT/COMMISSIONING <i>ELECTRICIANS LOCAL 96</i>	09/01/2024	\$47.05	\$13.99	\$19.22	\$0.00	\$80.26
	09/07/2025	\$48.16	\$14.98	\$19.60	\$0.00	\$82.74
	09/06/2026	\$49.38	\$15.96	\$20.00	\$0.00	\$85.34
For apprentice rates see "Apprentice- ELECTRICIAN"						
FIREMAN (ASST. ENGINEER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$45.96	\$15.55	\$16.50	\$0.00	\$78.01
	06/01/2025	\$47.02	\$15.55	\$16.50	\$0.00	\$79.07
	12/01/2025	\$48.19	\$15.55	\$16.50	\$0.00	\$80.24
	06/01/2026	\$49.25	\$15.55	\$16.50	\$0.00	\$81.30
	12/01/2026	\$50.43	\$15.55	\$16.50	\$0.00	\$82.48
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
FLAGGER & SIGNALER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$27.01	\$9.65	\$17.80	\$0.00	\$54.46
	06/01/2025	\$28.09	\$9.65	\$17.80	\$0.00	\$55.54
	12/01/2025	\$28.09	\$9.65	\$17.80	\$0.00	\$55.54
	06/01/2026	\$29.21	\$9.65	\$17.80	\$0.00	\$56.66
	12/01/2026	\$29.21	\$9.65	\$17.80	\$0.00	\$56.66
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
FLOORCOVERER <i>FLOORCOVERERS LOCAL 2168 ZONE 1</i>	09/01/2024	\$56.23	\$8.83	\$20.27	\$0.00	\$85.33
	03/01/2025	\$57.73	\$8.83	\$20.27	\$0.00	\$86.83
	09/01/2025	\$59.23	\$8.83	\$20.27	\$0.00	\$88.33
	03/01/2026	\$60.73	\$8.83	\$20.27	\$0.00	\$89.83
	09/01/2026	\$62.23	\$8.83	\$20.27	\$0.00	\$91.33
	03/01/2027	\$63.73	\$8.83	\$20.27	\$0.00	\$92.83

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - FLOORCOVERER - Local 2168 Zone I

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$25.30	\$8.83	\$1.76	\$0.00	\$35.89
2	45	\$25.30	\$8.83	\$1.76	\$0.00	\$35.89
3	55	\$30.93	\$8.83	\$3.52	\$0.00	\$43.28
4	55	\$30.93	\$8.83	\$3.52	\$0.00	\$43.28
5	70	\$39.36	\$8.83	\$16.75	\$0.00	\$64.94
6	70	\$39.36	\$8.83	\$16.75	\$0.00	\$64.94
7	80	\$44.98	\$8.83	\$18.51	\$0.00	\$72.32
8	80	\$44.98	\$8.83	\$18.51	\$0.00	\$72.32

Effective Date - 03/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$25.98	\$8.83	\$1.76	\$0.00	\$36.57
2	45	\$25.98	\$8.83	\$1.76	\$0.00	\$36.57
3	55	\$31.75	\$8.83	\$3.52	\$0.00	\$44.10
4	55	\$31.75	\$8.83	\$3.52	\$0.00	\$44.10
5	70	\$40.41	\$8.83	\$16.75	\$0.00	\$65.99
6	70	\$40.41	\$8.83	\$16.75	\$0.00	\$65.99
7	80	\$46.18	\$8.83	\$18.51	\$0.00	\$73.52
8	80	\$46.18	\$8.83	\$18.51	\$0.00	\$73.52

Notes: Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

FORK LIFT/CHERRY PICKER OPERATING ENGINEERS LOCAL 4	12/01/2024	\$57.03	\$15.55	\$16.50	\$0.00	\$89.08
	06/01/2025	\$58.33	\$15.55	\$16.50	\$0.00	\$90.38
	12/01/2025	\$59.78	\$15.55	\$16.50	\$0.00	\$91.83
	06/01/2026	\$61.08	\$15.55	\$16.50	\$0.00	\$93.13
	12/01/2026	\$62.53	\$15.55	\$16.50	\$0.00	\$94.58

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GENERATOR/LIGHTING PLANT/HEATERS OPERATING ENGINEERS LOCAL 4	12/01/2024	\$36.67	\$15.55	\$16.50	\$0.00	\$68.72
	06/01/2025	\$37.52	\$15.55	\$16.50	\$0.00	\$69.57
	12/01/2025	\$38.47	\$15.55	\$16.50	\$0.00	\$70.52
	06/01/2026	\$39.33	\$15.55	\$16.50	\$0.00	\$71.38
	12/01/2026	\$40.28	\$15.55	\$16.50	\$0.00	\$72.33

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

GLAZIER (GLASS PLANK/AIR BARRIER/INTERIOR SYSTEMS) GLAZIERS LOCAL 35 (ZONE 2)	07/01/2024	\$46.76	\$9.95	\$23.95	\$0.00	\$80.66
	01/01/2025	\$47.96	\$9.95	\$23.95	\$0.00	\$81.86

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - GLAZIER - Local 35 Zone 2

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.38	\$9.95	\$0.00	\$0.00	\$33.33
2	55	\$25.72	\$9.95	\$6.66	\$0.00	\$42.33
3	60	\$28.06	\$9.95	\$7.26	\$0.00	\$45.27
4	65	\$30.39	\$9.95	\$7.87	\$0.00	\$48.21
5	70	\$32.73	\$9.95	\$20.32	\$0.00	\$63.00
6	75	\$35.07	\$9.95	\$20.93	\$0.00	\$65.95
7	80	\$37.41	\$9.95	\$21.53	\$0.00	\$68.89
8	90	\$42.08	\$9.95	\$22.74	\$0.00	\$74.77

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.98	\$9.95	\$0.00	\$0.00	\$33.93
2	55	\$26.38	\$9.95	\$6.66	\$0.00	\$42.99
3	60	\$28.78	\$9.95	\$7.26	\$0.00	\$45.99
4	65	\$31.17	\$9.95	\$7.87	\$0.00	\$48.99
5	70	\$33.57	\$9.95	\$20.32	\$0.00	\$63.84
6	75	\$35.97	\$9.95	\$20.93	\$0.00	\$66.85
7	80	\$38.37	\$9.95	\$21.53	\$0.00	\$69.85
8	90	\$43.16	\$9.95	\$22.74	\$0.00	\$75.85

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

HOISTING ENGINEER/CRANES/GRADALLS	12/01/2024	\$57.03	\$15.55	\$16.50	\$0.00	\$89.08
OPERATING ENGINEERS LOCAL 4	06/01/2025	\$58.33	\$15.55	\$16.50	\$0.00	\$90.38
	12/01/2025	\$59.78	\$15.55	\$16.50	\$0.00	\$91.83
	06/01/2026	\$61.08	\$15.55	\$16.50	\$0.00	\$93.13
	12/01/2026	\$62.53	\$15.55	\$16.50	\$0.00	\$94.58

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - OPERATING ENGINEERS - Local 4

Effective Date - 12/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$31.37	\$0.00	\$0.00	\$0.00	\$31.37
2	60	\$34.22	\$15.55	\$16.50	\$0.00	\$66.27
3	65	\$37.07	\$15.55	\$16.50	\$0.00	\$69.12
4	70	\$39.92	\$15.55	\$16.50	\$0.00	\$71.97
5	75	\$42.77	\$15.55	\$16.50	\$0.00	\$74.82
6	80	\$45.62	\$15.55	\$16.50	\$0.00	\$77.67
7	85	\$48.48	\$15.55	\$16.50	\$0.00	\$80.53
8	90	\$51.33	\$15.55	\$16.50	\$0.00	\$83.38

Effective Date - 06/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$32.08	\$0.00	\$0.00	\$0.00	\$32.08
2	60	\$35.00	\$15.55	\$16.50	\$0.00	\$67.05
3	65	\$37.91	\$15.55	\$16.50	\$0.00	\$69.96
4	70	\$40.83	\$15.55	\$16.50	\$0.00	\$72.88
5	75	\$43.75	\$15.55	\$16.50	\$0.00	\$75.80
6	80	\$46.66	\$15.55	\$16.50	\$0.00	\$78.71
7	85	\$49.58	\$15.55	\$16.50	\$0.00	\$81.63
8	90	\$52.50	\$15.55	\$16.50	\$0.00	\$84.55

Notes:

Apprentice to Journeyworker Ratio:1:6

HVAC (DUCTWORK) SHEETMETAL WORKERS LOCAL 17 - A	08/01/2024	\$57.94	\$14.75	\$28.12	\$2.98	\$103.79
	02/01/2025	\$59.69	\$14.75	\$28.12	\$2.98	\$105.54
	08/01/2025	\$61.54	\$14.75	\$28.12	\$2.98	\$107.39
	02/01/2026	\$63.49	\$14.75	\$28.12	\$2.98	\$109.34

For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (ELECTRICAL CONTROLS) ELECTRICIANS LOCAL 96	09/01/2024	\$47.05	\$13.99	\$19.22	\$0.00	\$80.26
	09/07/2025	\$48.16	\$14.98	\$19.60	\$0.00	\$82.74
	09/06/2026	\$49.38	\$15.96	\$20.00	\$0.00	\$85.34

For apprentice rates see "Apprentice- ELECTRICIAN"

HVAC (TESTING AND BALANCING - AIR) SHEETMETAL WORKERS LOCAL 17 - A	08/01/2024	\$57.94	\$14.75	\$28.12	\$2.98	\$103.79
	02/01/2025	\$59.69	\$14.75	\$28.12	\$2.98	\$105.54
	08/01/2025	\$61.54	\$14.75	\$28.12	\$2.98	\$107.39
	02/01/2026	\$63.49	\$14.75	\$28.12	\$2.98	\$109.34

For apprentice rates see "Apprentice- SHEET METAL WORKER"

HVAC (TESTING AND BALANCING - WATER) PIPEFITTERS LOCAL 537	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38

For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
HVAC MECHANIC <i>PIPEFITTERS LOCAL 537</i>	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						
HYDRAULIC DRILLS <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.61	\$9.65	\$17.70	\$0.00	\$67.96
	06/01/2025	\$42.00	\$9.65	\$17.70	\$0.00	\$69.35
	12/01/2025	\$43.38	\$9.65	\$17.70	\$0.00	\$70.73
	06/01/2026	\$44.82	\$9.65	\$17.70	\$0.00	\$72.17
	12/01/2026	\$46.26	\$9.65	\$17.70	\$0.00	\$73.61
	06/01/2027	\$47.71	\$9.65	\$17.70	\$0.00	\$75.06
	12/01/2027	\$49.16	\$9.65	\$17.70	\$0.00	\$76.51
	06/01/2028	\$50.66	\$9.65	\$17.70	\$0.00	\$78.01
For apprentice rates see "Apprentice- LABORER"						
HYDRAULIC DRILLS (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.61	\$9.65	\$17.80	\$0.00	\$68.06
	06/01/2025	\$42.00	\$9.65	\$17.80	\$0.00	\$69.45
	12/01/2025	\$43.38	\$9.65	\$17.80	\$0.00	\$70.83
	06/01/2026	\$44.82	\$9.65	\$17.80	\$0.00	\$72.27
	12/01/2026	\$46.26	\$9.65	\$17.80	\$0.00	\$73.71
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
INSULATOR (PIPES & TANKS) <i>HEAT & FROST INSULATORS LOCAL 6 (BOSTON)</i>	09/01/2024	\$56.92	\$14.75	\$19.61	\$0.00	\$91.28
	09/01/2025	\$60.34	\$14.75	\$19.61	\$0.00	\$94.70
	09/01/2026	\$63.76	\$14.75	\$19.61	\$0.00	\$98.12

Apprentice - ASBESTOS INSULATOR (Pipes & Tanks) - Local 6 Boston

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.46	\$14.75	\$14.32	\$0.00	\$57.53
2	60	\$34.15	\$14.75	\$15.37	\$0.00	\$64.27
3	70	\$39.84	\$14.75	\$16.43	\$0.00	\$71.02
4	80	\$45.54	\$14.75	\$17.49	\$0.00	\$77.78

Effective Date - 09/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$30.17	\$14.75	\$14.32	\$0.00	\$59.24
2	60	\$36.20	\$14.75	\$15.37	\$0.00	\$66.32
3	70	\$42.24	\$14.75	\$16.43	\$0.00	\$73.42
4	80	\$48.27	\$14.75	\$17.49	\$0.00	\$80.51

Notes:

Steps are 1 year

Apprentice to Journeyworker Ratio:1:4

IRONWORKER/WELDER <i>IRONWORKERS LOCAL 7 (WORCESTER AREA)</i>	03/16/2024	\$53.67	\$8.35	\$26.70	\$0.00	\$88.72
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Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - IRONWORKER - Local 7 Worcester

Effective Date - 03/16/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$32.20	\$8.35	\$26.70	\$0.00	\$67.25
2	70	\$37.57	\$8.35	\$26.70	\$0.00	\$72.62
3	75	\$40.25	\$8.35	\$26.70	\$0.00	\$75.30
4	80	\$42.94	\$8.35	\$26.70	\$0.00	\$77.99
5	85	\$45.62	\$8.35	\$26.70	\$0.00	\$80.67
6	90	\$48.30	\$8.35	\$26.70	\$0.00	\$83.35

Notes:

Apprentice to Journeyworker Ratio:1:4

JACKHAMMER & PAVING BREAKER OPERATOR LABORERS - ZONE 2	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01

For apprentice rates see "Apprentice- LABORER"

LABORER LABORERS - ZONE 2	12/01/2024	\$39.86	\$9.65	\$17.70	\$0.00	\$67.21
	06/01/2025	\$41.25	\$9.65	\$17.70	\$0.00	\$68.60
	12/01/2025	\$42.63	\$9.65	\$17.70	\$0.00	\$69.98
	06/01/2026	\$44.07	\$9.65	\$17.70	\$0.00	\$71.42
	12/01/2026	\$45.51	\$9.65	\$17.70	\$0.00	\$72.86
	06/01/2027	\$46.96	\$9.65	\$17.70	\$0.00	\$74.31
	12/01/2027	\$48.41	\$9.65	\$17.70	\$0.00	\$75.76
	06/01/2028	\$49.91	\$9.65	\$17.70	\$0.00	\$77.26
	12/01/2028	\$51.41	\$9.65	\$17.70	\$0.00	\$78.76

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - LABORER - Zone 2

Effective Date - 12/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$23.92	\$9.65	\$17.70	\$0.00	\$51.27
2	70	\$27.90	\$9.65	\$17.70	\$0.00	\$55.25
3	80	\$31.89	\$9.65	\$17.70	\$0.00	\$59.24
4	90	\$35.87	\$9.65	\$17.70	\$0.00	\$63.22

Effective Date - 06/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$24.75	\$9.65	\$17.70	\$0.00	\$52.10
2	70	\$28.88	\$9.65	\$17.70	\$0.00	\$56.23
3	80	\$33.00	\$9.65	\$17.70	\$0.00	\$60.35
4	90	\$37.13	\$9.65	\$17.70	\$0.00	\$64.48

Notes:

Apprentice to Journeyworker Ratio:1:5

LABORER (HEAVY & HIGHWAY)	12/01/2024	\$39.86	\$9.65	\$17.80	\$0.00	\$67.31
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	06/01/2025	\$41.25	\$9.65	\$17.80	\$0.00	\$68.70
	12/01/2025	\$42.63	\$9.65	\$17.80	\$0.00	\$70.08
	06/01/2026	\$44.07	\$9.65	\$17.80	\$0.00	\$71.52
	12/01/2026	\$45.51	\$9.65	\$17.80	\$0.00	\$72.96

Apprentice - LABORER (Heavy & Highway) - Zone 2

Effective Date - 12/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$23.92	\$9.65	\$17.80	\$0.00	\$51.37
2	70	\$27.90	\$9.65	\$17.80	\$0.00	\$55.35
3	80	\$31.89	\$9.65	\$17.80	\$0.00	\$59.34
4	90	\$35.87	\$9.65	\$17.80	\$0.00	\$63.32

Effective Date - 06/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	60	\$24.75	\$9.65	\$17.80	\$0.00	\$52.20
2	70	\$28.88	\$9.65	\$17.80	\$0.00	\$56.33
3	80	\$33.00	\$9.65	\$17.80	\$0.00	\$60.45
4	90	\$37.13	\$9.65	\$17.80	\$0.00	\$64.58

Notes:

Apprentice to Journeyworker Ratio:1:5

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: CARPENTER TENDER <i>LABORERS - ZONE 2</i>	12/01/2024	\$39.86	\$9.65	\$17.70	\$0.00	\$67.21
	06/01/2025	\$41.25	\$9.65	\$17.70	\$0.00	\$68.60
	12/01/2025	\$42.63	\$9.65	\$17.70	\$0.00	\$69.98
	06/01/2026	\$44.07	\$9.65	\$17.70	\$0.00	\$71.42
	12/01/2026	\$45.51	\$9.65	\$17.70	\$0.00	\$72.86
	06/01/2027	\$46.96	\$9.65	\$17.70	\$0.00	\$74.31
	12/01/2027	\$48.41	\$9.65	\$17.70	\$0.00	\$75.76
	06/01/2028	\$49.91	\$9.65	\$17.70	\$0.00	\$77.26
	12/01/2028	\$51.41	\$9.65	\$17.70	\$0.00	\$78.76
For apprentice rates see "Apprentice- LABORER"						
LABORER: CEMENT FINISHER TENDER <i>LABORERS - ZONE 2</i>	12/01/2024	\$39.86	\$9.65	\$17.70	\$0.00	\$67.21
	06/01/2025	\$41.25	\$9.65	\$17.70	\$0.00	\$68.60
	12/01/2025	\$42.63	\$9.65	\$17.70	\$0.00	\$69.98
	06/01/2026	\$44.07	\$9.65	\$17.70	\$0.00	\$71.42
	12/01/2026	\$45.51	\$9.65	\$17.70	\$0.00	\$72.86
	06/01/2027	\$46.96	\$9.65	\$17.70	\$0.00	\$74.31
	12/01/2027	\$48.41	\$9.65	\$17.70	\$0.00	\$75.76
	06/01/2028	\$49.91	\$9.65	\$17.70	\$0.00	\$77.26
	12/01/2028	\$51.41	\$9.65	\$17.70	\$0.00	\$78.76
For apprentice rates see "Apprentice- LABORER"						
LABORER: HAZARDOUS WASTE/ASBESTOS REMOVER <i>LABORERS - ZONE 2</i>	12/02/2024	\$39.95	\$9.65	\$17.76	\$0.00	\$67.36
	06/02/2025	\$41.34	\$9.65	\$17.76	\$0.00	\$68.75
	12/01/2025	\$42.72	\$9.65	\$17.76	\$0.00	\$70.13
	06/01/2026	\$44.16	\$9.65	\$17.76	\$0.00	\$71.57
	12/07/2026	\$45.60	\$9.65	\$17.76	\$0.00	\$73.01
	06/07/2027	\$47.05	\$9.65	\$17.76	\$0.00	\$74.46
	12/06/2027	\$48.50	\$9.65	\$17.76	\$0.00	\$75.91
	06/05/2028	\$50.00	\$9.65	\$17.76	\$0.00	\$77.41
	12/04/2028	\$51.50	\$9.65	\$17.76	\$0.00	\$78.91
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"						
LABORER: MASON TENDER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
LABORER: MULTI-TRADE TENDER <i>LABORERS - ZONE 2</i>	12/01/2024	\$39.86	\$9.65	\$17.70	\$0.00	\$67.21
	06/01/2025	\$41.25	\$9.65	\$17.70	\$0.00	\$68.60
	12/01/2025	\$42.63	\$9.65	\$17.70	\$0.00	\$69.98
	06/01/2026	\$44.07	\$9.65	\$17.70	\$0.00	\$71.42
	12/01/2026	\$45.51	\$9.65	\$17.70	\$0.00	\$72.86
	06/01/2027	\$46.96	\$9.65	\$17.70	\$0.00	\$74.31
	12/01/2027	\$48.41	\$9.65	\$17.70	\$0.00	\$75.76
	06/01/2028	\$49.91	\$9.65	\$17.70	\$0.00	\$77.26
	12/01/2028	\$51.41	\$9.65	\$17.70	\$0.00	\$78.76
For apprentice rates see "Apprentice- LABORER"						
LABORER: TREE REMOVER <i>LABORERS - ZONE 2</i>	12/01/2024	\$39.86	\$9.65	\$17.70	\$0.00	\$67.21
	06/01/2025	\$41.25	\$9.65	\$17.70	\$0.00	\$68.60
	12/01/2025	\$42.63	\$9.65	\$17.70	\$0.00	\$69.98
	06/01/2026	\$44.07	\$9.65	\$17.70	\$0.00	\$71.42
	12/01/2026	\$45.51	\$9.65	\$17.70	\$0.00	\$72.86
	06/01/2027	\$46.96	\$9.65	\$17.70	\$0.00	\$74.31
	12/01/2027	\$48.41	\$9.65	\$17.70	\$0.00	\$75.76
	06/01/2028	\$49.91	\$9.65	\$17.70	\$0.00	\$77.26
	12/01/2028	\$51.41	\$9.65	\$17.70	\$0.00	\$78.76
This classification applies to the removal of standing trees, and the trimming and removal of branches and limbs when related to public works construction or site clearance incidental to construction . For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"						
LASER BEAM OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
MARBLE & TILE FINISHERS <i>BRICKLAYERS LOCAL 3 - MARBLE & TILE</i>	08/01/2024	\$49.32	\$11.49	\$21.62	\$0.00	\$82.43
	02/01/2025	\$50.36	\$11.49	\$21.62	\$0.00	\$83.47
	08/01/2025	\$52.08	\$11.49	\$21.62	\$0.00	\$85.19
	02/01/2026	\$53.16	\$11.49	\$21.62	\$0.00	\$86.27
	08/01/2026	\$54.92	\$11.49	\$21.62	\$0.00	\$88.03
	02/01/2027	\$56.04	\$11.49	\$21.62	\$0.00	\$89.15

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - MARBLE & TILE FINISHER - Local 3 Marble & Tile

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.66	\$11.49	\$21.62	\$0.00	\$57.77
2	60	\$29.59	\$11.49	\$21.62	\$0.00	\$62.70
3	70	\$34.52	\$11.49	\$21.62	\$0.00	\$67.63
4	80	\$39.46	\$11.49	\$21.62	\$0.00	\$72.57
5	90	\$44.39	\$11.49	\$21.62	\$0.00	\$77.50

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.18	\$11.49	\$21.62	\$0.00	\$58.29
2	60	\$30.22	\$11.49	\$21.62	\$0.00	\$63.33
3	70	\$35.25	\$11.49	\$21.62	\$0.00	\$68.36
4	80	\$40.29	\$11.49	\$21.62	\$0.00	\$73.40
5	90	\$45.32	\$11.49	\$21.62	\$0.00	\$78.43

Notes:

Apprentice to Journeyworker Ratio:1:3

MARBLE MASONS, TILELAYERS & TERRAZZO MECH	08/01/2024	\$64.52	\$11.49	\$23.56	\$0.00	\$99.57
BRICKLAYERS LOCAL 3 - MARBLE & TILE	02/01/2025	\$65.82	\$11.49	\$23.56	\$0.00	\$100.87
	08/01/2025	\$67.97	\$11.49	\$23.56	\$0.00	\$103.02
	02/01/2026	\$69.32	\$11.49	\$23.56	\$0.00	\$104.37
	08/01/2026	\$71.52	\$11.49	\$23.56	\$0.00	\$106.57
	02/01/2027	\$72.92	\$11.49	\$23.56	\$0.00	\$107.97

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - MARBLE-TILE-TERRAZZO MECHANIC - Local 3 Marble & Tile

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$32.26	\$11.49	\$23.56	\$0.00	\$67.31
2	60	\$38.71	\$11.49	\$23.56	\$0.00	\$73.76
3	70	\$45.16	\$11.49	\$23.56	\$0.00	\$80.21
4	80	\$51.62	\$11.49	\$23.56	\$0.00	\$86.67
5	90	\$58.07	\$11.49	\$23.56	\$0.00	\$93.12

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$32.91	\$11.49	\$23.56	\$0.00	\$67.96
2	60	\$39.49	\$11.49	\$23.56	\$0.00	\$74.54
3	70	\$46.07	\$11.49	\$23.56	\$0.00	\$81.12
4	80	\$52.66	\$11.49	\$23.56	\$0.00	\$87.71
5	90	\$59.24	\$11.49	\$23.56	\$0.00	\$94.29

Notes:

Apprentice to Journeyworker Ratio:1:5

MECH. SWEEPER OPERATOR (ON CONST. SITES)	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
<i>OPERATING ENGINEERS LOCAL 4</i>	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MECHANICS MAINTENANCE	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
<i>OPERATING ENGINEERS LOCAL 4</i>	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

MILLWRIGHT (Zone 2)	01/01/2024	\$42.76	\$10.08	\$21.47	\$0.00	\$74.31
<i>MILLWRIGHTS LOCAL 1121 - Zone 2</i>	01/06/2025	\$45.09	\$10.08	\$21.47	\$0.00	\$76.64
	01/05/2026	\$47.42	\$10.08	\$21.47	\$0.00	\$78.97

Apprentice - MILLWRIGHT - Local 1121 Zone 2

Effective Date - 01/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$23.52	\$10.08	\$5.50	\$0.00	\$39.10
2	65	\$27.79	\$10.08	\$6.50	\$0.00	\$44.37
3	75	\$32.07	\$10.08	\$18.97	\$0.00	\$61.12
4	85	\$36.35	\$10.08	\$19.97	\$0.00	\$66.40

Effective Date - 01/06/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	55	\$24.80	\$10.08	\$5.50	\$0.00	\$40.38
2	65	\$29.31	\$10.08	\$6.50	\$0.00	\$45.89
3	75	\$33.82	\$10.08	\$18.97	\$0.00	\$62.87
4	85	\$38.33	\$10.08	\$19.97	\$0.00	\$68.38

Notes: Step 1&2 Appr. indentured after 1/6/2020 receive no pension, but do receive annuity. (Step 1 \$5.72, Step 2 \$6.66)
Steps are 2,000 hours

Apprentice to Journeyworker Ratio:1:4

MORTAR MIXER <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01

For apprentice rates see "Apprentice- LABORER"

OILER (OTHER THAN TRUCK CRANES,GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$25.37	\$15.30	\$16.40	\$0.00	\$57.07
	06/01/2025	\$25.97	\$15.30	\$16.40	\$0.00	\$57.67
	12/01/2025	\$26.63	\$15.30	\$16.40	\$0.00	\$58.33
	06/01/2026	\$27.22	\$15.30	\$16.40	\$0.00	\$58.92
	12/01/2026	\$27.89	\$15.30	\$16.40	\$0.00	\$59.59

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

OILER (TRUCK CRANES, GRADALLS) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$31.08	\$15.30	\$16.40	\$0.00	\$62.78
	06/01/2025	\$31.80	\$15.30	\$16.40	\$0.00	\$63.50
	12/01/2025	\$32.60	\$15.30	\$16.40	\$0.00	\$64.30
	06/01/2026	\$33.32	\$15.30	\$16.40	\$0.00	\$65.02
	12/01/2026	\$34.12	\$15.30	\$16.40	\$0.00	\$65.82

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
OTHER POWER DRIVEN EQUIPMENT - CLASS II <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

PAINTER (BRIDGES/TANKS) <i>PAINTERS LOCAL 35 - ZONE 2</i>	07/01/2024	\$57.26	\$9.95	\$23.95	\$0.00	\$91.16
	01/01/2025	\$58.46	\$9.95	\$23.95	\$0.00	\$92.36

Apprentice - PAINTER Local 35 - BRIDGES/TANKS

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$28.63	\$9.95	\$0.00	\$0.00	\$38.58
2	55	\$31.49	\$9.95	\$6.66	\$0.00	\$48.10
3	60	\$34.36	\$9.95	\$7.26	\$0.00	\$51.57
4	65	\$37.22	\$9.95	\$7.87	\$0.00	\$55.04
5	70	\$40.08	\$9.95	\$20.32	\$0.00	\$70.35
6	75	\$42.95	\$9.95	\$20.93	\$0.00	\$73.83
7	80	\$45.81	\$9.95	\$21.53	\$0.00	\$77.29
8	90	\$51.53	\$9.95	\$22.74	\$0.00	\$84.22

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$29.23	\$9.95	\$0.00	\$0.00	\$39.18
2	55	\$32.15	\$9.95	\$6.66	\$0.00	\$48.76
3	60	\$35.08	\$9.95	\$7.26	\$0.00	\$52.29
4	65	\$38.00	\$9.95	\$7.87	\$0.00	\$55.82
5	70	\$40.92	\$9.95	\$20.32	\$0.00	\$71.19
6	75	\$43.85	\$9.95	\$20.93	\$0.00	\$74.73
7	80	\$46.77	\$9.95	\$21.53	\$0.00	\$78.25
8	90	\$52.61	\$9.95	\$22.74	\$0.00	\$85.30

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, NEW) *	07/01/2024	\$48.16	\$9.95	\$23.95	\$0.00	\$82.06
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. <i>PAINTERS LOCAL 35 - ZONE 2</i>	01/01/2025	\$49.36	\$9.95	\$23.95	\$0.00	\$83.26

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - New

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.08	\$9.95	\$0.00	\$0.00	\$34.03
2	55	\$26.49	\$9.95	\$6.66	\$0.00	\$43.10
3	60	\$28.90	\$9.95	\$7.26	\$0.00	\$46.11
4	65	\$31.30	\$9.95	\$7.87	\$0.00	\$49.12
5	70	\$33.71	\$9.95	\$20.32	\$0.00	\$63.98
6	75	\$36.12	\$9.95	\$20.93	\$0.00	\$67.00
7	80	\$38.53	\$9.95	\$21.53	\$0.00	\$70.01
8	90	\$43.34	\$9.95	\$22.74	\$0.00	\$76.03

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$24.68	\$9.95	\$0.00	\$0.00	\$34.63
2	55	\$27.15	\$9.95	\$6.66	\$0.00	\$43.76
3	60	\$29.62	\$9.95	\$7.26	\$0.00	\$46.83
4	65	\$32.08	\$9.95	\$7.87	\$0.00	\$49.90
5	70	\$34.55	\$9.95	\$20.32	\$0.00	\$64.82
6	75	\$37.02	\$9.95	\$20.93	\$0.00	\$67.90
7	80	\$39.49	\$9.95	\$21.53	\$0.00	\$70.97
8	90	\$44.42	\$9.95	\$22.74	\$0.00	\$77.11

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER (SPRAY OR SANDBLAST, REPAINT)	07/01/2024	\$46.22	\$9.95	\$23.95	\$0.00	\$80.12
PAINTERS LOCAL 35 - ZONE 2	01/01/2025	\$47.42	\$9.95	\$23.95	\$0.00	\$81.32

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 2 - Spray/Sandblast - Repaint

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.11	\$9.95	\$0.00	\$0.00	\$33.06
2	55	\$25.42	\$9.95	\$6.66	\$0.00	\$42.03
3	60	\$27.73	\$9.95	\$7.26	\$0.00	\$44.94
4	65	\$30.04	\$9.95	\$7.87	\$0.00	\$47.86
5	70	\$32.35	\$9.95	\$20.32	\$0.00	\$62.62
6	75	\$34.67	\$9.95	\$20.93	\$0.00	\$65.55
7	80	\$36.98	\$9.95	\$21.53	\$0.00	\$68.46
8	90	\$41.60	\$9.95	\$22.74	\$0.00	\$74.29

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.71	\$9.95	\$0.00	\$0.00	\$33.66
2	55	\$26.08	\$9.95	\$6.66	\$0.00	\$42.69
3	60	\$28.45	\$9.95	\$7.26	\$0.00	\$45.66
4	65	\$30.82	\$9.95	\$7.87	\$0.00	\$48.64
5	70	\$33.19	\$9.95	\$20.32	\$0.00	\$63.46
6	75	\$35.57	\$9.95	\$20.93	\$0.00	\$66.45
7	80	\$37.94	\$9.95	\$21.53	\$0.00	\$69.42
8	90	\$42.68	\$9.95	\$22.74	\$0.00	\$75.37

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, NEW) *	07/01/2024	\$46.76	\$9.95	\$23.95	\$0.00	\$80.66
* If 30% or more of surfaces to be painted are new construction, NEW paint rate shall be used. PAINTERS LOCAL 35 - ZONE 2	01/01/2025	\$47.96	\$9.95	\$23.95	\$0.00	\$81.86

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER - Local 35 Zone 2 - BRUSH NEW

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.38	\$9.95	\$0.00	\$0.00	\$33.33
2	55	\$25.72	\$9.95	\$6.66	\$0.00	\$42.33
3	60	\$28.06	\$9.95	\$7.26	\$0.00	\$45.27
4	65	\$30.39	\$9.95	\$7.87	\$0.00	\$48.21
5	70	\$32.73	\$9.95	\$20.32	\$0.00	\$63.00
6	75	\$35.07	\$9.95	\$20.93	\$0.00	\$65.95
7	80	\$37.41	\$9.95	\$21.53	\$0.00	\$68.89
8	90	\$42.08	\$9.95	\$22.74	\$0.00	\$74.77

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.98	\$9.95	\$0.00	\$0.00	\$33.93
2	55	\$26.38	\$9.95	\$6.66	\$0.00	\$42.99
3	60	\$28.78	\$9.95	\$7.26	\$0.00	\$45.99
4	65	\$31.17	\$9.95	\$7.87	\$0.00	\$48.99
5	70	\$33.57	\$9.95	\$20.32	\$0.00	\$63.84
6	75	\$35.97	\$9.95	\$20.93	\$0.00	\$66.85
7	80	\$38.37	\$9.95	\$21.53	\$0.00	\$69.85
8	90	\$43.16	\$9.95	\$22.74	\$0.00	\$75.85

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER / TAPER (BRUSH, REPAINT)	07/01/2024	\$44.82	\$9.95	\$23.95	\$0.00	\$78.72
PAINTERS LOCAL 35 - ZONE 2	01/01/2025	\$46.02	\$9.95	\$23.95	\$0.00	\$79.92

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - PAINTER Local 35 Zone 2 - BRUSH REPAINT

Effective Date - 07/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$22.41	\$9.95	\$0.00	\$0.00	\$32.36
2	55	\$24.65	\$9.95	\$6.66	\$0.00	\$41.26
3	60	\$26.89	\$9.95	\$7.26	\$0.00	\$44.10
4	65	\$29.13	\$9.95	\$7.87	\$0.00	\$46.95
5	70	\$31.37	\$9.95	\$20.32	\$0.00	\$61.64
6	75	\$33.62	\$9.95	\$20.93	\$0.00	\$64.50
7	80	\$35.86	\$9.95	\$21.53	\$0.00	\$67.34
8	90	\$40.34	\$9.95	\$22.74	\$0.00	\$73.03

Effective Date - 01/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$23.01	\$9.95	\$0.00	\$0.00	\$32.96
2	55	\$25.31	\$9.95	\$6.66	\$0.00	\$41.92
3	60	\$27.61	\$9.95	\$7.26	\$0.00	\$44.82
4	65	\$29.91	\$9.95	\$7.87	\$0.00	\$47.73
5	70	\$32.21	\$9.95	\$20.32	\$0.00	\$62.48
6	75	\$34.52	\$9.95	\$20.93	\$0.00	\$65.40
7	80	\$36.82	\$9.95	\$21.53	\$0.00	\$68.30
8	90	\$41.42	\$9.95	\$22.74	\$0.00	\$74.11

Notes:

Steps are 750 hrs.

Apprentice to Journeyworker Ratio:1:1

PAINTER TRAFFIC MARKINGS (HEAVY/HIGHWAY)	12/01/2024	\$39.86	\$9.65	\$17.80	\$0.00	\$67.31
LABORERS - ZONE 2 (HEAVY & HIGHWAY)	06/01/2025	\$41.25	\$9.65	\$17.80	\$0.00	\$68.70
	12/01/2025	\$42.63	\$9.65	\$17.80	\$0.00	\$70.08
	06/01/2026	\$44.07	\$9.65	\$17.80	\$0.00	\$71.52
	12/01/2026	\$45.51	\$9.65	\$17.80	\$0.00	\$72.96

For apprentice rates see "Apprentice- LABORER (Heavy and Highway)

PANEL & PICKUP TRUCKS DRIVER	12/01/2024	\$39.78	\$15.07	\$20.17	\$0.00	\$75.02
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	01/01/2025	\$39.78	\$15.57	\$20.17	\$0.00	\$75.52
	06/01/2025	\$40.78	\$15.57	\$20.17	\$0.00	\$76.52
	12/01/2025	\$40.78	\$15.57	\$21.78	\$0.00	\$78.13
	01/01/2026	\$40.78	\$16.17	\$21.78	\$0.00	\$78.73
	06/01/2026	\$41.78	\$16.17	\$21.78	\$0.00	\$79.73
	12/01/2026	\$41.78	\$16.17	\$23.52	\$0.00	\$81.47
	01/01/2027	\$41.78	\$16.77	\$23.52	\$0.00	\$82.07

PIER AND DOCK CONSTRUCTOR (UNDERPINNING AND DECK)	08/01/2024	\$51.97	\$10.08	\$24.29	\$0.00	\$86.34
PILE DRIVER LOCAL 56 (ZONE 2)						

For apprentice rates see "Apprentice- PILE DRIVER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PILE DRIVER PILE DRIVER LOCAL 56 (ZONE 2)	08/01/2024	\$51.97	\$10.08	\$24.29	\$0.00	\$86.34

Apprentice - PILE DRIVER - Local 56 Zone 2

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	45	\$23.39	\$10.08	\$2.53	\$0.00	\$36.00
2	55	\$28.58	\$10.08	\$5.07	\$0.00	\$43.73
3	70	\$36.38	\$10.08	\$19.22	\$0.00	\$65.68
4	80	\$41.58	\$10.08	\$21.76	\$0.00	\$73.42

Notes:

% Indentured BEFORE 8/1/2020, 50/60/70/75/80/80/90/90
Step 1 \$60.36/2 \$65.75/3 \$70.75/4 \$73.35/5&6 \$75.95/7&8 81.14

Apprentice to Journeyworker Ratio:1:5

PIPEFITTER & STEAMFITTER PIPEFITTERS LOCAL 537	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38

Apprentice - PIPEFITTER - Local 537

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$26.83	\$12.70	\$9.05	\$0.00	\$48.58
2	45	\$30.19	\$12.70	\$21.80	\$0.00	\$64.69
3	60	\$40.25	\$12.70	\$21.80	\$0.00	\$74.75
4	70	\$46.96	\$12.70	\$21.80	\$0.00	\$81.46
5	80	\$53.66	\$12.70	\$21.80	\$0.00	\$88.16

Effective Date - 03/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	40	\$27.55	\$12.70	\$9.05	\$0.00	\$49.30
2	45	\$31.00	\$12.70	\$21.80	\$0.00	\$65.50
3	60	\$41.33	\$12.70	\$21.80	\$0.00	\$75.83
4	70	\$48.22	\$12.70	\$21.80	\$0.00	\$82.72
5	80	\$55.10	\$12.70	\$21.80	\$0.00	\$89.60

Notes:

** 1:3; 3:15; 1:10 thereafter / Steps are 1 yr.
Refrig/AC Mechanic **1:1;1:2;2:4;3:6;4:8;5:10;6:12;7:14;8:17;9:20;10:23(Max)

Apprentice to Journeyworker Ratio:**

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PIPELAYER LABORERS - ZONE 2	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
	12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01
For apprentice rates see "Apprentice- LABORER"						

PIPELAYER (HEAVY & HIGHWAY) LABORERS - ZONE 2 (HEAVY & HIGHWAY)	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						

PLUMBERS & GASFITTERS PLUMBERS & GASFITTERS LOCAL 12	09/01/2024	\$69.04	\$14.32	\$19.61	\$0.00	\$102.97
	03/02/2025	\$70.84	\$14.32	\$19.61	\$0.00	\$104.77

Apprentice - PLUMBER/GASFITTER - Local 12

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$24.16	\$14.32	\$7.06	\$0.00	\$45.54
2	40	\$27.62	\$14.32	\$8.02	\$0.00	\$49.96
3	55	\$37.97	\$14.32	\$10.93	\$0.00	\$63.22
4	65	\$44.88	\$14.32	\$12.86	\$0.00	\$72.06
5	75	\$51.78	\$14.32	\$14.79	\$0.00	\$80.89

Effective Date - 03/02/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$24.79	\$14.32	\$7.06	\$0.00	\$46.17
2	40	\$28.34	\$14.32	\$8.02	\$0.00	\$50.68
3	55	\$38.96	\$14.32	\$10.93	\$0.00	\$64.21
4	65	\$46.05	\$14.32	\$12.86	\$0.00	\$73.23
5	75	\$53.13	\$14.32	\$14.79	\$0.00	\$82.24

Notes:

** 1:2; 2:6; 3:10; 4:14; 5:19/Steps are 1 yr
Step4 with lic\$76.49 tot.rate, Step5 with lic. \$85.32 tot. rate

Apprentice to Journeyworker Ratio:**

PNEUMATIC CONTROLS (TEMP.) PIPEFITTERS LOCAL 537	09/01/2024	\$67.08	\$12.70	\$21.80	\$0.00	\$101.58
	03/01/2025	\$68.88	\$12.70	\$21.80	\$0.00	\$103.38
For apprentice rates see "Apprentice- PIPEFITTER" or "PLUMBER/PIPEFITTER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PNEUMATIC DRILL/TOOL OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.61	\$9.65	\$17.70	\$0.00	\$67.96
	06/01/2025	\$42.00	\$9.65	\$17.70	\$0.00	\$69.35
	12/01/2025	\$43.38	\$9.65	\$17.70	\$0.00	\$70.73
	06/01/2026	\$44.82	\$9.65	\$17.70	\$0.00	\$72.17
	12/01/2026	\$46.26	\$9.65	\$17.70	\$0.00	\$73.61
	06/01/2027	\$47.71	\$9.65	\$17.70	\$0.00	\$75.06
	12/01/2027	\$49.16	\$9.65	\$17.70	\$0.00	\$76.51
	06/01/2028	\$50.66	\$9.65	\$17.70	\$0.00	\$78.01
	12/01/2028	\$52.16	\$9.65	\$17.70	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"						
PNEUMATIC DRILL/TOOL OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
POWDERMAN & BLASTER <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.86	\$9.65	\$17.70	\$0.00	\$68.21
	06/01/2025	\$42.25	\$9.65	\$17.70	\$0.00	\$69.60
	12/01/2025	\$43.63	\$9.65	\$17.70	\$0.00	\$70.98
	06/01/2026	\$45.07	\$9.65	\$17.70	\$0.00	\$72.42
	12/01/2026	\$46.51	\$9.65	\$17.70	\$0.00	\$73.86
	06/01/2027	\$47.96	\$9.65	\$17.70	\$0.00	\$75.31
	12/01/2027	\$49.41	\$9.65	\$17.70	\$0.00	\$76.76
	06/01/2028	\$50.91	\$9.65	\$17.70	\$0.00	\$78.26
	12/01/2028	\$52.41	\$9.65	\$17.70	\$0.00	\$79.76
For apprentice rates see "Apprentice- LABORER"						
POWDERMAN & BLASTER (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.86	\$9.40	\$17.55	\$0.00	\$67.81
	06/01/2025	\$42.25	\$9.40	\$17.55	\$0.00	\$69.20
	12/01/2025	\$43.63	\$9.40	\$17.55	\$0.00	\$70.58
	06/01/2026	\$45.07	\$9.40	\$17.55	\$0.00	\$72.02
	12/01/2026	\$46.51	\$9.40	\$17.55	\$0.00	\$73.46
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
POWER SHOVEL/DERRICK/TRENCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$57.03	\$15.55	\$16.50	\$0.00	\$89.08
	06/01/2025	\$58.33	\$15.55	\$16.50	\$0.00	\$90.38
	12/01/2025	\$59.78	\$15.55	\$16.50	\$0.00	\$91.83
	06/01/2026	\$61.08	\$15.55	\$16.50	\$0.00	\$93.13
	12/01/2026	\$62.53	\$15.55	\$16.50	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
PUMP OPERATOR (CONCRETE) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
PUMP OPERATOR (DEWATERING, OTHER) <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$36.67	\$15.55	\$16.50	\$0.00	\$68.72
	06/01/2025	\$37.52	\$15.55	\$16.50	\$0.00	\$69.57
	12/01/2025	\$38.47	\$15.55	\$16.50	\$0.00	\$70.52
	06/01/2026	\$39.33	\$15.55	\$16.50	\$0.00	\$71.38
	12/01/2026	\$40.28	\$15.55	\$16.50	\$0.00	\$72.33
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
READY-MIX CONCRETE DRIVER <i>TEAMSTERS 170 - J.G. MacLellan (Lowell)</i>	05/01/2024	\$30.00	\$11.17	\$6.55	\$0.00	\$47.72
	01/01/2025	\$30.00	\$11.57	\$6.55	\$0.00	\$48.12
	05/01/2025	\$30.50	\$11.57	\$6.65	\$0.00	\$48.72
	01/01/2026	\$30.50	\$11.97	\$6.65	\$0.00	\$49.12
RECLAIMERS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
RIDE-ON MOTORIZED BUGGY OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.11	\$9.65	\$17.70	\$0.00	\$67.46
	06/01/2025	\$41.50	\$9.65	\$17.70	\$0.00	\$68.85
	12/01/2025	\$42.88	\$9.65	\$17.70	\$0.00	\$70.23
	06/01/2026	\$44.32	\$9.65	\$17.70	\$0.00	\$71.67
	12/01/2026	\$45.76	\$9.65	\$17.70	\$0.00	\$73.11
	06/01/2027	\$47.21	\$9.65	\$17.70	\$0.00	\$74.56
	12/01/2027	\$48.66	\$9.65	\$17.70	\$0.00	\$76.01
	06/01/2028	\$50.16	\$9.65	\$17.70	\$0.00	\$77.51
12/01/2028	\$51.66	\$9.65	\$17.70	\$0.00	\$79.01	
For apprentice rates see "Apprentice- LABORER"						
ROLLER/SPREADER/MULCHING MACHINE <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
ROOFER (Inc.Roofer Waterproofing &Roofer Damproofg) <i>ROOFERS LOCAL 33</i>	08/01/2024	\$51.03	\$13.03	\$21.70	\$0.00	\$85.76
	02/01/2025	\$52.28	\$13.03	\$21.70	\$0.00	\$87.01
	08/01/2025	\$53.78	\$13.03	\$21.70	\$0.00	\$88.51
	02/01/2026	\$55.03	\$13.03	\$21.70	\$0.00	\$89.76

Classification

Effective Date Base Wage Health Pension Supplemental Unemployment Total Rate

Apprentice - ROOFER - Local 33

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$25.52	\$13.03	\$6.52	\$0.00	\$45.07
2	60	\$30.62	\$13.03	\$21.70	\$0.00	\$65.35
3	65	\$33.17	\$13.03	\$21.70	\$0.00	\$67.90
4	75	\$38.27	\$13.03	\$21.70	\$0.00	\$73.00
5	85	\$43.38	\$13.03	\$21.70	\$0.00	\$78.11

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$26.14	\$13.03	\$6.52	\$0.00	\$45.69
2	60	\$31.37	\$13.03	\$21.70	\$0.00	\$66.10
3	65	\$33.98	\$13.03	\$21.70	\$0.00	\$68.71
4	75	\$39.21	\$13.03	\$21.70	\$0.00	\$73.94
5	85	\$44.44	\$13.03	\$21.70	\$0.00	\$79.17

Notes: ** 1:5, 2:6-10, the 1:10; Reroofing: 1:4, then 1:1
 Step 1 is 2000 hrs.; Steps 2-5 are 1000 hrs.
 (Hot Pitch Mechanics' receive \$1.00 hr. above ROOFER)

Apprentice to Journeyworker Ratio:**

ROOFER SLATE / TILE / PRECAST CONCRETE	08/01/2024	\$51.28	\$13.03	\$21.70	\$0.00	\$86.01
ROOFERS LOCAL 33	02/01/2025	\$52.53	\$13.03	\$21.70	\$0.00	\$87.26
	08/01/2025	\$54.03	\$13.03	\$21.70	\$0.00	\$88.76
	02/01/2026	\$55.28	\$13.03	\$21.70	\$0.00	\$90.01

For apprentice rates see "Apprentice- ROOFER"

SHEETMETAL WORKER	08/01/2024	\$57.94	\$14.75	\$28.12	\$2.98	\$103.79
SHEETMETAL WORKERS LOCAL 17 - A	02/01/2025	\$59.69	\$14.75	\$28.12	\$2.98	\$105.54
	08/01/2025	\$61.54	\$14.75	\$28.12	\$2.98	\$107.39
	02/01/2026	\$63.49	\$14.75	\$28.12	\$2.98	\$109.34

Apprentice - SHEET METAL WORKER - Local 17-A

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	\$24.33	\$14.75	\$6.13	\$0.00	\$45.21
2	42	\$24.33	\$14.75	\$6.13	\$0.00	\$45.21
3	47	\$27.23	\$14.75	\$12.11	\$1.63	\$55.72
4	47	\$27.23	\$14.75	\$12.11	\$1.63	\$55.72
5	52	\$30.13	\$14.75	\$13.09	\$1.75	\$59.72
6	52	\$30.13	\$14.75	\$13.34	\$1.76	\$59.98
7	60	\$34.76	\$14.75	\$14.75	\$1.94	\$66.20
8	65	\$37.66	\$14.75	\$15.73	\$2.06	\$70.20
9	75	\$43.46	\$14.75	\$17.69	\$2.30	\$78.20
10	85	\$49.25	\$14.75	\$19.15	\$2.52	\$85.67

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	42	\$25.07	\$14.75	\$6.13	\$0.00	\$45.95
2	42	\$25.07	\$14.75	\$6.13	\$0.00	\$45.95
3	47	\$28.05	\$14.75	\$12.11	\$1.66	\$56.57
4	47	\$28.05	\$14.75	\$12.11	\$1.66	\$56.57
5	52	\$31.04	\$14.75	\$13.09	\$1.78	\$60.66
6	52	\$31.04	\$14.75	\$13.34	\$1.79	\$60.92
7	60	\$35.81	\$14.75	\$14.75	\$1.97	\$67.28
8	65	\$38.80	\$14.75	\$15.73	\$2.09	\$71.37
9	75	\$44.77	\$14.75	\$17.69	\$2.33	\$79.54
10	85	\$50.74	\$14.75	\$19.15	\$2.56	\$87.20

Notes:
Steps are 6 mos.

Apprentice to Journeyworker Ratio:1:4

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP < 35 TONS	12/01/2024	\$40.24	\$15.07	\$20.17	\$0.00	\$75.48
TEAMSTERS JOINT COUNCIL NO. 10 ZONE B	01/01/2025	\$40.24	\$15.57	\$20.17	\$0.00	\$75.98
	06/01/2025	\$41.24	\$15.57	\$20.17	\$0.00	\$76.98
	12/01/2025	\$41.24	\$15.57	\$21.78	\$0.00	\$78.59
	01/01/2026	\$41.24	\$16.17	\$21.78	\$0.00	\$79.19
	06/01/2026	\$42.24	\$16.17	\$21.78	\$0.00	\$80.19
	12/01/2026	\$42.24	\$16.17	\$23.52	\$0.00	\$81.93
	01/01/2027	\$42.24	\$16.77	\$23.52	\$0.00	\$82.53

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
SPECIALIZED EARTH MOVING EQUIP > 35 TONS <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2024	\$40.53	\$15.07	\$20.17	\$0.00	\$75.77
	01/01/2025	\$40.53	\$15.57	\$20.17	\$0.00	\$76.27
	06/01/2025	\$41.53	\$15.57	\$20.17	\$0.00	\$77.27
	12/01/2025	\$41.53	\$15.57	\$21.78	\$0.00	\$78.88
	01/01/2026	\$41.53	\$16.17	\$21.78	\$0.00	\$79.48
	06/01/2026	\$42.53	\$16.17	\$21.78	\$0.00	\$80.48
	12/01/2026	\$42.53	\$16.17	\$23.52	\$0.00	\$82.22
	01/01/2027	\$42.53	\$16.77	\$23.52	\$0.00	\$82.82
SPRINKLER FITTER <i>SPRINKLER FITTERS LOCAL 550 - (Section A) Zone 1</i>	10/01/2024	\$70.84	\$11.51	\$23.30	\$0.00	\$105.65
	03/01/2025	\$72.64	\$11.51	\$23.30	\$0.00	\$107.45

Apprentice - SPRINKLER FITTER - Local 550 (Section A) Zone 1

Effective Date - 10/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$24.79	\$11.51	\$12.90	\$0.00	\$49.20
2	40	\$28.34	\$11.51	\$13.70	\$0.00	\$53.55
3	45	\$31.88	\$11.51	\$14.50	\$0.00	\$57.89
4	50	\$35.42	\$11.51	\$15.30	\$0.00	\$62.23
5	55	\$38.96	\$11.51	\$16.10	\$0.00	\$66.57
6	60	\$42.50	\$11.51	\$16.90	\$0.00	\$70.91
7	65	\$46.05	\$11.51	\$17.70	\$0.00	\$75.26
8	70	\$49.59	\$11.51	\$18.50	\$0.00	\$79.60
9	75	\$53.13	\$11.51	\$19.30	\$0.00	\$83.94
10	80	\$56.67	\$11.51	\$20.10	\$0.00	\$88.28

Effective Date - 03/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	35	\$25.42	\$11.51	\$12.90	\$0.00	\$49.83
2	40	\$29.06	\$11.51	\$13.70	\$0.00	\$54.27
3	45	\$32.69	\$11.51	\$14.50	\$0.00	\$58.70
4	50	\$36.32	\$11.51	\$15.30	\$0.00	\$63.13
5	55	\$39.95	\$11.51	\$16.10	\$0.00	\$67.56
6	60	\$43.58	\$11.51	\$16.90	\$0.00	\$71.99
7	65	\$47.22	\$11.51	\$17.70	\$0.00	\$76.43
8	70	\$50.85	\$11.51	\$18.50	\$0.00	\$80.86
9	75	\$54.48	\$11.51	\$19.30	\$0.00	\$85.29
10	80	\$58.11	\$11.51	\$20.10	\$0.00	\$89.72

Notes: Apprentice entered prior 9/30/10:
40/45/50/55/60/65/70/75/80/85
Steps are 850 hours

Apprentice to Journeyworker Ratio:1:3

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
STEAM BOILER OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

TAMPERS, SELF-PROPELLED OR TRACTOR DRAWN <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89

For apprentice rates see "Apprentice- OPERATING ENGINEERS"

TERRAZZO FINISHERS <i>BRICKLAYERS LOCAL 3 - MARBLE & TILE</i>	08/01/2024	\$63.44	\$11.49	\$23.59	\$0.00	\$98.52
	02/01/2025	\$64.74	\$11.49	\$23.59	\$0.00	\$99.82
	08/01/2025	\$66.89	\$11.49	\$23.59	\$0.00	\$101.97
	02/01/2026	\$68.24	\$11.49	\$23.59	\$0.00	\$103.32
	08/01/2026	\$70.44	\$11.49	\$23.59	\$0.00	\$105.52
	02/01/2027	\$71.84	\$11.49	\$23.59	\$0.00	\$106.92

Apprentice - TERRAZZO FINISHER - Local 3 Marble & Tile

Effective Date - 08/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$31.72	\$11.49	\$23.59	\$0.00	\$66.80
2	60	\$38.06	\$11.49	\$23.59	\$0.00	\$73.14
3	70	\$44.41	\$11.49	\$23.59	\$0.00	\$79.49
4	80	\$50.75	\$11.49	\$23.59	\$0.00	\$85.83
5	90	\$57.10	\$11.49	\$23.59	\$0.00	\$92.18

Effective Date - 02/01/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$32.37	\$11.49	\$23.59	\$0.00	\$67.45
2	60	\$38.84	\$11.49	\$23.59	\$0.00	\$73.92
3	70	\$45.32	\$11.49	\$23.59	\$0.00	\$80.40
4	80	\$51.79	\$11.49	\$23.59	\$0.00	\$86.87
5	90	\$58.27	\$11.49	\$23.59	\$0.00	\$93.35

Notes:

Apprentice to Journeyworker Ratio:1:3

TEST BORING DRILLER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2024	\$51.28	\$9.65	\$18.22	\$0.00	\$79.15
	06/01/2025	\$52.78	\$9.65	\$18.22	\$0.00	\$80.65
	12/01/2025	\$54.28	\$9.65	\$18.22	\$0.00	\$82.15
	06/01/2026	\$55.83	\$9.65	\$18.22	\$0.00	\$83.70
	12/01/2026	\$57.33	\$9.65	\$18.22	\$0.00	\$85.20

For apprentice rates see "Apprentice- LABORER"

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TEST BORING DRILLER HELPER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2024	\$47.07	\$9.65	\$18.22	\$0.00	\$74.94
	06/01/2025	\$48.57	\$9.65	\$18.22	\$0.00	\$76.44
	12/01/2025	\$50.07	\$9.65	\$18.22	\$0.00	\$77.94
	06/01/2026	\$51.62	\$9.65	\$18.22	\$0.00	\$79.49
	12/01/2026	\$53.12	\$9.65	\$18.22	\$0.00	\$80.99
For apprentice rates see "Apprentice- LABORER"						
TEST BORING LABORER <i>LABORERS - FOUNDATION AND MARINE</i>	12/01/2024	\$46.95	\$9.65	\$18.22	\$0.00	\$74.82
	06/01/2025	\$48.45	\$9.65	\$18.22	\$0.00	\$76.32
	12/01/2025	\$49.95	\$9.65	\$18.22	\$0.00	\$77.82
	06/01/2026	\$51.50	\$9.65	\$18.22	\$0.00	\$79.37
	12/01/2026	\$53.00	\$9.65	\$18.22	\$0.00	\$80.87
For apprentice rates see "Apprentice- LABORER"						
TRACTORS/PORTABLE STEAM GENERATORS <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$56.40	\$15.55	\$16.50	\$0.00	\$88.45
	06/01/2025	\$57.68	\$15.55	\$16.50	\$0.00	\$89.73
	12/01/2025	\$59.12	\$15.55	\$16.50	\$0.00	\$91.17
	06/01/2026	\$60.40	\$15.55	\$16.50	\$0.00	\$92.45
	12/01/2026	\$61.84	\$15.55	\$16.50	\$0.00	\$93.89
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
TRAILERS FOR EARTH MOVING EQUIPMENT <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2024	\$40.82	\$15.07	\$20.17	\$0.00	\$76.06
	01/01/2025	\$40.82	\$15.57	\$20.17	\$0.00	\$76.56
	06/01/2025	\$41.82	\$15.57	\$20.17	\$0.00	\$77.56
	12/01/2025	\$41.82	\$15.57	\$21.78	\$0.00	\$79.17
	01/01/2026	\$41.82	\$16.17	\$21.78	\$0.00	\$79.77
	06/01/2026	\$42.82	\$16.17	\$21.78	\$0.00	\$80.77
	12/01/2026	\$42.82	\$16.17	\$23.52	\$0.00	\$82.51
	01/01/2027	\$42.82	\$16.77	\$23.52	\$0.00	\$83.11
TUNNEL WORK - COMPRESSED AIR <i>LABORERS (COMPRESSED AIR)</i>	12/01/2024	\$59.18	\$9.65	\$19.00	\$0.00	\$87.83
	06/01/2025	\$60.68	\$9.65	\$19.00	\$0.00	\$89.33
	12/01/2025	\$62.18	\$9.65	\$19.00	\$0.00	\$90.83
	06/01/2026	\$63.73	\$9.65	\$19.00	\$0.00	\$92.38
	12/01/2026	\$65.23	\$9.65	\$19.00	\$0.00	\$93.88
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - COMPRESSED AIR (HAZ. WASTE) <i>LABORERS (COMPRESSED AIR)</i>	12/01/2024	\$61.18	\$9.65	\$19.00	\$0.00	\$89.83
	06/01/2025	\$62.68	\$9.65	\$19.00	\$0.00	\$91.33
	12/01/2025	\$64.18	\$9.65	\$19.00	\$0.00	\$92.83
	06/01/2026	\$65.73	\$9.65	\$19.00	\$0.00	\$94.38
	12/01/2026	\$67.23	\$9.65	\$19.00	\$0.00	\$95.88
For apprentice rates see "Apprentice- LABORER"						
TUNNEL WORK - FREE AIR <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2024	\$51.25	\$9.65	\$19.00	\$0.00	\$79.90
	06/01/2025	\$52.75	\$9.65	\$19.00	\$0.00	\$81.40
	12/01/2025	\$54.25	\$9.65	\$19.00	\$0.00	\$82.90
	06/01/2026	\$55.80	\$9.65	\$19.00	\$0.00	\$84.45
	12/01/2026	\$57.30	\$9.65	\$19.00	\$0.00	\$85.95
For apprentice rates see "Apprentice- LABORER"						

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
TUNNEL WORK - FREE AIR (HAZ. WASTE) <i>LABORERS (FREE AIR TUNNEL)</i>	12/01/2024	\$53.25	\$9.65	\$19.00	\$0.00	\$81.90
	06/01/2025	\$54.75	\$9.65	\$19.00	\$0.00	\$83.40
	12/01/2025	\$56.25	\$9.65	\$19.00	\$0.00	\$84.90
	06/01/2026	\$57.80	\$9.65	\$19.00	\$0.00	\$86.45
	12/01/2026	\$59.30	\$9.65	\$19.00	\$0.00	\$87.95
For apprentice rates see "Apprentice- LABORER"						
VAC-HAUL <i>TEAMSTERS JOINT COUNCIL NO. 10 ZONE B</i>	12/01/2024	\$40.24	\$15.07	\$20.17	\$0.00	\$75.48
	01/01/2025	\$40.24	\$15.57	\$20.17	\$0.00	\$75.98
	06/01/2025	\$41.24	\$15.57	\$20.17	\$0.00	\$76.98
	12/01/2025	\$41.24	\$15.57	\$21.78	\$0.00	\$78.59
	01/01/2026	\$41.24	\$16.17	\$21.78	\$0.00	\$79.19
	06/01/2026	\$42.24	\$16.17	\$21.78	\$0.00	\$80.19
	12/01/2026	\$42.24	\$16.17	\$23.52	\$0.00	\$81.93
	01/01/2027	\$42.24	\$16.77	\$23.52	\$0.00	\$82.53
VOICE-DATA-VIDEO TECHNICIAN <i>ELECTRICIANS LOCAL 96</i>	09/01/2024	\$35.29	\$13.99	\$17.57	\$0.00	\$66.85
	09/07/2025	\$36.12	\$14.98	\$17.91	\$0.00	\$69.01
	09/06/2026	\$37.04	\$15.96	\$18.27	\$0.00	\$71.27

Apprentice - VOICE-DATA-VIDEO TECHNICIAN - Local 96

Effective Date - 09/01/2024

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$17.65	\$13.99	\$4.41	\$0.00	\$36.05
2	55	\$19.41	\$13.99	\$4.46	\$0.00	\$37.86
3	60	\$21.17	\$13.99	\$17.15	\$0.00	\$52.31
4	65	\$22.94	\$13.99	\$17.20	\$0.00	\$54.13
5	70	\$24.70	\$13.99	\$17.25	\$0.00	\$55.94
6	75	\$26.47	\$13.99	\$17.30	\$0.00	\$57.76
7	80	\$28.23	\$13.99	\$17.36	\$0.00	\$59.58
8	85	\$30.00	\$13.99	\$17.41	\$0.00	\$61.40

Effective Date - 09/07/2025

Step	percent	Apprentice Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
1	50	\$18.06	\$14.98	\$4.51	\$0.00	\$37.55
2	55	\$19.87	\$14.98	\$4.57	\$0.00	\$39.42
3	60	\$21.67	\$14.98	\$17.48	\$0.00	\$54.13
4	65	\$23.48	\$14.98	\$17.53	\$0.00	\$55.99
5	70	\$25.28	\$14.98	\$17.59	\$0.00	\$57.85
6	75	\$27.09	\$14.98	\$17.64	\$0.00	\$59.71
7	80	\$28.90	\$14.98	\$17.70	\$0.00	\$61.58
8	85	\$30.70	\$14.98	\$17.75	\$0.00	\$63.43

Notes:

Apprentice to Journeyworker Ratio:1:1

Classification	Effective Date	Base Wage	Health	Pension	Supplemental Unemployment	Total Rate
WAGON DRILL OPERATOR <i>LABORERS - ZONE 2</i>	12/01/2024	\$40.61	\$9.65	\$17.70	\$0.00	\$67.96
	06/01/2025	\$42.00	\$9.65	\$17.70	\$0.00	\$69.35
	12/01/2025	\$43.38	\$9.65	\$17.70	\$0.00	\$70.73
	06/01/2026	\$44.82	\$9.65	\$17.70	\$0.00	\$72.17
	12/01/2026	\$46.26	\$9.65	\$17.70	\$0.00	\$73.61
	06/01/2027	\$47.71	\$9.65	\$17.70	\$0.00	\$75.06
	12/01/2027	\$49.16	\$9.65	\$17.70	\$0.00	\$76.51
	06/01/2028	\$50.66	\$9.65	\$17.70	\$0.00	\$78.01
	12/01/2028	\$52.16	\$9.65	\$17.70	\$0.00	\$79.51
For apprentice rates see "Apprentice- LABORER"						
WAGON DRILL OPERATOR (HEAVY & HIGHWAY) <i>LABORERS - ZONE 2 (HEAVY & HIGHWAY)</i>	12/01/2024	\$40.11	\$9.65	\$17.80	\$0.00	\$67.56
	06/01/2025	\$41.50	\$9.65	\$17.80	\$0.00	\$68.95
	12/01/2025	\$42.88	\$9.65	\$17.80	\$0.00	\$70.33
	06/01/2026	\$44.32	\$9.65	\$17.80	\$0.00	\$71.77
	12/01/2026	\$45.76	\$9.65	\$17.80	\$0.00	\$73.21
For apprentice rates see "Apprentice- LABORER (Heavy and Highway)"						
WASTE WATER PUMP OPERATOR <i>OPERATING ENGINEERS LOCAL 4</i>	12/01/2024	\$57.03	\$15.55	\$16.50	\$0.00	\$89.08
	06/01/2025	\$58.33	\$15.55	\$16.50	\$0.00	\$90.38
	12/01/2025	\$59.78	\$15.55	\$16.50	\$0.00	\$91.83
	06/01/2026	\$61.08	\$15.55	\$16.50	\$0.00	\$93.13
	12/01/2026	\$62.53	\$15.55	\$16.50	\$0.00	\$94.58
For apprentice rates see "Apprentice- OPERATING ENGINEERS"						
WATER METER INSTALLER <i>PLUMBERS & GASFITTERS LOCAL 12</i>	09/01/2024	\$69.04	\$14.32	\$19.61	\$0.00	\$102.97
	03/02/2025	\$70.84	\$14.32	\$19.61	\$0.00	\$104.77
For apprentice rates see "Apprentice- PLUMBER/PIPEFITTER" or "PLUMBER/GASFITTER"						

Additional Apprentices Information:

All apprentices must be registered with the Division of Apprenticeship Training (DAS) in accordance with M.G.L. c. 23, §§ 11E-11L. Minimum wage rates for apprentices employed on public works projects are listed above as a percentage of the hourly prevailing wage rate established by the Commissioner under the provisions of M.G.L. c. 149, §§ 26-27D. Apprentice ratios are established by DAS pursuant to M.G.L. c. 23, §§ 11E-11L. Ratios are expressed as the allowable number of apprentices to journeymen or fraction thereof, unless otherwise specified. The ratios listed herein have been taken from relevant private collective bargaining agreements (CBAs) and are provided for illustrative purposes only. They have not been independently verified as being accurate or continuing to be accurate. Parties having questions regarding what ratio to use should contact DAS.

APPENDIX I

NATIONAL GRID
GENERAL GUIDELINES FOR WORKING AROUND GAS UTILITIES

nationalgrid	Gas Policy Damage Prevention	Doc. # DAM01003 Page 1 of 4
	Vibrational and Impact Forces in the Vicinity of Underground Gas Facilities	Revision 0 – 07/15/16

Vibrational and Impact Forces in the Vicinity of Underground Gas Facilities DAM01003

1. Purpose

The purpose of this document is to provide notification and monitoring guidelines for activities that produce vibrational and impact forces (e.g. pile driving) that occur in the vicinity of gas mains and services. For activities involving backfilling and tamping refer to excavation and backfill CNST01003, Backfill and Restoration. For activities involving blasting refer to [Requirements and Planning Related to Foreign Construction Using Blasting Near Existing Gas Facilities \[DAM01002\]](#).

2. Responsibilities

Damage Prevention (DP) or designee shall be responsible for:

- The timely mark out of gas facilities as prescribed in this procedure, and adherence to applicable One-Call laws.
- Notifications, as prescribed within this policy if made aware that vibration or impact activity (i.e. pile-driving) is taking place in the vicinity of gas facilities.
- The arrangement of contractor surveillance when deemed necessary

Public Works Engineering (PWE) (This is Project Engineering & Design in NE & UNY) or designee shall be responsible for:


- Notifications, as prescribed within this policy, to applicable jurisdictional departments if made aware that vibration or impact activity (i.e. pile-driving) is taking place in the vicinity of gas facilities
- Reviewing proposed vibration or impact activity (i.e. pile-driving) within 25 ft. of cast iron facilities and within 15 ft. of non-cast iron facilities
- Determination of the necessity for contractor surveillance and monitoring
- Seek input from relevant asset owner group(s) in Gas Systems Engineering, as necessary.
- Directing the performance of any monitoring required
- Developing contingency plan for gas main isolation if required and routing to Gas Control for review and approval
- Notifications to Gas Control if required
- Communicating National Grid standards and procedures to third party and municipalities

Gas Operations Engineering (GOE) or designee shall be responsible for:

- Supporting Public Works Engineering in providing necessary input, such as modeling data and mapping data in the development of the contingency plan
- Identify valve locations for isolation, and perform model analysis to simulate the isolation of the system/segment of pipe identified in the contingency operations

Engineering (Transmission, Distribution, Project, I&R) or designee shall be responsible for:

- Providing support and direction, analysis and equipment as required to ensure that vibration monitoring requirements can be adhered to and that facilities are protected
- Specifying additional requirements as deemed necessary to protect gas facilities

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	Vibrational and Impact Forces in the Vicinity of Underground Gas Facilities	Revision 0 – 07/15/16

Gas Construction/Field Operations, Contractors and Third-Party Excavators or designee shall be responsible for:

- Adhering to all facility verification requirements
- The performance of pre and post leakage surveys, when assigned and directed, and the associated documentation
- Performing remedial actions as directed when required
- Leak, Corrosion and/or valve repairs as required within this procedure
- Gas main/service relocation or cut-off as required

3. Personal & Process Safety

- All required PPE shall be worn or utilized in accordance with the current National Grid Safety Policy when performing field tasks associated with this document.



Verify that all Dig-Safe Notifications and regional Mark-Out and Locate, and pre-excavation requirements are completed before any excavations are performed.

4. Operator Qualification Required Tasks [Qualified or Directed & Observed]




Not all personnel shall be required to perform all tasks associated with this document. Therefore, Operations personnel shall only be required to qualify on those tasks associated with the tasks they will perform in their respective regions.

- Task 18 – Conducting Gas Leakage Surveys
- Task 21 – Line Locating and Mark-Out
- Task 70 – Properties of Natural Gas and Abnormal Operation Conditions

5. Content

5.1. Notifications

- a. Excavators shall follow all State Dig Safe/One-Call regulations.
- b. When Public Works Engineering is aware of 3rd party construction involving vibration or impact forces within 25 ft. of gas facilities, Public Works shall notify, Damage Prevention, Gas System Operations Control Center, Transmission/Distribution Engineering and Construct/Maintain prior to the start of operations with the exact date, time and location of work.
- c. For in-house construction projects involving vibration or impact forces within 25 ft. of gas facilities, Project Management shall notify Damage Prevention, Gas System Operations Control Center, Transmission/Distribution Engineering and Construct/Maintain prior to the start of operations with the exact date, time and location of work.
- d. When Public Works is aware that 3rd party construction involving vibration or impact forces will take place within 200 ft. of a gas regulating facility, Public Works shall notify I&R with the exact date, time and location of work.
- e. For in-house construction projects involving vibration or impact forces that will take place within 200 ft. of a gas regulating facility Project Management shall notify I&R with the exact date, time and location of work.

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	Vibrational and Impact Forces in the Vicinity of Underground Gas Facilities	Revision 0 – 07/15/16

- f. If protected steel main is involved, PWE shall notify Corrosion Engineering of the location and scheduling of activities to determine and perform if required any pre and post cathodic protection testing/verification.
- g. A National Grid Representative (construction inspector, qualified Gas Construction personnel, Contractor Oversight or Damage Prevention) should periodically inspect the location when operations are underway within 25 ft. of a cast iron gas main or within 15 ft. of steel or plastic gas facilities.

5.2. Contingency Planning



A contingency plan should be developed unless it is determined that it is not warranted. A contingency plan should be considered when a gas facility will remain in service throughout the procedure but whose integrity may be jeopardized due to its proximity to the operation.

- a. If required, GOE shall develop a contingency plan. Instructions for the development of emergency preparedness and contingency plans are established GEIP1 Gas Emergency Notification Procedure, GEIP2 Gas System Emergency Management Procedure, and GEIP3 Gas Emergency Operations Center (EOC) Activation and Operations Procedure. However, when developing an emergency plan consideration shall be given to:
 - 1) Establishing a means to isolate the gas facility.
 - i. Valves or line stopper devices shall be located, and accessed prior to the operations.
 - ii. An SOP should be prepared and submitted for approval only if gas main relocation or cut-off is required.
 - 2) Allocation of required manpower, equipment and materials to implement the plan.
 - 3) Coordinating, with all other affected groups and departments
 - 4) Notification to Gas Control
 - i. Applicable National Grid procedures shall serve to direct the channels of communication and reporting
 - 5) Lines of communication between National Grid and contractor personnel

Specific actions the excavator should take in an emergency.

5.3. Facility Verification and Monitoring



All Dig-Safe Notifications and regional pre-marking, mark-out and locate, and pre-excavation requirements must be completed before any excavations are performed, including required hand-dug test holes prior to any mechanical excavations.

- a. For activities within 25 ft. of Cast Iron and 15 ft. of steel and plastic gas facilities:
 - 1) Leak surveys shall be performed prior to and after work is performed.



Cast Iron gas facilities ≤ 8 in. diameter that are within 10 ft. should be replaced/relocated. Notify Project Engineering and Design for treatment of larger diameter facilities

- 2) When directed by PWE, Engineering or Damage Prevention, prior to commencing

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activities that involve vibrational and impact forces and after hand excavated verification of the depth and location of the gas facility, the operator should excavate an opening equal or greater in depth to bottom of the elevation of the gas facility and commence operations at this depth.

- b. When directed by PWE, Engineering or Damage Prevention, the following constraints should be followed for activities within 12 ft. of gas facilities:
- 1) Cast iron gas facilities should be monitored with a seismograph to ensure that PPV (Peak Particle Velocity) at the gas facility does not exceed 2 in./sec.
 - 2) Non-cast iron gas facilities should be monitored with a seismograph to ensure that PPV at the gas facility does not exceed 5 in./sec.
 - 3) If monitoring indicates excessive displacement and/or vibration in excess of limits, suspend activities and consider alternative methods. Contact the appropriate National Grid Engineering department for analysis and guidance. (Project Engineering/Transmission/Distribution Engineering, etc.). The following measures should be considered:
 - i. Expose 4 ft. horizontal portions of the gas main that falls within 12 ft. of any proposed pile.
 - ii. Main should be monitoring for displacement utilizing methods such as an optical survey.



Third-Party Excavators shall be billed for repairs should any damage occur to National Grid Gas Facilities.

6. Knowledge Base & References

Knowledge Base		References
1 - Compliance History	5 - Job Aid	1 - Regulatory – Codes
2 - Data Capture	6 - Learning & Development	2 - Technical Documents
3 - Definitions	7 - Standard Drawings	3 - Tools Catalog
4 - Document History	8 - Tools & Equipment	

7. Attachments

No attachments

General Guidelines for Working Around Gas Utilities

Notice: National Grid requests the opportunity to review design plans and construction projects prior initiation. This document intends to provide minimum guidelines to consider when planning construction, and does not remove the need to coordinate with National Grid. Additional measures may be required to maintain the integrity of all gas pipeline and ancillary items to ensure the safety of the general public and personnel on site. National Grid should be contacted and involved as early as possible to prevent delays or undue costs during construction.

NGRID Contacts:

Gas Leaks & Emergencies - 800-233-5325

Damage Prevention –

Dig Safe and General construction

Contractor must call Dig Safe to have the gas mains and services marked out before construction.

Contractor shall dig test pits to ascertain the exact locations, cover and invert elevations, clearances, and alignment of existing gas facilities as needed. Contractor shall exercise extreme caution when excavating in the vicinity of any gas facility. Hand excavation shall be performed to locate all gas facilities and whenever digging within 24" of gas facilities. If cover over gas piping is removed the required cover must be replaced.

Notification of Construction

National Grid requires a minimum 4-month's advanced notification prior to the start of construction to allow for the review of 3rd party design plans, the design of required gas distribution main replacement and/or upgrades in coordination with 3rd party construction, and time to line up the required resources to start standard gas projects. Depending on the classification and complexity of the gas infrastructure in question, lead times for the design of gas facilities in conflict may increase. Where non-stock material is required, National Grid cannot guarantee the procurement within a given duration. National Grid's ability to start construction will be contingent on obtaining the required permit approval from municipalities, state, and federal agencies alike.

Please also note that the safety and reliability of our gas system takes precedence. National Grid will review projects on a case-by-case basis, however standard practice is to restrict live gas work during the normal heating season of November 15th through April 15th.

Types of Gas Facilities

Gas mains and services are made of several different materials and contain a wide range of pressures. Typical materials used for buried gas pipe includes bare steel, coated steel, plastic, cast iron, wrought iron, ductile iron, and copper. Never assume that a pipe is not gas. At times gas lines are inserted into older lines to save excavation cost. Contact National Grid damage prevention if there are questions around any pipe being a live gas facility.

Exposure of Gas Facilities

If any gas mains or services become exposed, National Grid must be notified to inspect the line before backfilling. Also any damage that may have been made to the pipe or pipe coating will need to be repaired by National Grid before backfilling. See Language for Backfill and Compaction around Gas Pipes, below.

Support In Place

Care must be exercised when saw cutting over any gas infrastructure, the exact depth of gas mains and services vary. Undermined gas pipe must be adequately supported and protected from damage. Steel and plastic gas facilities may be supported in accordance with standard CNST-6045. Please contact National Grid prior to exposing and supporting any natural gas pipe or facility. **See appendix 1**

Cast Iron gas main requires special attention, plans should be reviewed by National Grid prior to excavation and supporting in place. Refer to Encroachments section below for additional information.

Encroachments

Massachusetts state law requires the replacement of encroached gas pipe per DPU ruling: 220 CMR 113, National Grid treats encroachments as an emergency. Cast iron gas pipe 8" in diameter and smaller may need to be replaced with steel or plastic pipe prior to construction to prevent encroachments from occurring. Where crossing existing cast iron facilities, the use of smaller buckets and hand tools is recommended to limit trench openings to 36" in width. This will greatly reduce the number of encroachments requiring replacement and repair.

Cast iron gas pipe larger than 8" in diameter are not covered under the encroachment guidelines and cannot be encroached by law. However, National Grid does not allow more than 10 linear feet of large diameter cast iron gas main or more than (1) bell and spigot joint to be exposed and supported at a time, whichever is more restrictive.

Protection of Exposed Pipe

Hand excavation or vacuum excavation shall be used when exposing gas pipe or in the close vicinity of gas pipe. If a gas facility becomes exposed, contact National Grid for review and analyses prior to backfilling.

Where gas facilities are exposed, the pipe must be protected from damage. The use of tools or equipment directly on or near our pipe, as well as any construction activity that could move or damage our pipeline or pipe coating, will not be permitted by National Grid. If a gas facility becomes exposed, the use of construction blankets, plywood, rock shielding, fiberglass reinforcement protection wraps, or other means must be used to protect the gas pipe coating from debris and damage. Small nicks, holes, and discontinuation in the pipe wall/pipe coating can become a weak spot that hastens corrosion and could lead to premature failure.

Vibration

Low levels of vibration must be maintained when working around gas facilities. If activities may impose increased levels of vibrations on our gas pipe, contact National Grid for review. Construction activities may include, but are not limited to pile driving, ledge removal and blasting, certain methods of soil compaction, micro-tunneling, jacking, directional drilling, etc.

Blasting

National Grid must be notified of any blasting that will take place within 200 feet of a gas utility. National Grid must be supplied with a detailed blast plan for blasting in the vicinity of gas facilities. The evaluation of the blast plan by a National Grid engineer may take some time, therefore, blast plan data should be submitted at least two weeks prior to the planned blasting. As a general rule, blasting will not be permitted within 10 feet of a gas line and PPV at the nearest gas pipe shall not exceed 2 in/sec without approval from National Grid. PPV at the nearest gas main shall be monitored.

Clearances

Except under special applications which may require greater clearances (steam lines, high voltage cables, etc.), underground structures and utilities installed parallel to National Grid's gas facilities must maintain a minimum of three (3) feet separation.

Except under special applications which may require greater clearances (steam lines, high voltage cables, etc.), underground structures and utilities must be installed with a minimum separation of twelve (12) inches from National Grid's gas facilities.

Contact National Grid engineer for guidance if the above separations cannot be maintained.

Regulator Stations

Gas regulator stations are **critical** facilities and National Grid must be contacted prior to the commencement of work within 200 feet of a station. Regulator stations are typically in buried vaults accessed through either manhole covers or aluminum doors. Only authorized National Grid employees shall open a regulator station vault. Be aware that a complex nest of piping and valves often exists in the vicinity outside the vaults.

Valves - NEVER OPERATE A GAS VALVE. ONLY NATIONAL GRID SHALL OPERATE GAS VALVES.

Access to gas valves must be maintained throughout construction and left at grade at the end of construction. Contact Gate Valve Adjustment/Damage Prevention prior to restoration to coordinate the adjustment of road boxes. Grade adjustments overtop transmission pipeline should be coordinated with National Grid engineering prior to construction. The adjustment of road boxes, manholes, or vaults that house valves/purges/blowoffs/etc. on transmission pipeline may require design work and the procurement of non-stock items with long lead times.

Valve boxes and covers associated with retired main may be removed or abandoned by removing their covers and filling with compacted soil after confirming with a national grid representative.

Pipeline Markers:

Pipeline markers and above ground signage indicating the presence of high pressure transmission pipeline **must remain in place at all times**. If the location of existing markers need to be relocated for any reason, contact National Grid Damage Prevention prior to removal.

Excavations Involving Transmission Pipelines

If the proposed construction is within close proximity of high pressure transmission gas main, contact National Grid's Damage Prevention Department for specific requirements. It is recommended that:

- A National Grid representative is on site continuously during any excavation/subsurface work within 15 feet of a transmission facility.
- When working within 15' of the outside perimeter of any transmission pipeline, hand tools and vacuum excavation must be used until the exact alignment has been verified
- When working within 15' of the outside perimeter of any transmission pipeline, verification holes should be dug using hand tools/vacuum excavation at 50 ft intervals over transmission main that runs adjacent to a proposed individual construction excavation.
- Where crossing transmission gas pipe with utilities and underground structures, test holes must be dug at the crossing to confirm the depth, invert elevation, and separation.
- Once the exact alignment of transmission piping has been verified using hand tools and vacuum excavation, powered excavation may be used within 15' of the pipeline, **but no closer than the transmission pipeline Safety Zone (18" + ½ the diameter of the pipeline).**

Guidelines for Backfill and Compaction Around Gas Pipes

Permanent Backfill and Compaction

This work shall consist of backfilling and compacting all disturbed material at and around existing gas pipes and facilities. Size of pipe, material, length of exposed pipe, location of pipe, etc. will all follow the same set of Standards and Specifications stipulated by Nationalgrid Company. If design plans call for gas pipes to be exposed and supported (sheeting methods not used), then at the time of backfill, all disturbed material below the invert of the gas pipe shall be removed and replaced with suitable roadway or trench excavation material or bedding material. The contractor will not be allowed to replace this disturbed material with the same existing material if it has now been mixed with adjacent silty subsoil (clays) and fines. Well-graded gravel and sands will be used to replace the unsuitable material when no excess suitable material is available on site. Soils with high humus or mineral content should not be used to for backfill because they can promote electrolytic or bacterial attack.

Backfilling the gas pipe should begin immediately after the work in that location is complete. The region within 6" alongside and on top of the gas pipe shall be backfilled with padding sand (free of cinders, ash, and rock). In no case shall the material used for backfilling in this region contain any stones. Backfill shall consist of suitable materials (medium to coarse sands with little or no silts) placed in layers of not more than 8" to 12" after compaction.

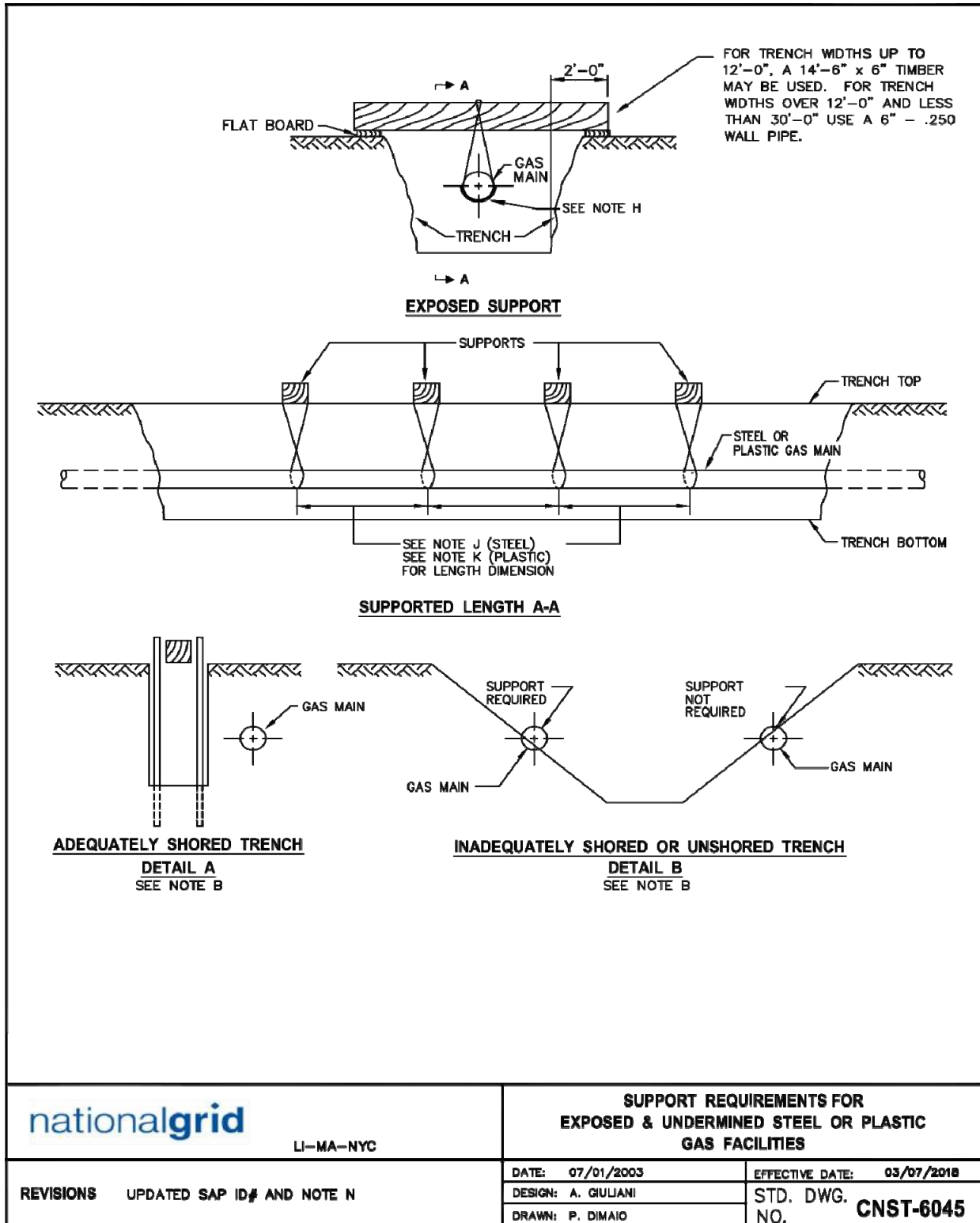
Trench spoil material shall be suitable for backfilling above the padding material as long as rocks with a diameter larger than 3" are removed. The layers shall be mechanically compacted to the industry standard of 95% or until a density comparable to the unexcavated material is achieved. In some instances, flooding with water is an acceptable method of compaction but only if the back-fill material is clean, coarse, and adequate drainage is existent. The above specified backfill material is essential in order to attain the degree of compaction necessary to avoid future settlement.

Tracing Wire, if necessary, shall be installed 2" to 6" below Plastic gas pipes. Contact National Grid if tracer wire has been damaged during excavation.

Warning Tape shall be installed approximately 12" above the gas pipe.

A minimum of 2" temporary pavement shall be applied over the trench as soon as possible.

Appendix 1



NOTES:

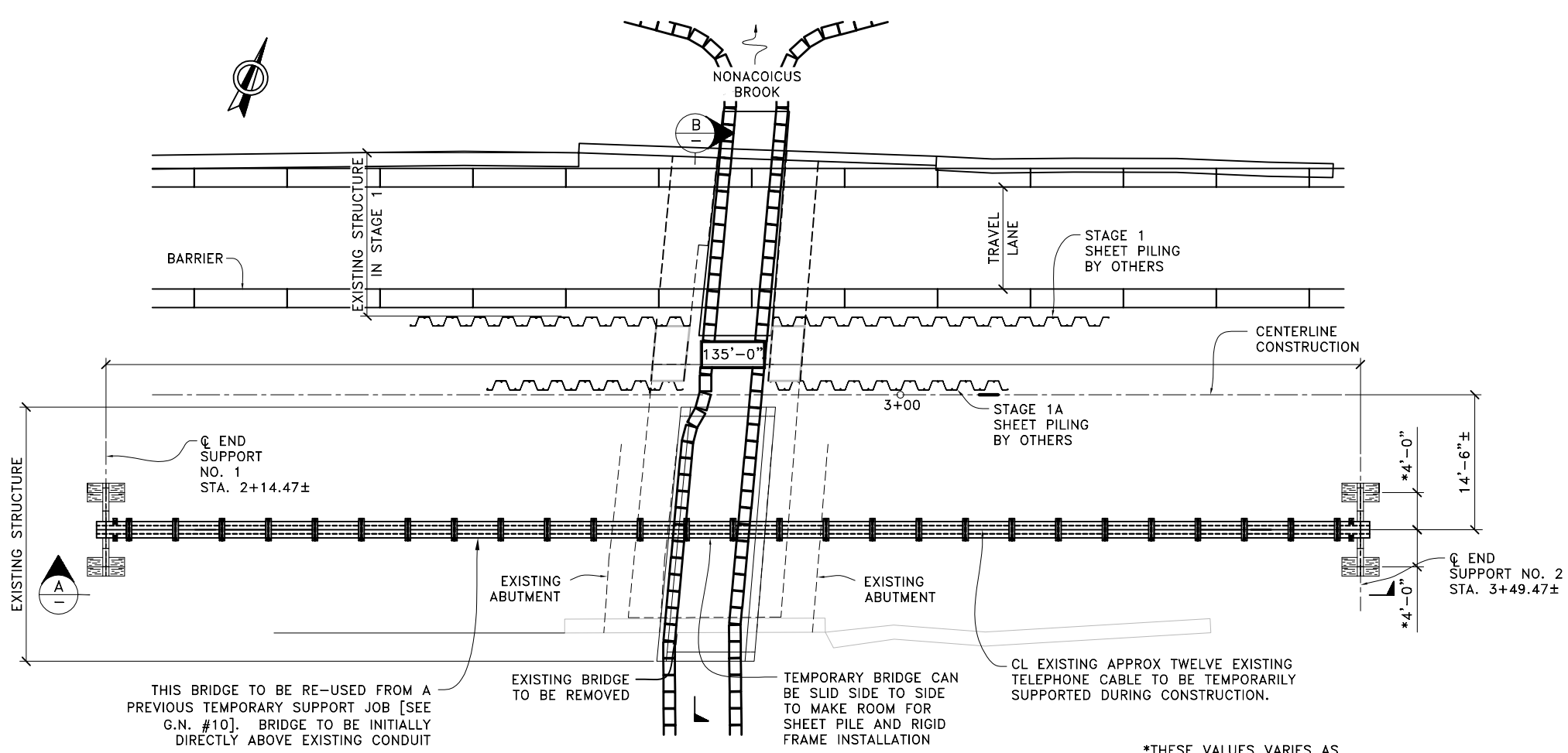
- A. THIS CONSTRUCTION STANDARD SHALL BE USED TO SUPPORT PLASTIC OR STEEL GAS FACILITIES WHICH ARE UNDERMINED AND EXPOSED BY CONSTRUCTION ACTIVITY.
- B. IF AN EXCAVATION IS MADE AT ANY DISTANCE PARALLEL TO THE GAS FACILITY WITH ADEQUATE OSHA STRUCTURAL SHORING, AS SHOWN IN DETAIL "A", OR IF A STABLE SOIL CONDITION WITH SUFFICIENT COVER ABOVE THE PIPE'S CENTERLINE EXISTS, AS SHOWN IN DETAIL "B", THEN SUPPORTS ARE NOT REQUIRED. UNSTABLE SOIL IS DEFINED AS A SOIL WHICH CAN CAUSE "SOIL RUN OUT" FROM BENEATH THE PIPE (e.g., WASHOUT, SOFT CLAY, etc.) OR CAN SHIFT DUE TO CONSTRUCTION ACTIVITY, VIBRATIONS, etc.; AND CAUSE A SOIL SCENARIO TO OCCUR AS SHOWN IN DETAIL "B" TO REQUIRE PIPE SUPPORT.
- C. IF AN EXCAVATION CROSSES OR RUNS PARALLEL TO A GAS FACILITY, SUPPORTS MAY NOT BE REQUIRED IF THE EXPOSED SECTION OF PLASTIC PIPES IS 3' OR LESS AND STEEL PIPES 7' OR LESS.
- D. ALL EXCAVATIONS SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE ONE CALL DIG SAFE PROGRAM USING THE APPROPRIATE MARK OUT, TEST HOLES AND EXCAVATION TO AVOID DAMAGE TO PIPE OR PIPE COATINGS:
- NEW YORK STATE CODE RULE 753
 - MA CHAPTER 82 - SECTION 40, GENERAL LAWS, REGULATING NOTICE REQUIREMENTS FOR EXCAVATION IN PUBLIC WAYS
- E. USE OF THIS CONSTRUCTION STANDARD DOES NOT RELIEVE THE CONSTRUCTION AGENCY OR AUTHORITY OR THEIR RESPECTIVE CONTRACTORS OF RESPONSIBILITY FOR DAMAGES. ALL DAMAGES WILL BE REPAIRED IN ACCORDANCE WITH EXISTING STANDARDS AND THE APPROPRIATE PARTY SHALL BE BILLED FOR ALL EXPENSES.
- F. GAS FACILITIES SHOULD NOT BE UNDERMINED WITHOUT ADEQUATE SUPPORT (DETAIL A). ALL SUPPORT LINES SHALL BE TENSIONED SO THAT NO DEFLECTION WILL OCCUR WHEN THE FACILITY IS UNDERMINED. THIS TENSION SHALL BE CHECKED AT THE START AND END OF EACH DAY AND ADJUSTED AS NECESSARY.
- G. WHERE A COUPLING, GAS SERVICE, CLAMP, VALVE, DRIP LINE OR OTHER APPURTENANCE EXISTS ON THE EXPOSED SECTION OF MAIN, AN ADDITIONAL SUPPORT SHALL BE INSTALLED AT THE LOCATION.
- H. WHEN SUPPORTING AN EXPOSED FACILITY, THE PIPE COATING SHALL BE PROTECTED WITH ROCK SHIELD (ITEM [ID 9340226](#)), OR OTHER LIKE MATERIAL CUT TO A MINIMUM WIDTH OF ½ THE SUPPORTED PIPE DIAMETER. SUPPORT LINES SHALL BE A MINIMUM OF ¾" POLYPROPYLENE OR BETTER. [FRP SHEILDS MAY ALSO BE USED FOR THIS PURPOSE PROVIDED THEY EXTEND A MINIMUM OF ½ WAY UP THE PIPE TO PROTECT FROM SIDE LOADING.](#)
- I. SUPPORTS FOR GAS TRANSMISSION FACILITIES SHALL BE REVIEWED WITH GAS ENGINEERING PRIOR TO INSTALLATION.
- J. THE MAXIMUM SPACING BETWEEN SUPPORTS FOR STEEL FACILITIES SHALL BE AS FOLLOWS: 7' SPACING FOR ¾" AND 1 ¼" STEEL

10' SPACING FOR 2" STEEL
15' SPACING FOR 3" AND 4" STEEL
20' SPACING FOR 6" AND LARGER STEEL

- K. THE MAXIMUM SPACING BETWEEN SUPPORTS FOR PLASTIC FACILITIES SHALL BE AS FOLLOWS :
 - 3 ' SPACING FOR 2" AND SMALLER PLASTIC
 - 6' SPACING FOR 4" AND LARGER PLASTIC
- L. VIBRATING MACHINES ARE ALLOWED OVER STEEL OR PLASTIC FACILITIES WITH 24" OR GREATER COVER. HAND HELD MECHANICAL TAMPER IS ACCEPTABLE OVER ANY FACILITY WITH 12" OR GREATER COVER.
- M. WHEN CONSTRUCTION ACTIVITY IS COMPLETED, CLEAN FILL SHALL BE COMPACTED AROUND AND UNDER THE GAS FACILITY BEFORE REMOVING SUPPORTS.
- N. [CONTACT NATIONAL GRID FOR REPLACEMENT REQUIREMENTS OF CAST IRON PIPE.](#)

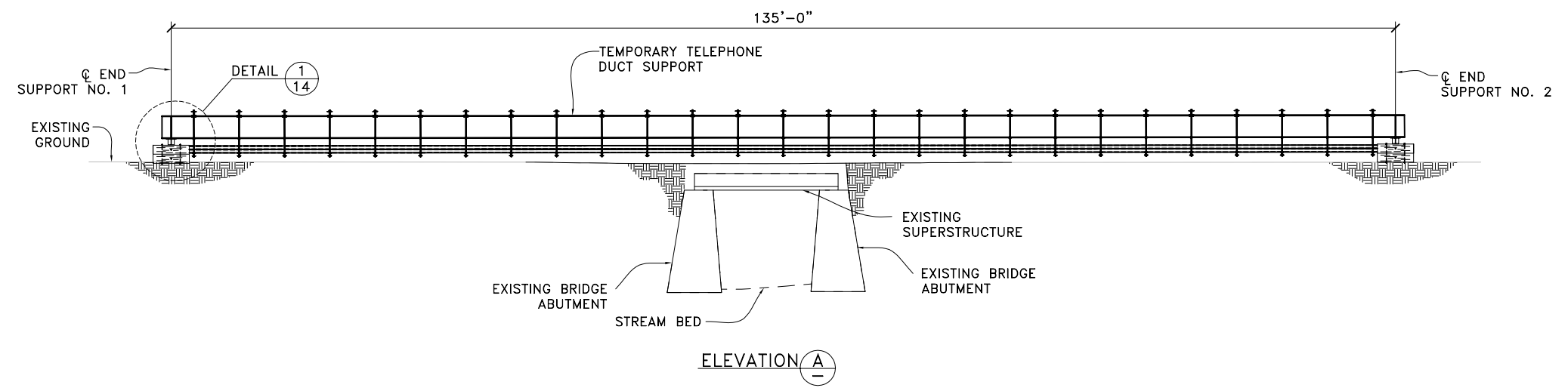
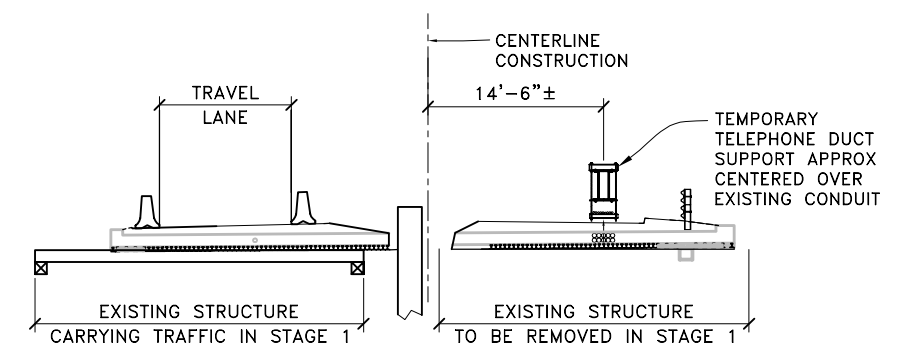
APPENDIX J

TEMPORARY UTILITY BRIDGE PLANS
AMERICAN U-TEL



LOCATION PLAN 1
(TEMPORARY UTILITY BRIDGE SHOWN ABOVE EXISTING BRIDGE) STAGE 1

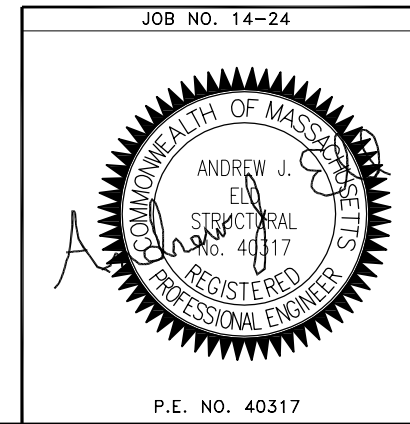
*THESE VALUES VARIAS AS THE TEMPORARY BRIDGE IS SLID SIDE TO SIDE

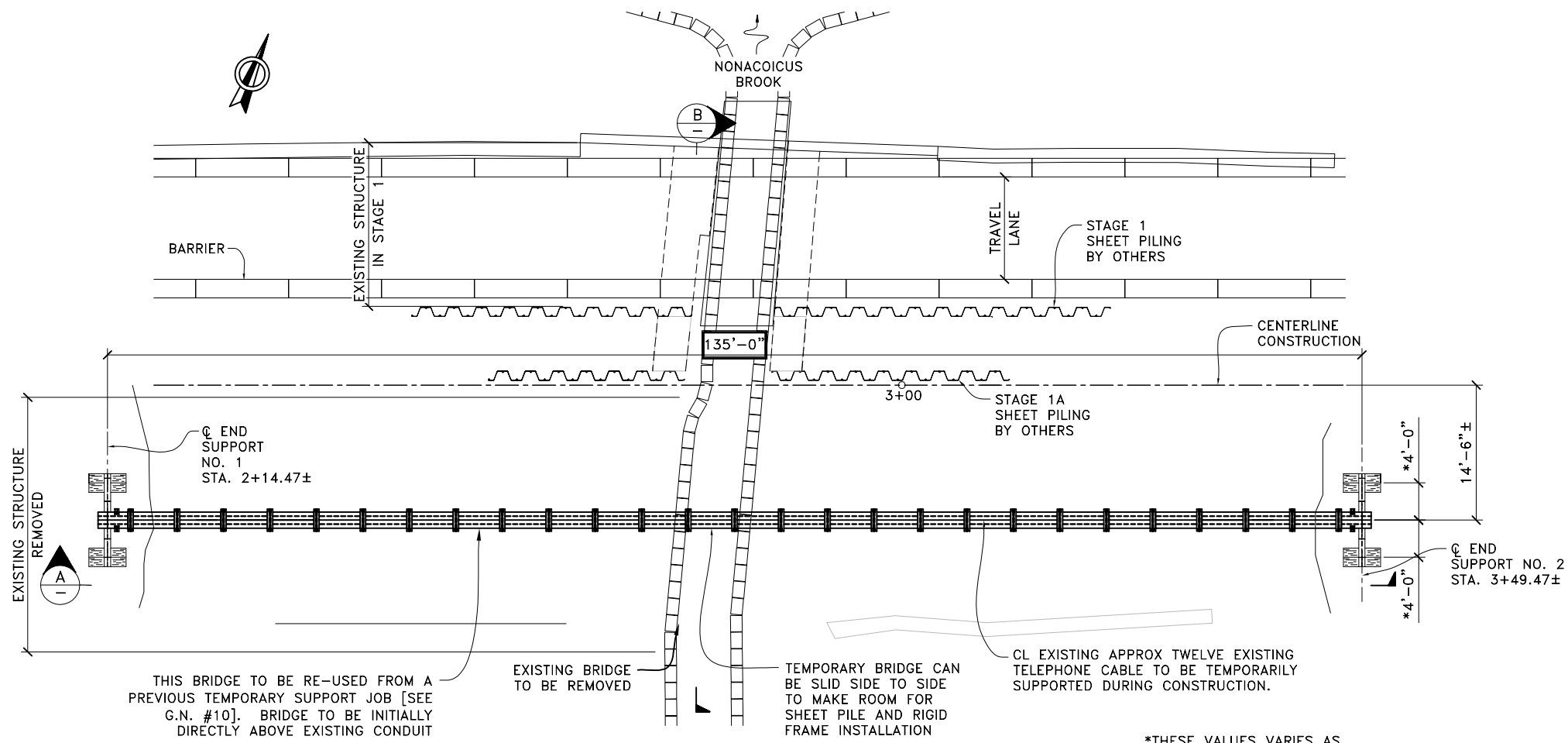


- GENERAL NOTES**
- 1) THESE TEMPORARY BRIDGE DRAWINGS ARE BASED ON AVAILABLE EXISTING AND PROPOSED VEHICULAR BRIDGE DRAWINGS. CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE FABRICATION AND INSTALLATION OF CONDUITS AND SUPPORTS.
 - 2) SUBGRADE CONDUIT INSTALLATION BY OTHERS.
 - 3) THE CONTRACTOR IS REQUIRED TO COMPLY WITH ALL NATIONALLY ACCEPTED SAFETY PRACTICES, OSHA AND ANY OTHER SAFETY REQUIREMENTS IMPOSED BY THE OWNER, AGENCY OR ANY OTHER PARTIES WHICH MAY HAVE JURISDICTION OVER SAFETY.
 - 4) ALL HANGER RODS AT HANGER SUPPORTS TO BE 3/4" Ø THREADED RODS WITH 3/4" Ø NUTS. RODS TO BE ASTM A36, Fy=36KSI MIN.
 - 5) DESIGN AND INSTALLATION OF PERMANENT UTILITY SUPPORTS NOT PART OF THESE DRAWINGS.
 - 6) THE EXISTING TELEPHONE AND CABLE CONDUIT TO BE SUPPORTED IN PLACE AND CAN BE LIFTED VERTICALLY AND HORIZONTALLY DURING CONSTRUCTION IN ORDER TO FACILITATE THE CONSTRUCTION OF THE NEW BRIDGE. CABLES CONSIST OF NUMBER OF COPPER AND FIBER OPTIC CABLES WITH AN ESTIMATED TOTAL WEIGHT OF 30.0 LBS/FT.
 - 7) ALL NEW STEEL FOR TEMPORARY UTILITY BRIDGE TO BE Fy=50 KSI MIN. ALL HIGH STRENGTH BOLTS TO BE ASTM A325 WITH NUTS AND HARDENED WASHERS.
 - 8) THIS DESIGN IS FOR THE EXPRESS PURPOSE FOR USE ON THE WEST MAIN STREET BRIDGE OVER THE NONACOICUS CREEK IN AYER, MASSACHUSETTS AND IS NOT TO BE USED ELSEWHERE.
 - 9) FOR SEQUENCE OF CONSTRUCTION, SEE DWG 14-24-16.
 - 10) AN EXISTING TEMPORARY UTILITY BRIDGE TO BE RE-USED ON THIS JOB. FOR DETAILS OF THE EXISTING BRIDGE USED TO SUPPORT THE EXISTING VERIZON CONDUIT, SEE ATTACHED DRAWINGS FOR AMERICAN U-TEL, JOB 25-10, S.R. 31 (RIVER STREET) OVER NORTH NASHUA RIVER IN FITCHBURG, MASSACHUSETTS. MANY COMPONENTS ARE ALSO SHOWN ON THESE DRAWINGS. WE WILL BE USING THE FULL 137FT BRIDGE AS SHOWN ON AUT JOB 25-10. THE MAIN SUPPORT BEAM HAS THREE SECTIONS-40FT, 45FT AND A 52FT SECTION. ALSO, IF THE BRIDGE DOES NOT HAVE GUIDE TUBES [SEE DRAWINGS 14-24-14 AND 14-24-15], TUBES WILL NEED TO BE INSTALLED, WITH HOLES DRILLED INTO THE W30'S IN ORDER TO ACCEPT THE GUIDE TUBES. FOR PULLING THE BRIDGE SIDE TO SIDE, THE SHACKLES CAN BE PLACED IN HOLES IN THE END STIFFENERS. ANY MISSING COMPONENTS REQUIRED FROM THE ORIGINAL DESIGNS WILL NEED TO BE FABRICATED AGAIN AND ADHERE TO G.N. NO. 7.
 - 11) THE TELEPHONE COMPANY TO DETERMINE IF THERE IS SUFFICIENT SLACK IN THE CABLES IN ORDER TO MOVE THE CABLE VERTICALLY AND HORIZONTALLY AS NEEDED.
 - 12) THE TEMPORARY BRIDGES HAVE BEEN DESIGNED PER AISC, ASD.

2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24
REV	COMMENTS	BY	DATE

WEST MAIN STREET OVER NONACOICUS BROOK AYER, MASSACHUSETTS			
TEMPORARY UTILITY BRIDGE LOCATION PLAN 1			
ANDREW J. ELD, P.E.			
OWNER: VERIZON			
FURNISHED BY: AMERICAN U-TEL 9957 HOBART ROAD WILLOUHGBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285			
CHECKED BY: AE	DATE: 6-28-24		
DRAWN BY: WS	DATE: 6-24-24		
DRAWING NO: 14-24-10	SH. 1	OF 1	





THIS BRIDGE TO BE RE-USED FROM A PREVIOUS TEMPORARY SUPPORT JOB [SEE G.N. #10]. BRIDGE TO BE INITIALLY DIRECTLY ABOVE EXISTING CONDUIT

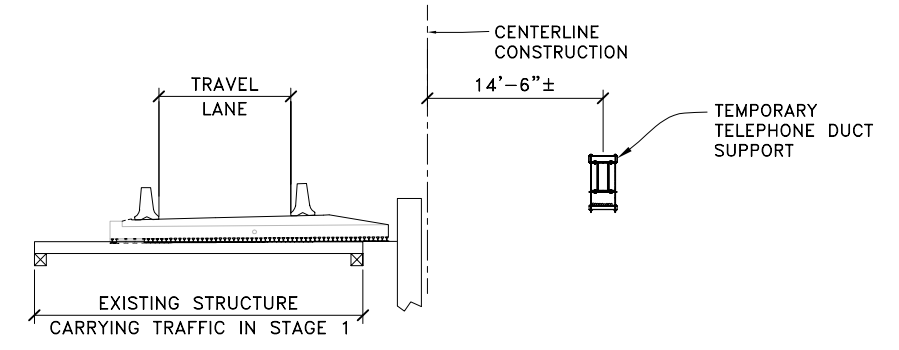
EXISTING BRIDGE TO BE REMOVED

TEMPORARY BRIDGE CAN BE SLID SIDE TO SIDE TO MAKE ROOM FOR SHEET PILE AND RIGID FRAME INSTALLATION

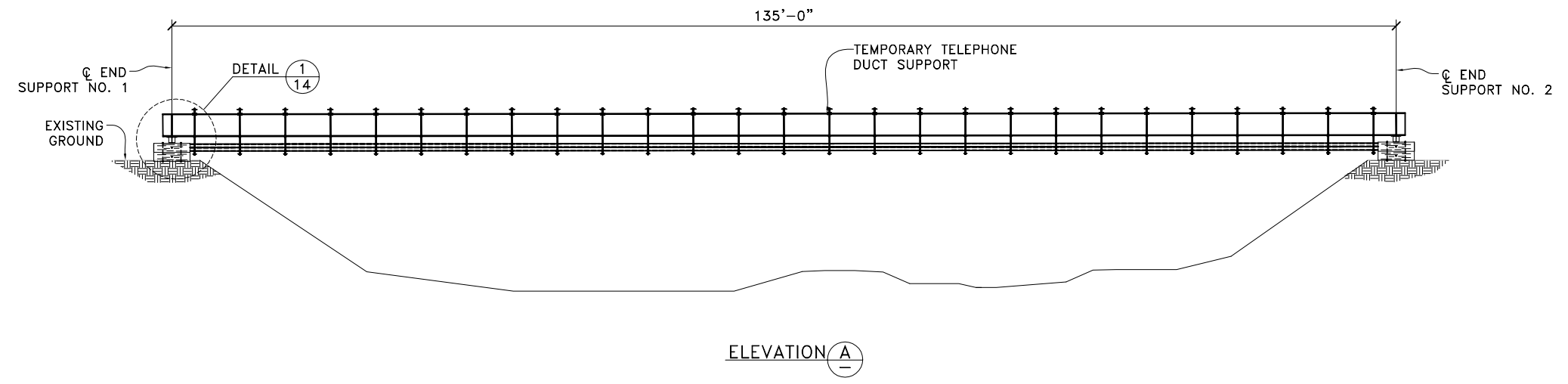
CL EXISTING APPROX TWELVE EXISTING TELEPHONE CABLE TO BE TEMPORARILY SUPPORTED DURING CONSTRUCTION.

*THESE VALUES VARIES AS THE TEMPORARY BRIDGE IS SLID SIDE TO SIDE

LOCATION PLAN 2
(TEMPORARY UTILITY BRIDGE SHOWN ABOVE EXISTING REMOVED BRIDGE)
STAGE 1



SECTION B STAGE 1



ELEVATION A

2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24
REV	COMMENTS	BY	DATE

WEST MAIN STREET
OVER NONACOICUS BROOK
AYER, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE
LOCATION PLAN 2

ANDREW J. ELD, P.E.

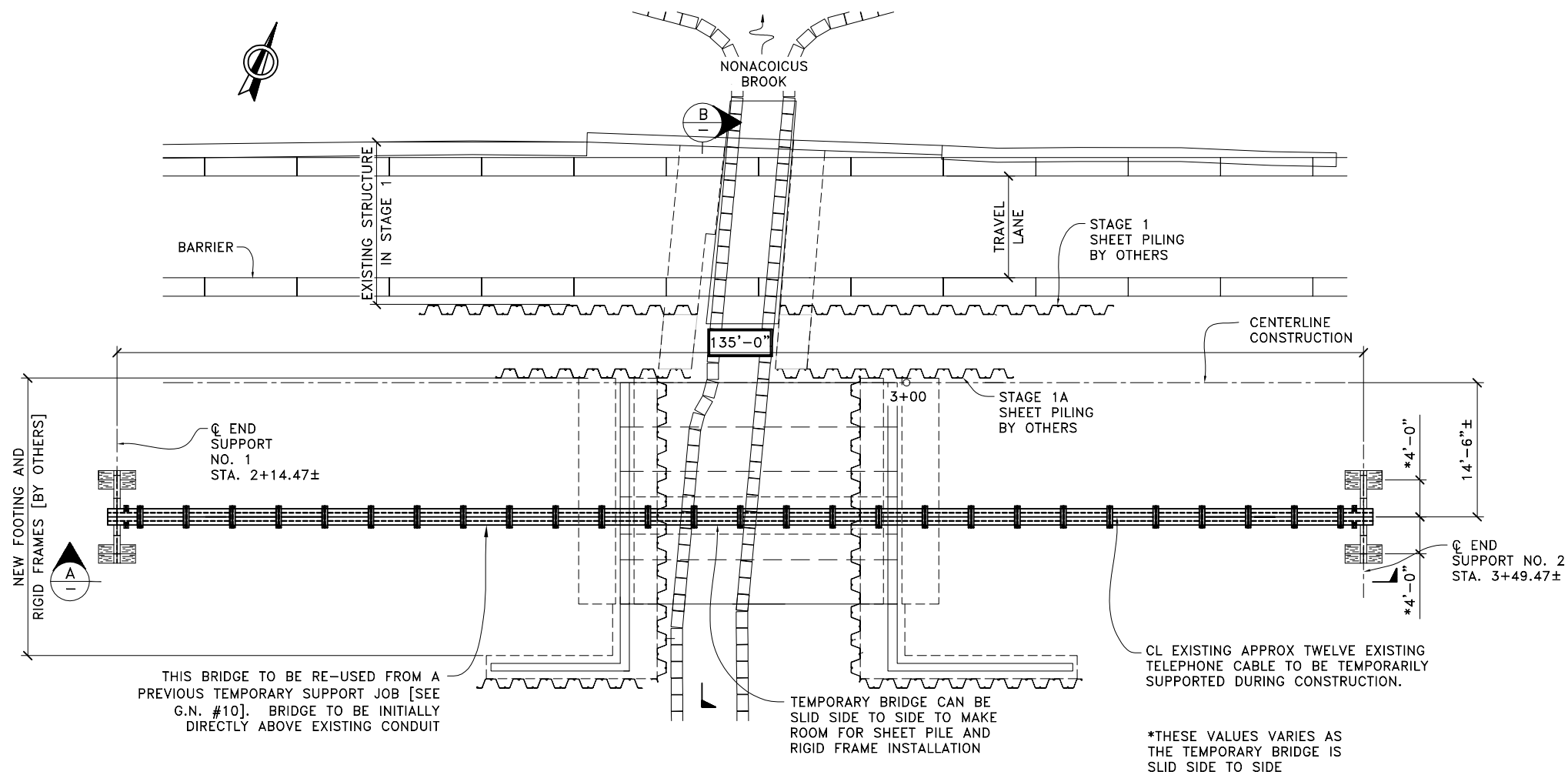
OWNER: VERIZON

FURNISHED BY: AMERICAN U-TEL
9957 HOBART ROAD
WILLOUGHBY, OHIO 44094
(440)946-6027 FAX:(440)946-7285

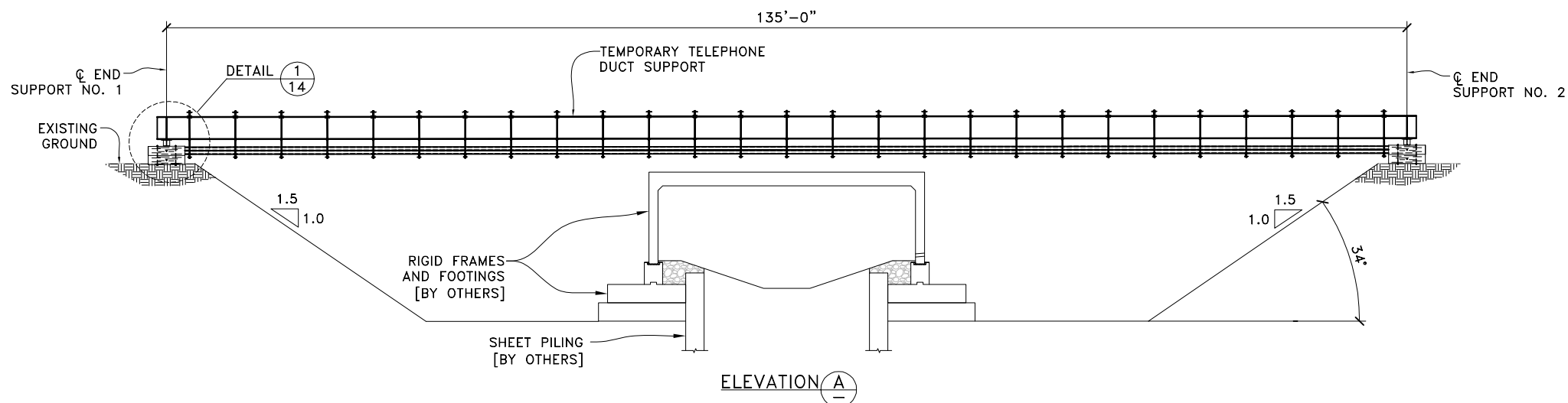
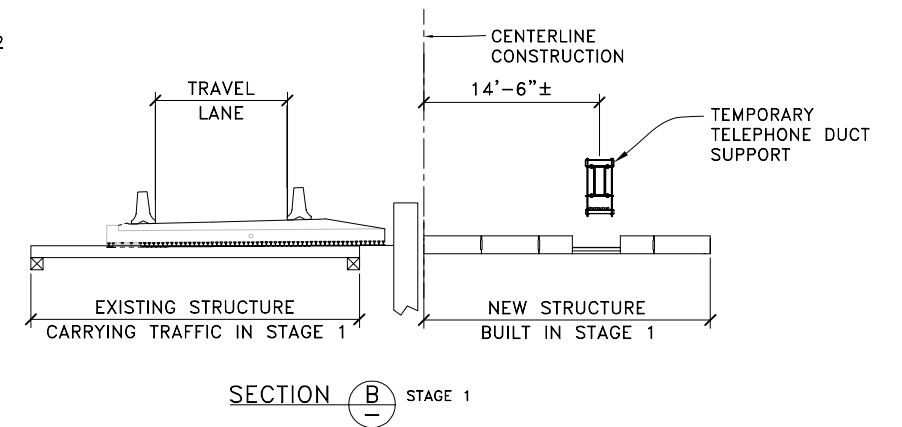
CHECKED BY: AE	DATE: 6-28-24
DRAWN BY: WS	DATE: 6-24-24
DRAWING NO: 14-24-11	SH. 1 OF 1

JOB NO. 14-24

P.E. NO. 40317



LOCATION PLAN 3
(TEMPORARY UTILITY BRIDGE SHOWN ABOVE PROPOSED BRIDGE)
STAGE 1



ELEVATION A

2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24
REV	COMMENTS	BY	DATE

WEST MAIN STREET
OVER NONACOICUS BROOK
AYER, MASSACHUSETTS

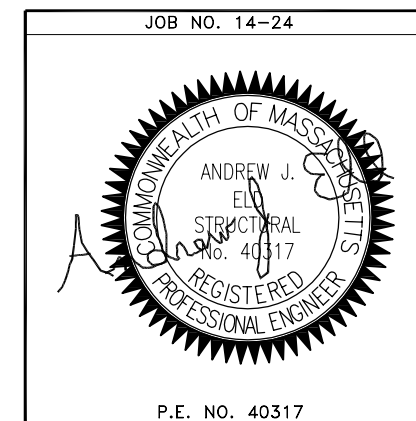
TEMPORARY UTILITY BRIDGE
LOCATION PLAN 3

ANDREW J. ELD, P.E.

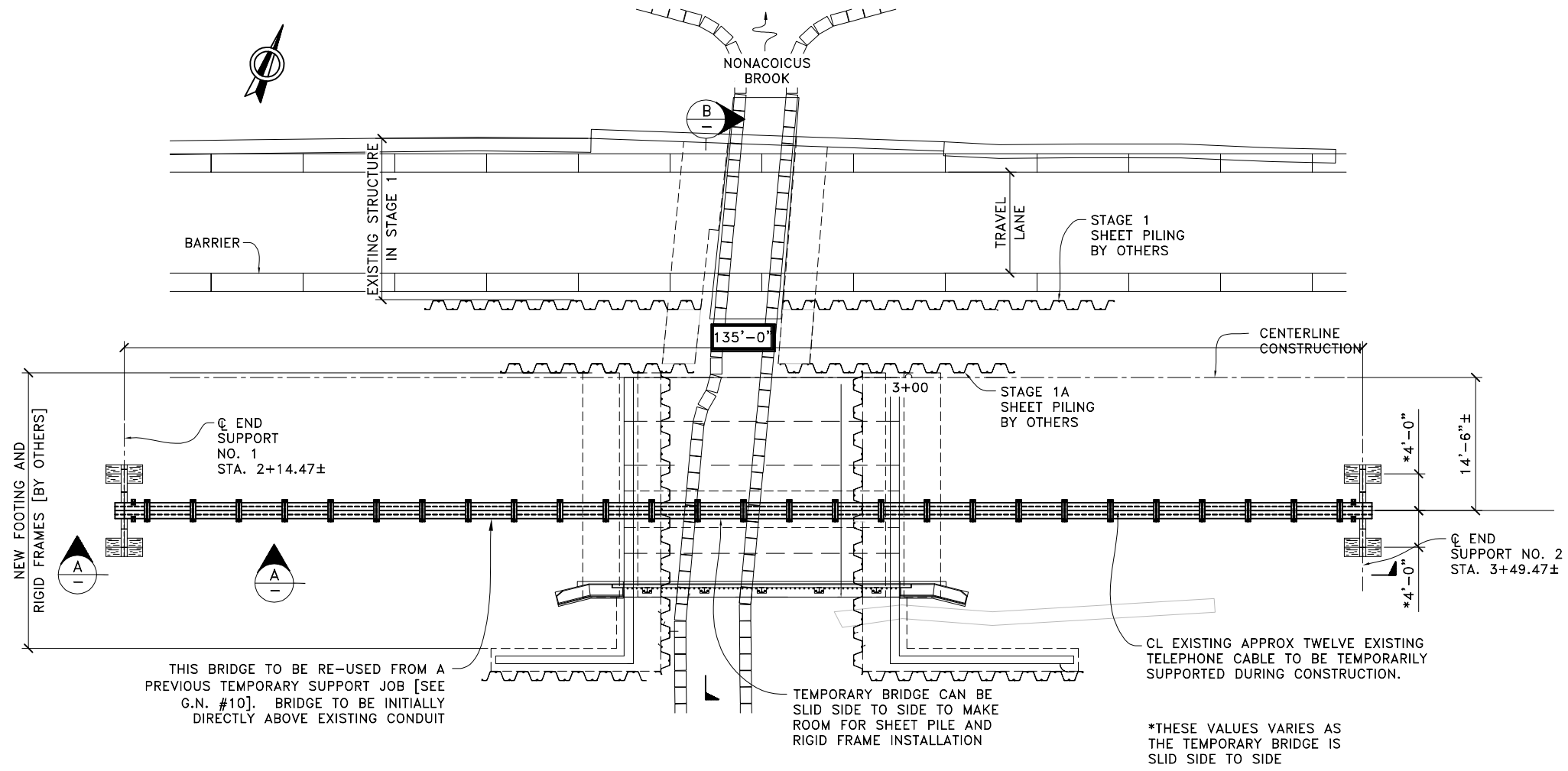
OWNER: VERIZON

FURNISHED BY: AMERICAN U-TEL
9957 HOBART ROAD
WILLOUGHBY, OHIO 44094
(440)946-6027 FAX:(440)946-7285

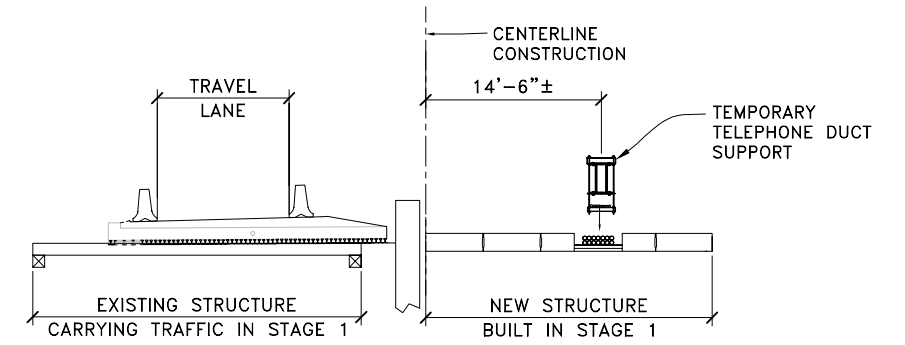
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DRAWN BY: WS	DATE: 6-24-24
DRAWING NO: 14-24-12	SH. 1 OF 1



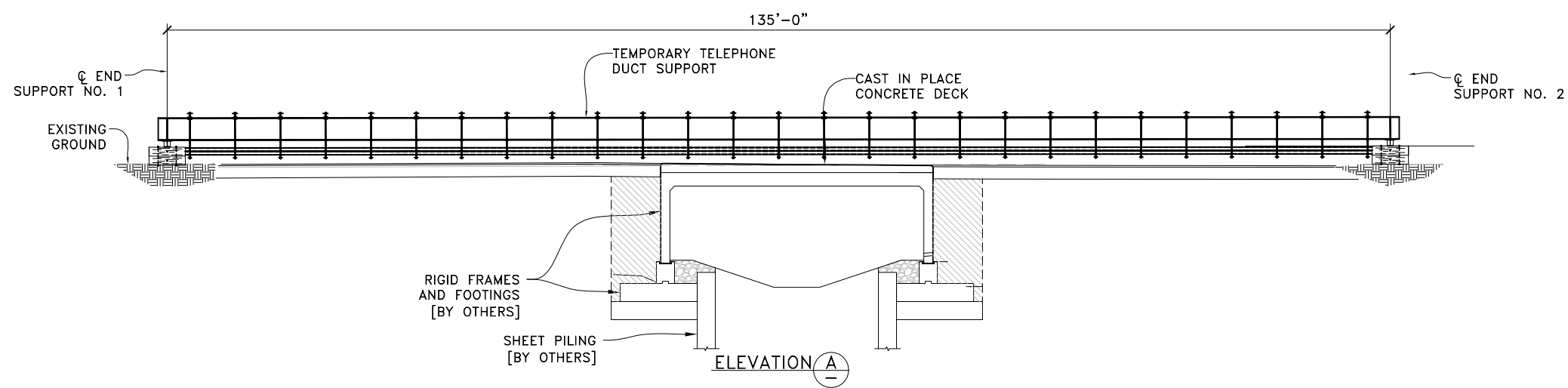
P.E. NO. 40317



LOCATION PLAN 4
(TEMPORARY UTILITY BRIDGE SHOWN ABOVE PROPOSED BRIDGE)
STAGE 1



SECTION B STAGE 1



ELEVATION A

2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24
REV	COMMENTS	BY	DATE

WEST MAIN STREET
OVER NONACOICUS BROOK
AYER, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE
LOCATION PLAN 4

ANDREW J. ELD, P.E.

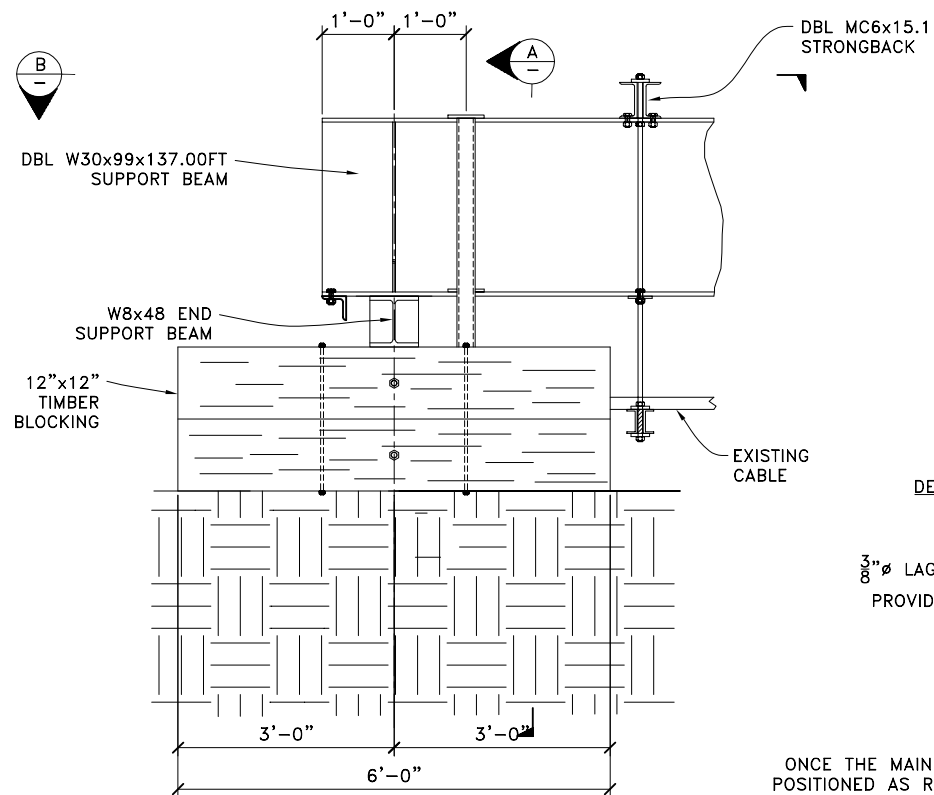
OWNER: VERIZON

FURNISHED BY: AMERICAN U-TEL
9957 HOBART ROAD
WILLOUGHBY, OHIO 44094
(440)946-6027 FAX:(440)946-7285

CHECKED BY: AE DATE: 6-28-24
DRAWN BY: WS DATE: 6-24-24
DRAWING NO: 14-24-13 SH. 1 OF 1

JOB NO. 14-24

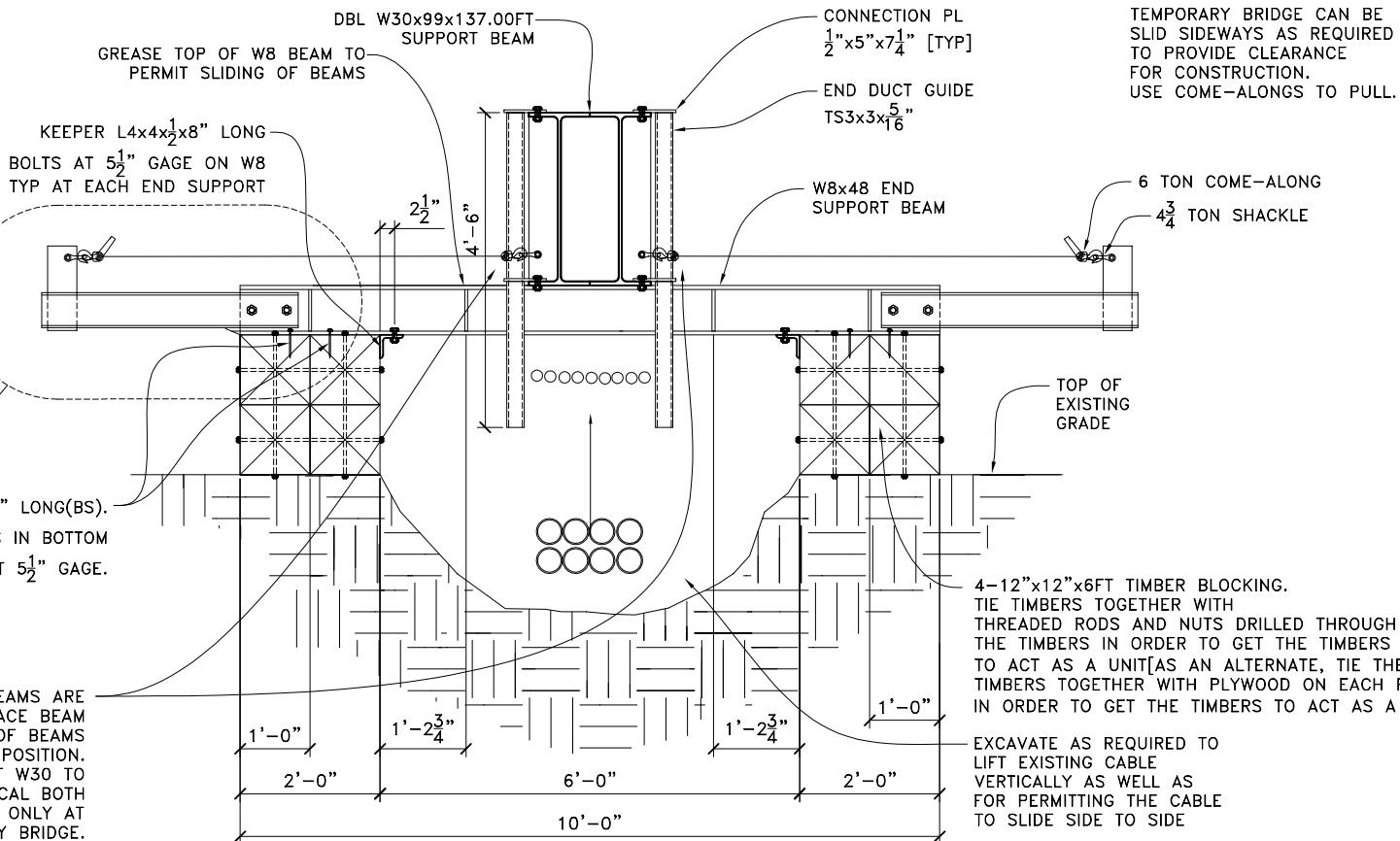
P.E. NO. 40317



DETAIL 1
 $\frac{3}{4}"=1'-0"$

ONCE THE MAIN SUPPORT BEAMS ARE POSITIONED AS REQUIRED, PLACE BEAM CLAMPS TO EACH SIDE OF BEAMS HOLD TEMP BRIDGE IN POSITION. CLAMP BOTTOM FLANGE OF W30 TO TOP FLANGE OF W8, TYPICAL BOTH SIDES OF SUPPORT BEAM BUT ONLY AT ONE END OF THE TEMPORARY BRIDGE.

DETAIL 2
 $\frac{3}{8}" \phi$ LAG SCREW x 4" LONG (BS). PROVIDE $\frac{1}{2}" \phi$ HOLES IN BOTTOM FLANGE AT $5\frac{1}{2}"$ GAGE.

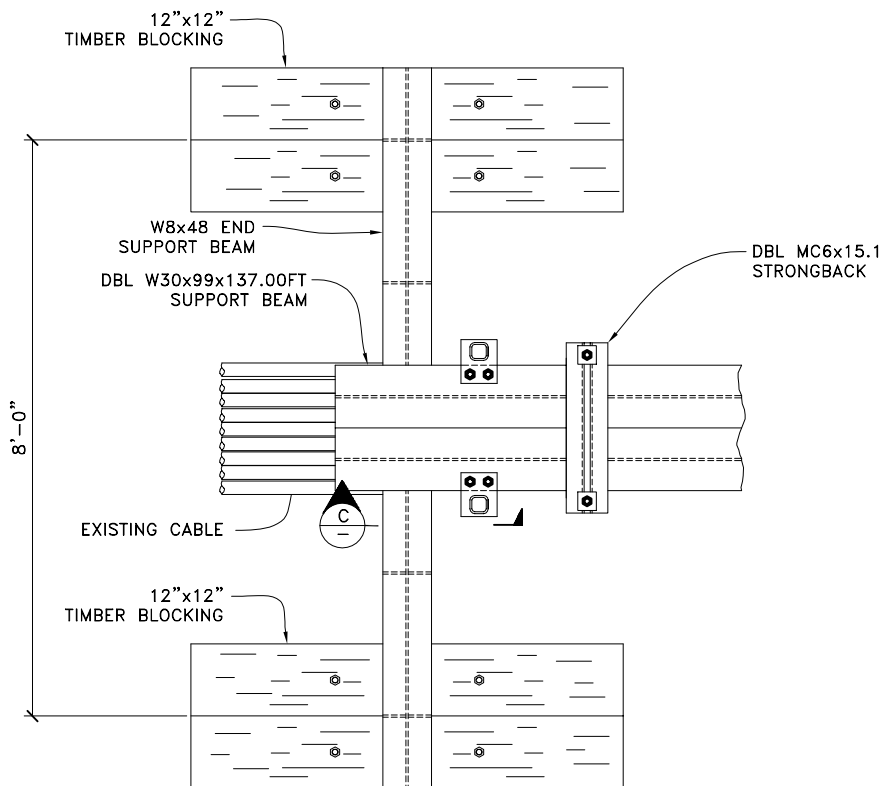


SECTION A
 $\frac{3}{4}"=1'-0"$

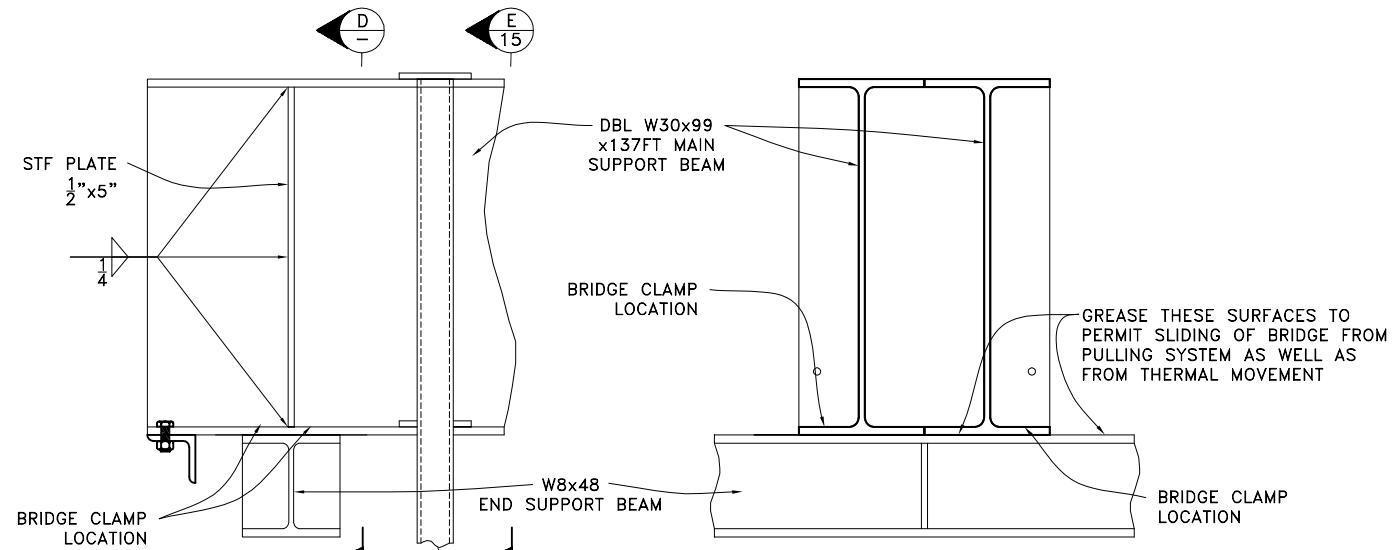
TEMPORARY BRIDGE CAN BE SLID SIDWAYS AS REQUIRED TO PROVIDE CLEARANCE FOR CONSTRUCTION. USE COME-ALONGS TO PULL.

4-12"x12"x6FT TIMBER BLOCKING. TIE TIMBERS TOGETHER WITH THREADED RODS AND NUTS DRILLED THROUGH THE TIMBERS IN ORDER TO GET THE TIMBERS TO ACT AS A UNIT [AS AN ALTERNATE, TIE THE TIMBERS TOGETHER WITH PLYWOOD ON EACH FACE IN ORDER TO GET THE TIMBERS TO ACT AS A UNIT].

EXCAVATE AS REQUIRED TO LIFT EXISTING CABLE VERTICALLY AS WELL AS FOR PERMITTING THE CABLE TO SLIDE SIDE TO SIDE



SECTION B
 $\frac{3}{4}"=1'-0"$



SECTION C
 $\frac{1}{2}"=1'-0"$

SECTION D
 $\frac{1}{2}"=1'-0"$

NOTE: THESE GUIDE TUBES WILL NEED TO BE INSTALLED AT THE BRIDGE END THAT HAS THE W30 BOLTED SPLICE

JOB NO. 14-24

P.E. NO. 40317

REV	COMMENTS	BY	DATE
2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24

WEST MAIN STREET
 OVER NONACOICUS BROOK
 AYER, MASSACHUSETTS

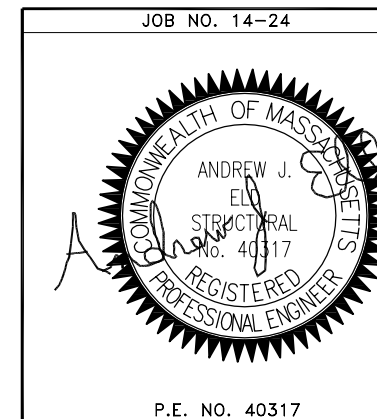
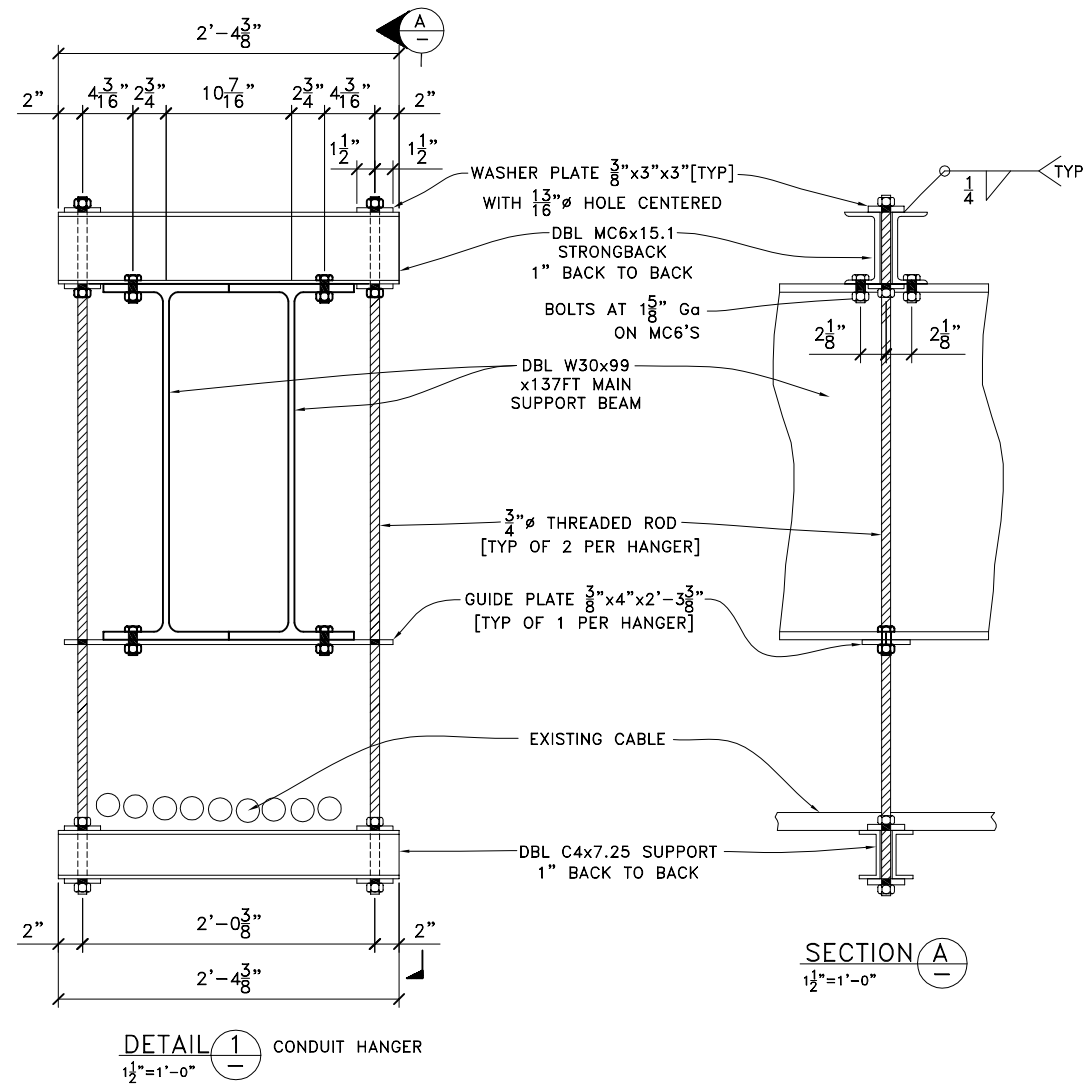
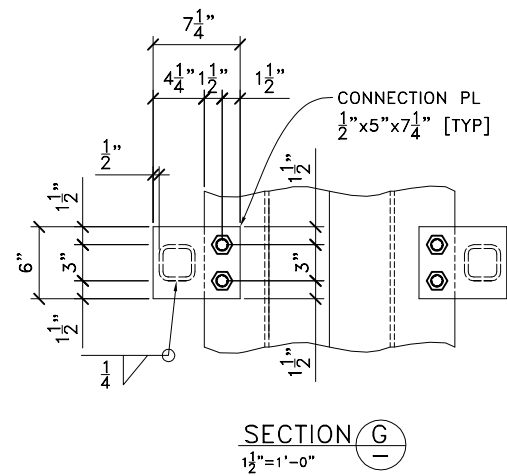
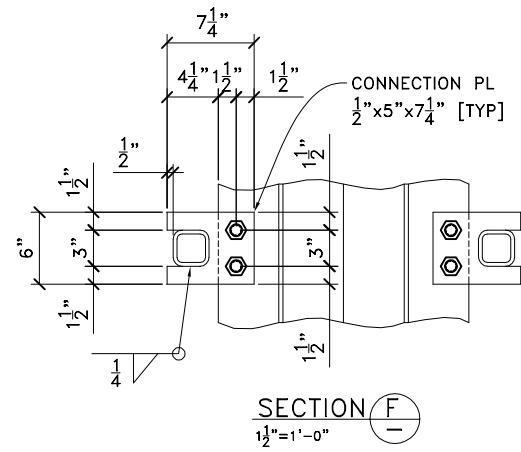
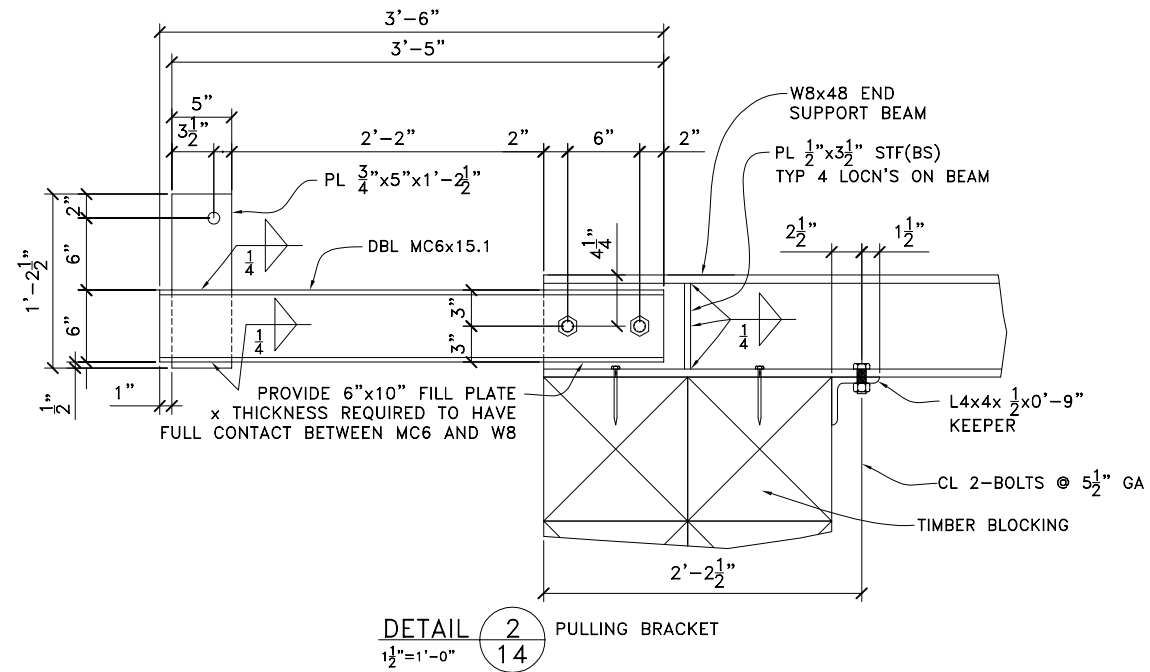
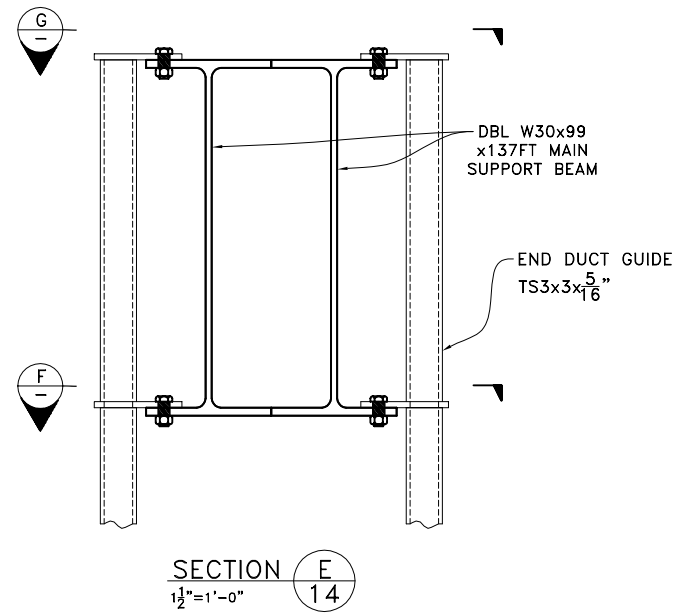
TEMPORARY UTILITY BRIDGE
 END SUPPORTS DETAILS 1

ANDREW J. ELD, P.E.

OWNER: VERIZON

FURNISHED BY: AMERICAN U-TEL
 9957 HOBART ROAD
 WILLOUHGBY, OHIO 44094
 (440)946-6027 FAX:(440)946-7285

CHECKED BY: AE DATE: 6-28-24
 DRAWN BY: WS DATE: 6-24-24
 DRAWING NO: 14-24-14 SH. 1 OF 1



2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24
REV	COMMENTS	BY	DATE

WEST MAIN STREET
OVER NONACOICUS BROOK
AYER, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE
END SUPPORTS DETAILS 2

ANDREW J. ELD, P.E.

OWNER: VERIZON
FURNISHED BY: AMERICAN U-TEL
9957 HOBART ROAD
WILLOUGHBY, OHIO 44094
(440)946-6027 FAX:(440)946-7285

CHECKED BY: AE	DATE: 6-28-24
DRAWN BY: WS	DATE: 6-24-24
DRAWING NO: 14-24-15	SH. 1 OF 1

CONSTRUCTION SEQUENCE

STEP 1: REMOVE FULL LENGTH OF ROADWAY DECK OVER THE EXISTING TELEPHONE DUCTS (BY BRIDGE CONTRACTOR DURING STAGE 1 OF THE BRIDGE RECONSTRUCTION).

STEP 2: DEMOLISH EXISTING ABUTMENT SEAT AND BACKWALL (BY BRIDGE CONTRACTORS) AS REQUIRED.

STEP 3: EXCAVATE AS REQUIRED AT BOTH APPROACHES (BY AMERICAN U-TEL) TO THE BOTTOM OF THE EXISTING DUCTS AS REQUIRED TO ENABLE THE INSTALLATION END SUPPORTS.

STEP 4: EXCAVATE AS REQUIRED AT BOTH APPROACHES AT BOTH PROPOSED END SUPPORT LOCATIONS. INSTALL END SUPPORTS. ERECT MAIN SUPPORT BEAMS. SEE DRAWING 14-24-10 FOR DETAILS OF ASSEMBLED UTILITY BRIDGE. THIS STEP TO BE PERFORMED BY AMERICAN U-TEL.

STEP 5: ASSEMBLE HANGER SUPPORTS TO SUPPORT EXISTING DUCTS AS SHOWN ON DETAIL 1 ON DRAWING 14-24-15. REMOVE EXISTING CONDUIT FROM AROUND THE EXISTING CABLES. PULL CABLE UP TO TEMPORARY BRIDGE ONTO TEMPORARY HANGER [PLACE SPLIT FIBERGLASS DUCT AROUND EXISTING CABLE IF NEEDED FOR PROTECTION]. TEMPORARY HANGER RODS ARE TO BE TIGHTENED UNTIL THE CABLES ARE FULLY SUPPORTED BY THE TEMPORARY BRIDGE. THIS STEP TO BE PERFORMED BY AMERICAN U-TEL.

STEP 6: DEMOLISH REMAINING SUPERSTRUCTURE (BY BRIDGE CONTRACTOR).

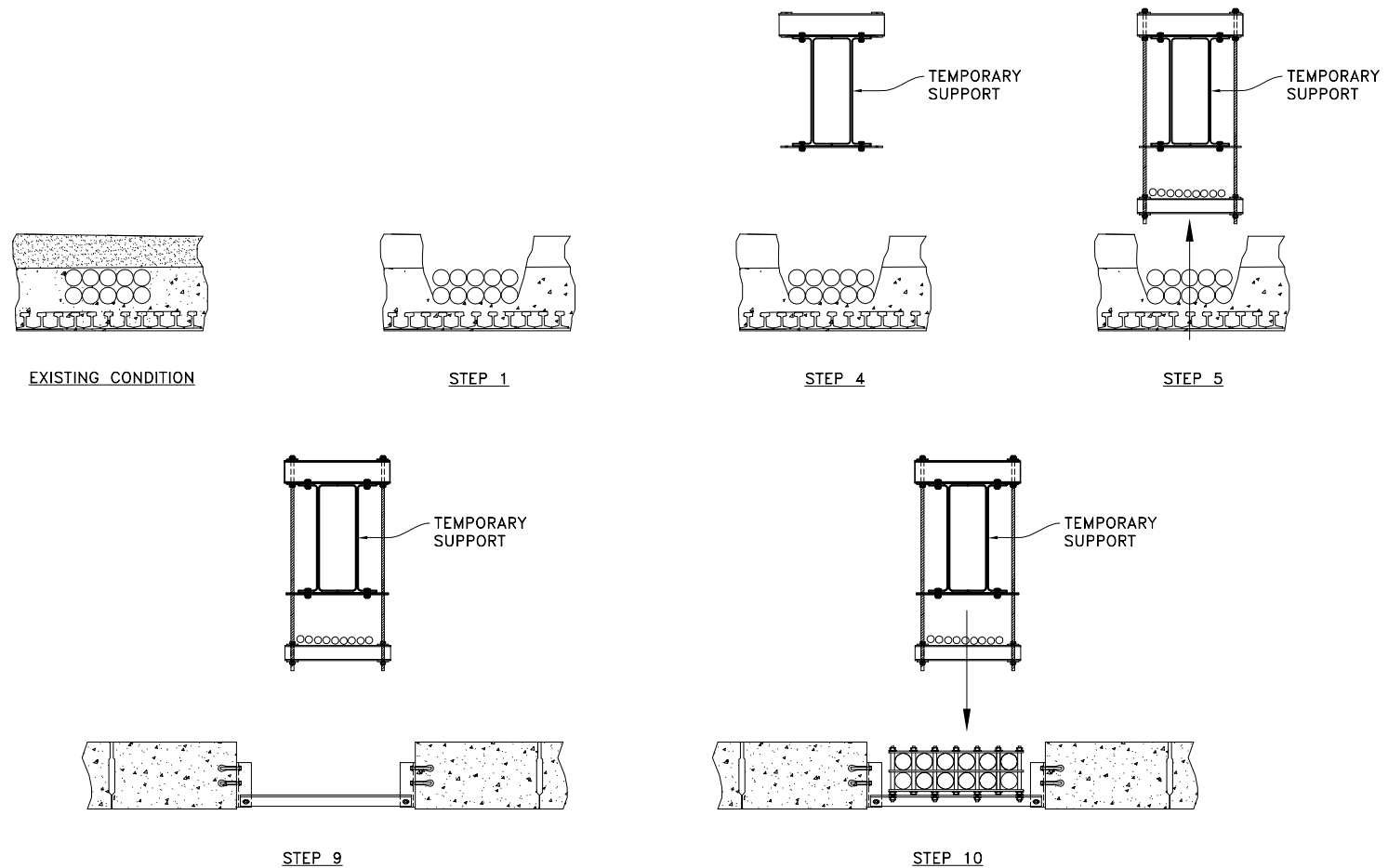
STEP 7: DEMOLISH REMAINING ABUTMENTS AND ROADWAY AS PER THE CONTRACT (BY BRIDGE CONTRACTOR).

STEP 8: SLIDE TEMPORARY BRIDGE SIDE TO SIDE AS REQUIRED TO PROVIDE CLEARANCE FOR CONSTRUCTION OF NEW ABUTMENTS. THIS STEP TO BE PERFORMED BY AMERICAN U-TEL.

STEP 9: ERECT NEW CONCRETE RIGID FRAMES (BY BRIDGE CONTRACTOR). FILL IN APPROACHES BEYOND THE RIGID FRAMES AS PER BRIDGE CONTRACT DRAWINGS (BY BRIDGE CONTRACTOR).

STEP 10: LOWER EXISTING CABLE TO TOP OF THE CONDUIT SUPPORT. REMOVE TEMPORARY BRIDGE BEAMS AND END SUPPORTS. ENCASE THE EXISTING CABLE WITH SPLIT FIBERGLASS CONDUIT ON THE BRIDGE AND SPLIT STEEL CONDUIT IN THE APPROACHES A MINIMUM DISTANCE OF 10FT FROM THE ENDS OF THE BRIDGE. STEP 10 TO BE PERFORMED BY AMERICAN U-TEL. SEE FINAL CONDUIT SUPPORT DRAWINGS FOR EXACT DETAILS IN THIS STEP.

STEP 12: COMPLETE REMAINING CONTRACT WORK (BY BRIDGE CONTRACTOR).



JOB NO. 10-23

P.E. NO. 40317

2	NEW BRIDGE LENGTH	AE	12/02/24
1	APPROVAL	AE	06/28/24
REV	COMMENTS	BY	DATE

WEST MAIN STREET
OVER NONACOICUS BROOK
AYER, MASSACHUSETTS

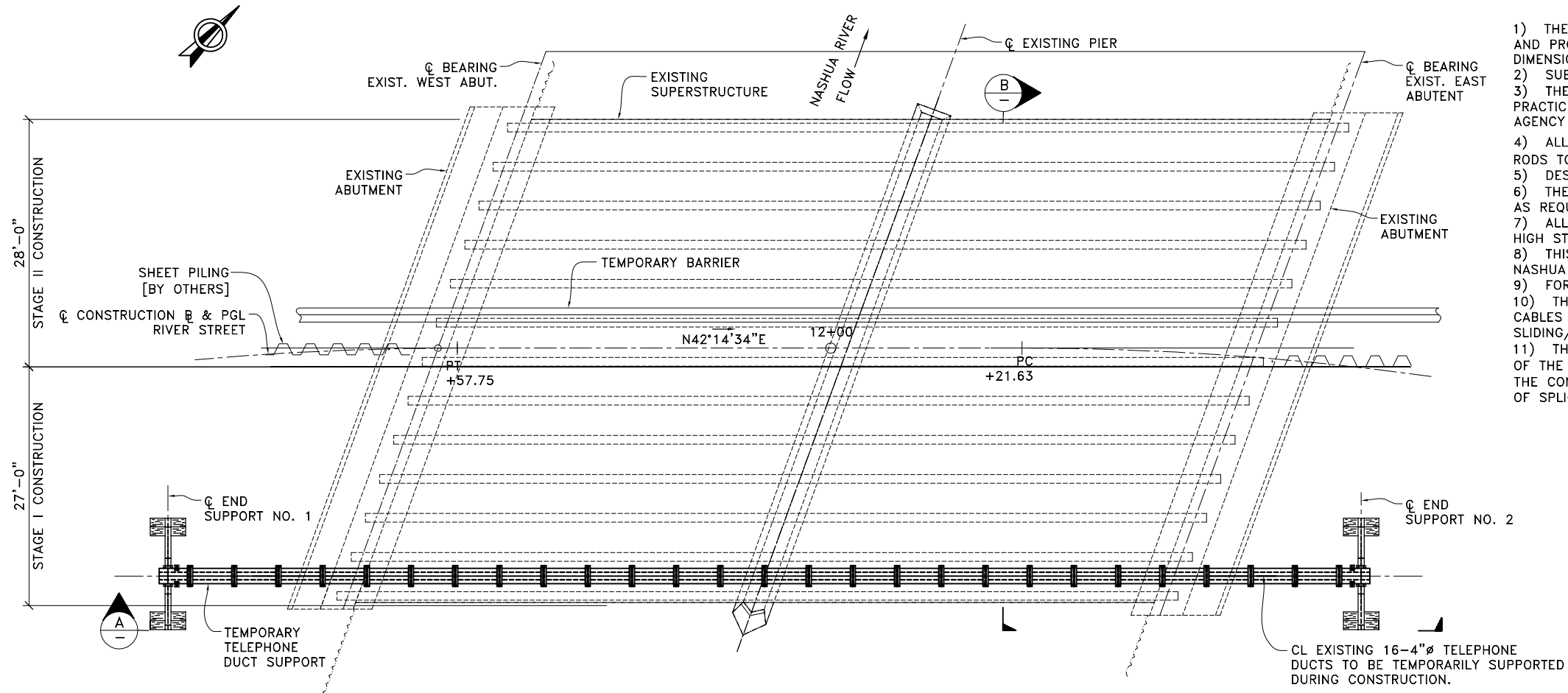
TEMPORARY UTILITY BRIDGE
CONSTRUCTION SEQUENCE

ANDREW J. ELD, P.E.

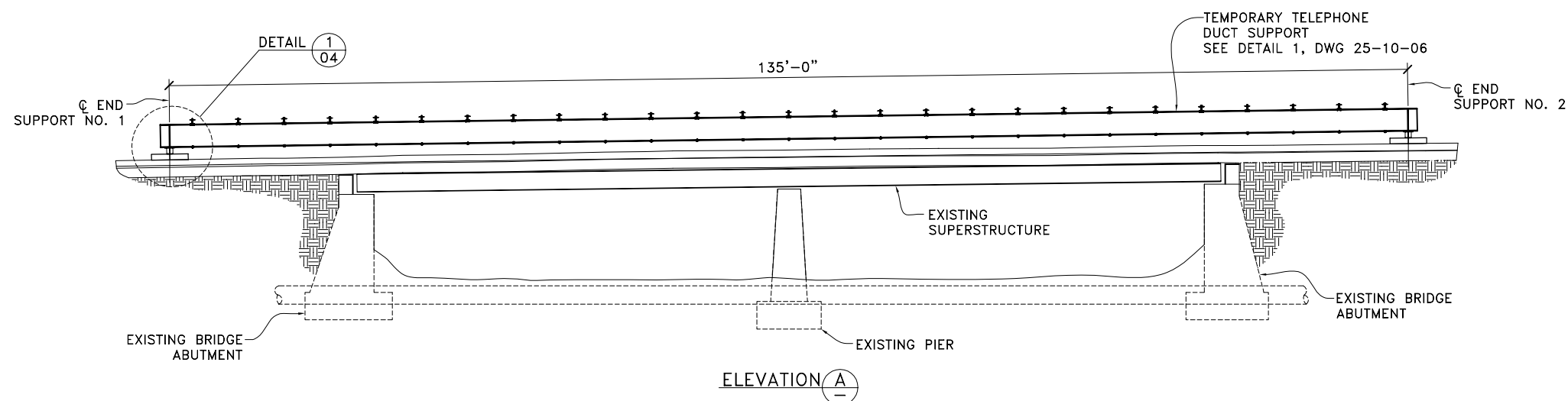
OWNER: VERIZON

FURNISHED BY: AMERICAN U-TEL
9957 HOBART ROAD
WILLOUGHBY, OHIO 44094
(440)946-6027 FAX:(440)946-7285

CHECKED BY: AE DATE: 6-28-24
DRAWN BY: WS DATE: 6-24-24
DRAWING NO: 14-24-16 SH. 1 OF 1

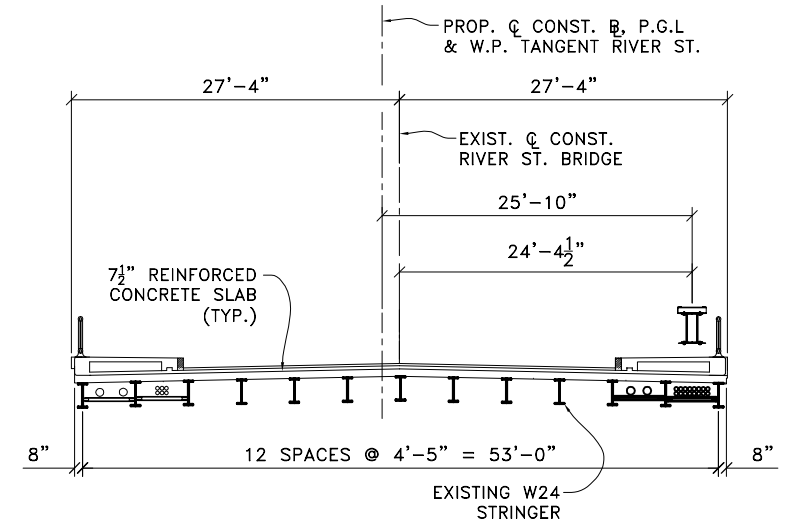


LOCATION PLAN 1
(TEMPORARY UTILITY BRIDGE SHOWN ABOVE EXISTING BRIDGE)
STAGE 1



ELEVATION (A)

- 1) THESE DRAWINGS TEMPORARY BRIDGE DRAWINGS ARE BASED ON AVAILABLE EXISTING AND PROPOSED VEHICULAR BRIDGE DRAWINGS. CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE FABRICATION AND INSTALLATION OF CONDUITS AND SUPPORTS.
- 2) SUBGRADE CONDUIT INSTALLATION BY OTHERS.
- 3) THE CONTRACTOR IS REQUIRED TO COMPLY WITH ALL NATIONALLY ACCEPTED SAFETY PRACTICES, OSHA AND ANY OTHER SAFETY REQUIREMENTS IMPOSED BY THE OWNER, AGENCY OR ANY OTHER PARTIES WHICH MAY HAVE JURISDICTION OVER SAFETY.
- 4) ALL HANGER RODS AT HANGER SUPPORTS TO BE $\frac{3}{4}$ " ϕ THREADED RODS WITH $\frac{3}{4}$ " ϕ NUTS. RODS TO BE ASTM A36, Fy=36KSI MIN.
- 5) DESIGN AND INSTALLATION OF PERMANENT UTILITY SUPPORTS BY OTHERS.
- 6) THE EXISTING TELEPHONE CONDUIT TO BE SUPPORTED IN PLACE AND IS TO BE MOVED AS REQUIRED DURING CONSTRUCTION AS WELL AS DURING FINAL ALIGNMENT.
- 7) ALL STEEL FOR TEMPORARY UTILITY BRIDGE TO BE ASTM A36, Fy=36 KSI MIN. ALL HIGH STRENGTH BOLTS TO BE ASTM A325 WITH NUTS AND HARDENED WASHERS.
- 8) THIS DESIGN IS FOR THE EXPRESS PURPOSE FOR USE ON RIVER STREET OVER NORTH NASHUA RIVER IN FITCHBURG, MASSACHUSETTS AND IS NOT TO BE USED ELSEWHERE.
- 9) FOR SEQUENCE OF CONSTRUCTION, SEE DWG. 25-10-07.
- 10) THE TELEPHONE COMPANY TO DETERMINE IF THERE IS SUFFICIENT SLACK IN THE CABLES IN ORDER TO MOVE THE CABLE HORIZONTALLY AS WELL AS VERTICALLY DURING SLIDING/SUPPORT PROCEDURES.
- 11) THE SPLICE DETAIL SHOWN ON DRAWING 25-10-07 TO BE USED AT THE DISCRETION OF THE CONTRACTOR AND/OR FABRICATOR FOR EASE OF FABRICATION, SHIPPING, ETC. THE CONTRACTOR AND/OR FABRICATOR TO DETERMINE THE LOCATIONS AS WELL AS NUMBER OF SPLICE LOCATIONS REQUIRED.



SECTION (B)

REV	COMMENTS	BY	DATE
0	FOR APPROVAL	AE	3/07/11

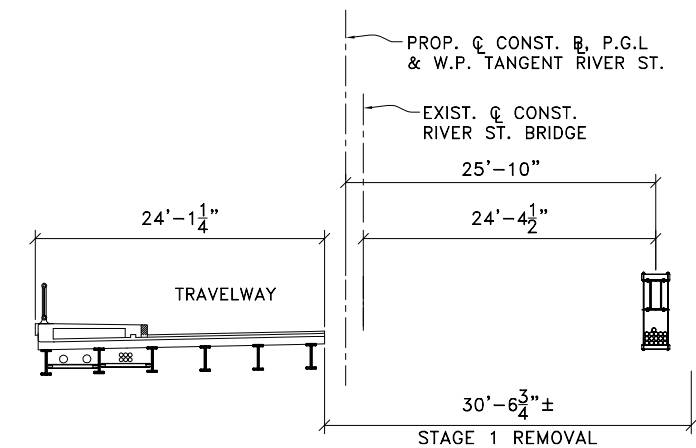
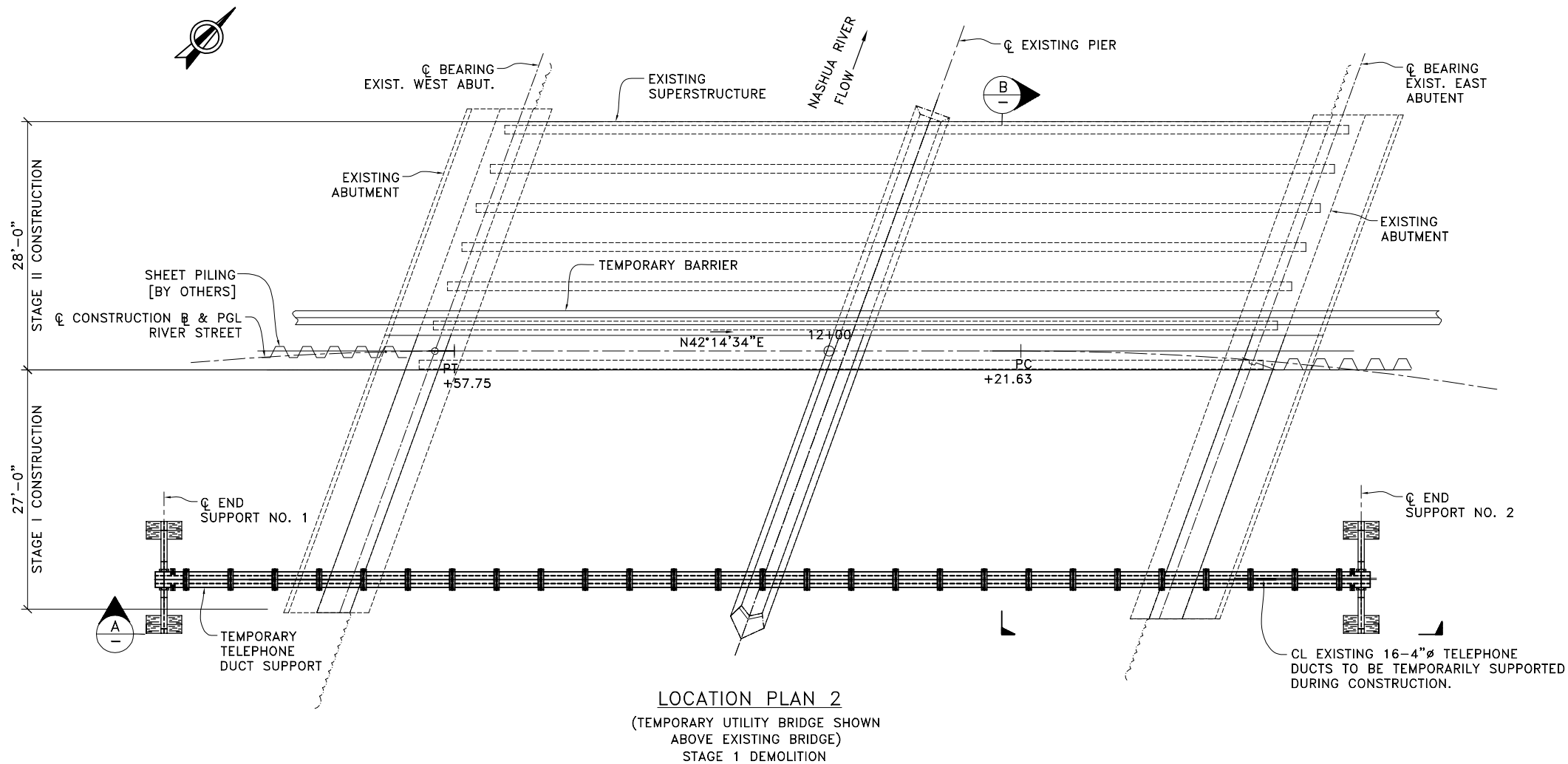
RIVER STREET OVER
NORTH NASHUA RIVER
IN FITCHBURG, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE
LOCATION PLAN 1

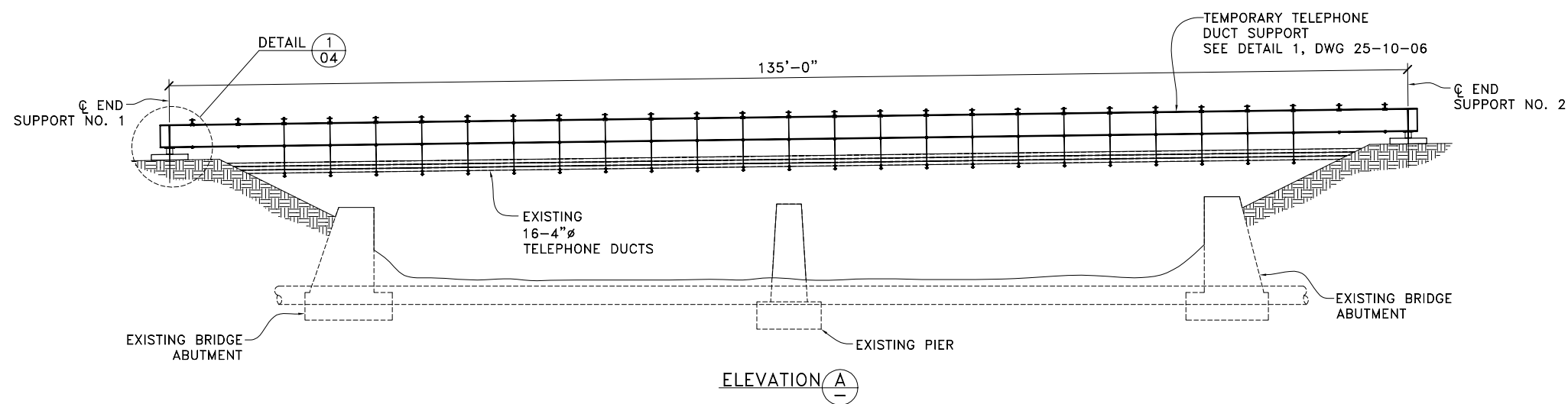
ANDREW J. ELD, P.E.

JOB NO. 25-10	OWNER: VERIZON
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUGHBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285	
CHECKED BY: AE	DATE: 2-06-11
DRAWN BY: WS	DATE: 2-03-11
DRAWING NO: 25-10-01	SH. 1 OF 7

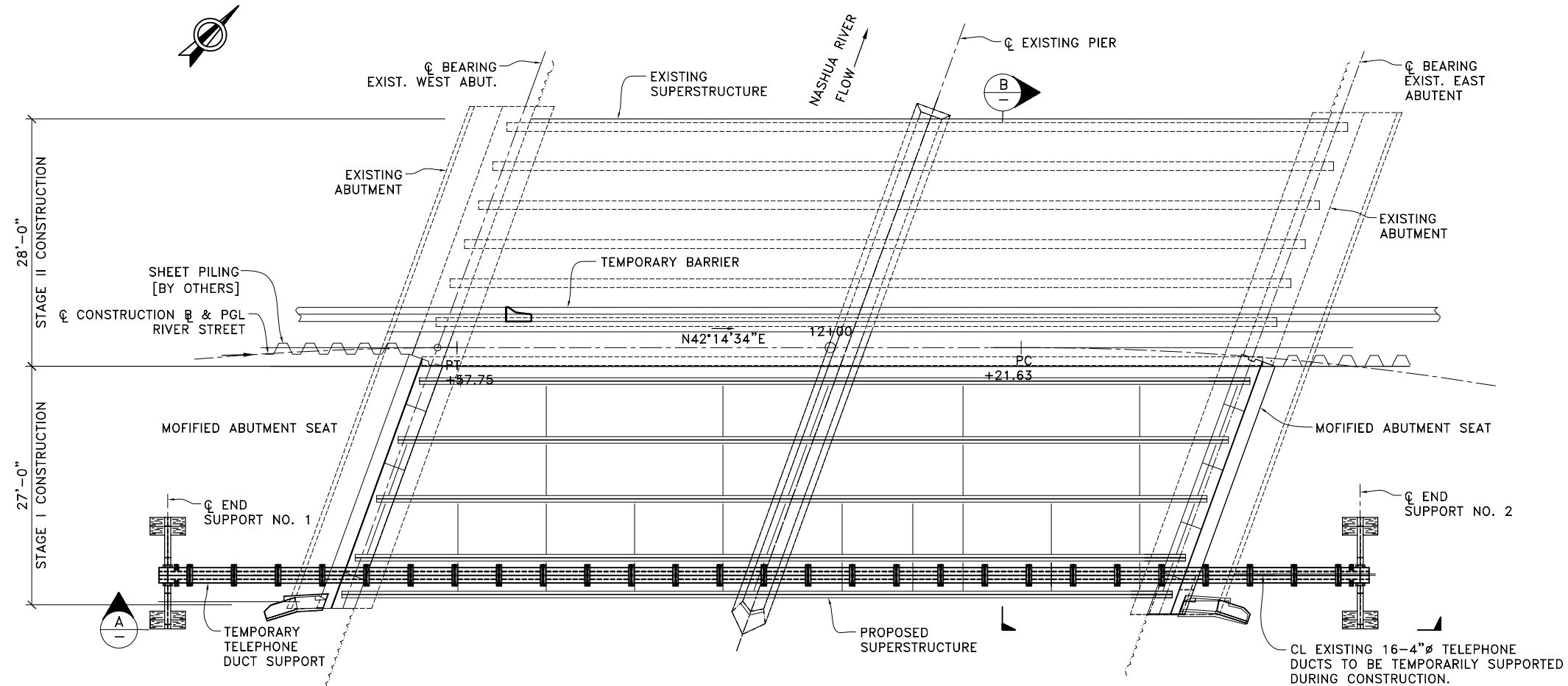
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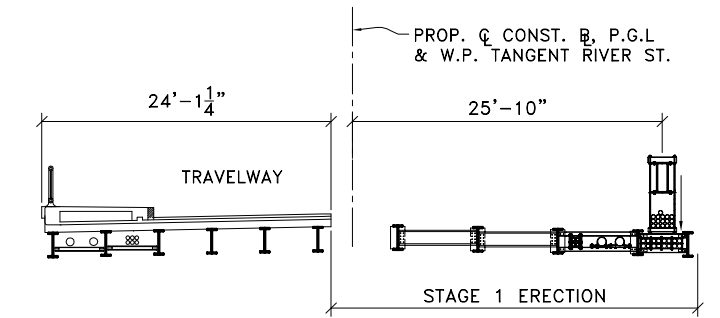
FOR REFERENCE



0	FOR APPROVAL	AE	3/07/11
REV	COMMENTS	BY	DATE
RIVER STREET OVER NORTH NASHUA RIVER IN FITCHBURG, MASSACHUSETTS			
TEMPORARY UTILITY BRIDGE LOCATION PLAN 2			
ANDREW J. ELD, P.E.			
JOB NO. 25-10	OWNER: VERIZON		
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUHGBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285			
CHECKED BY: AE		DATE: 2-06-11	
DRAWN BY: WS		DATE: 2-03-11	
DRAWING NO: 25-10-02		SH. 2 OF 7	

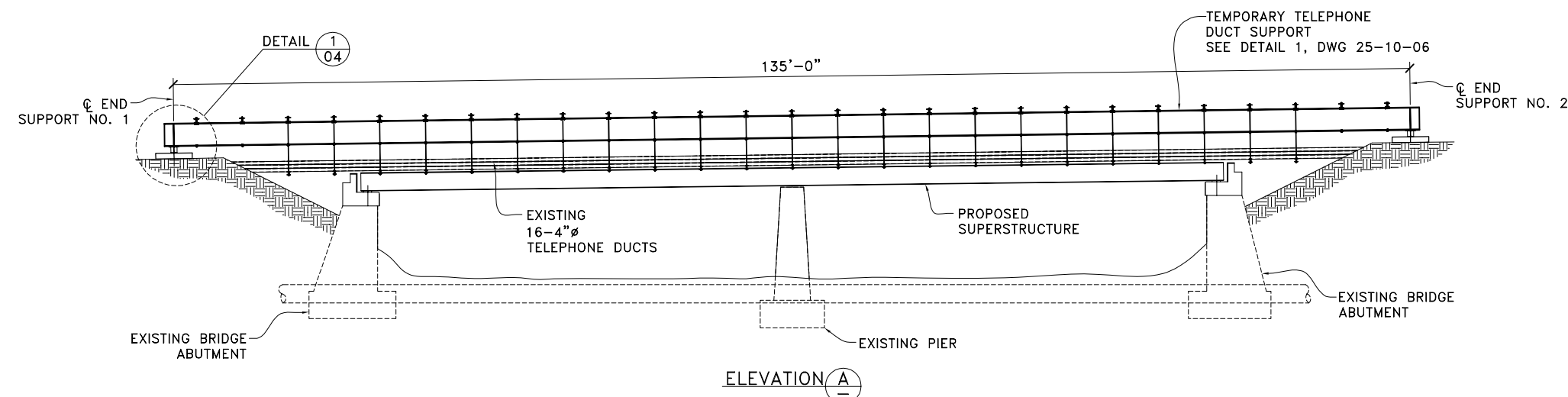


LOCATION PLAN 3
(TEMPORARY UTILITY BRIDGE SHOWN
ABOVE PROPOSED BRIDGE)
STAGE 1 CONSTRUCTION



SECTION B STAGE 1 CONSTRUCTION

FOR REFERENCE



ELEVATION A

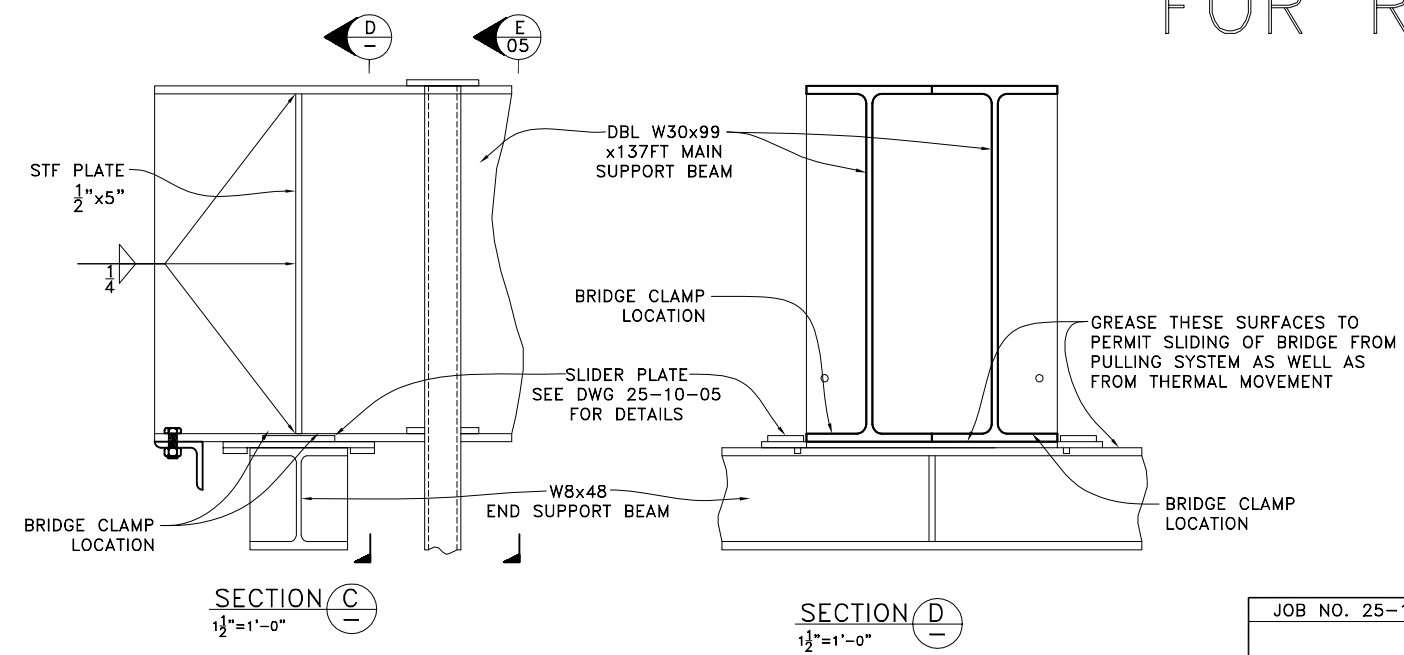
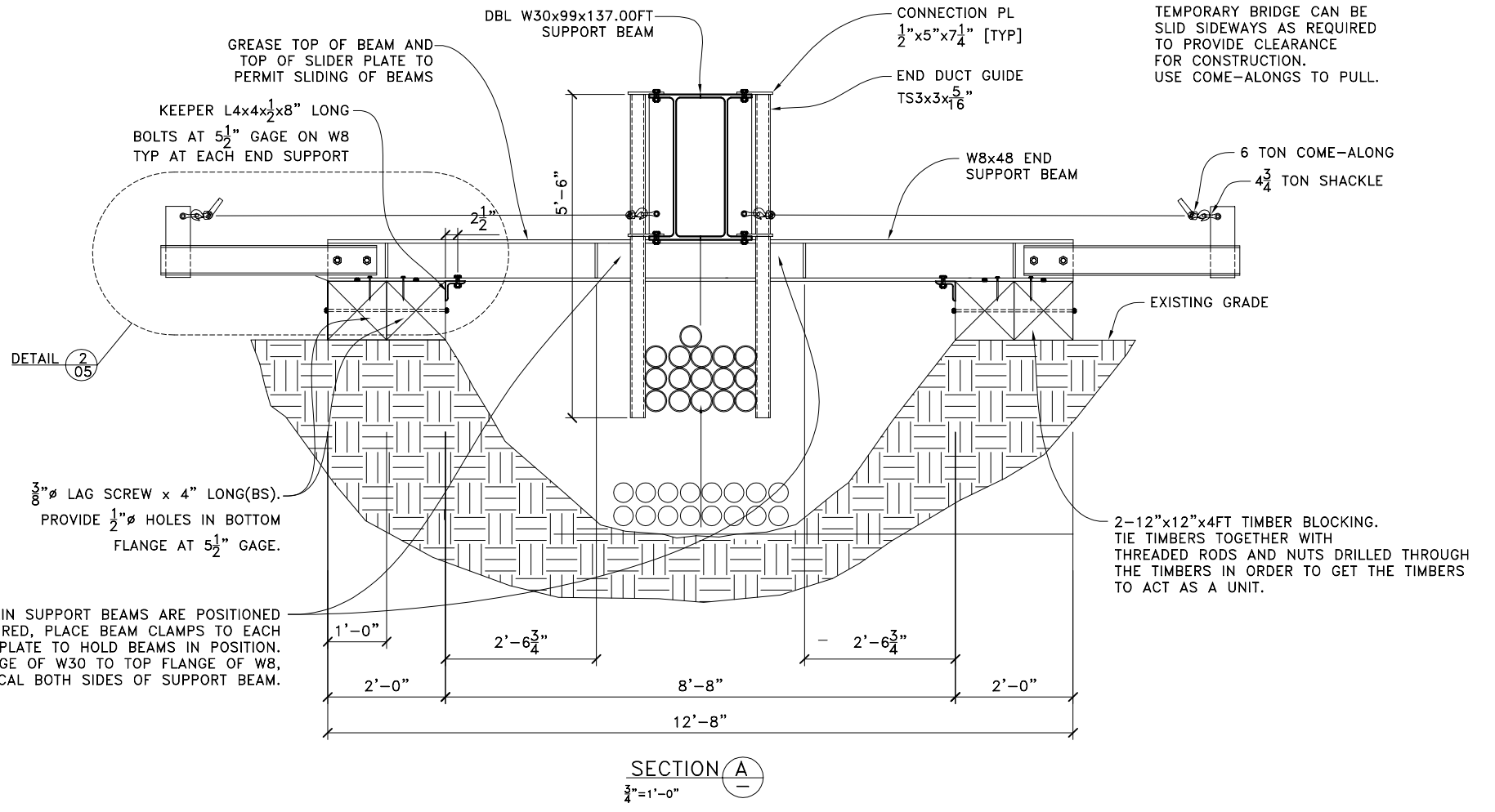
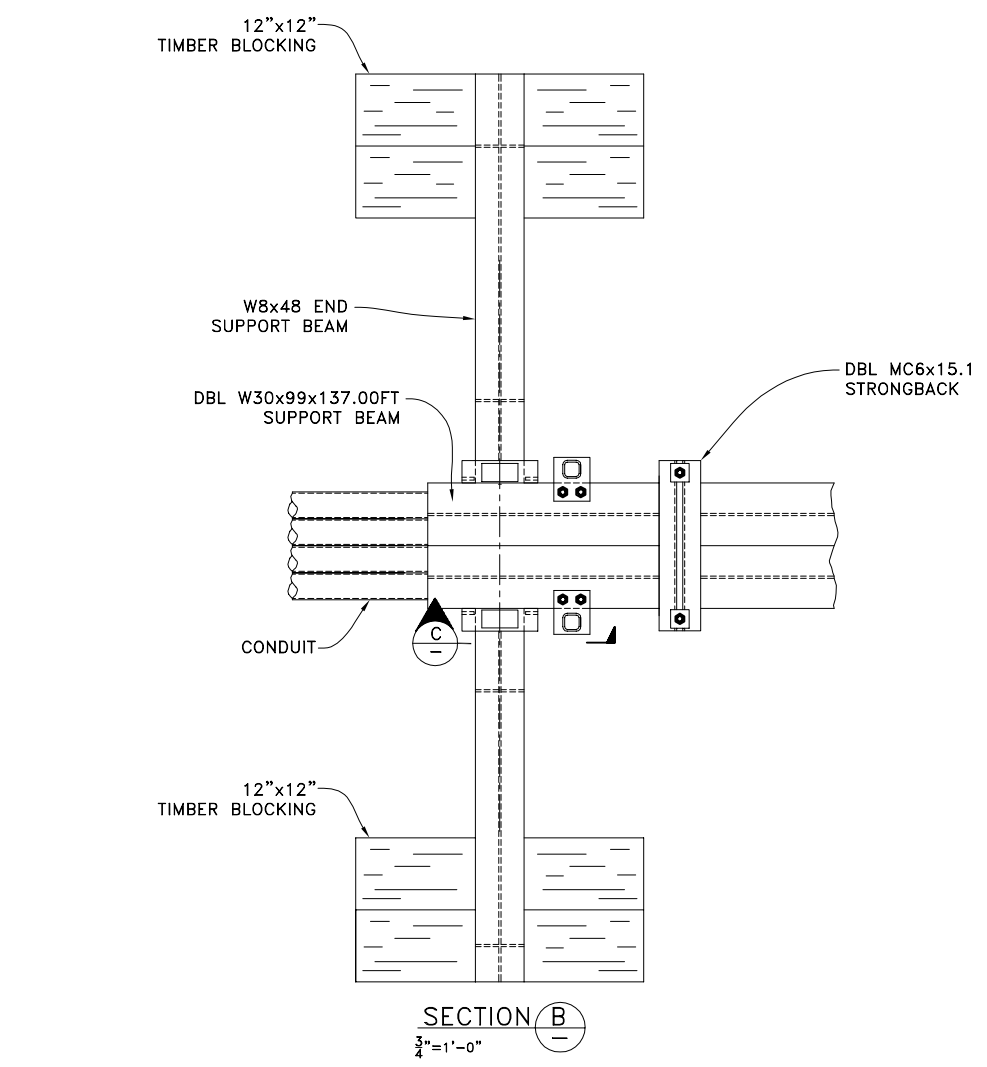
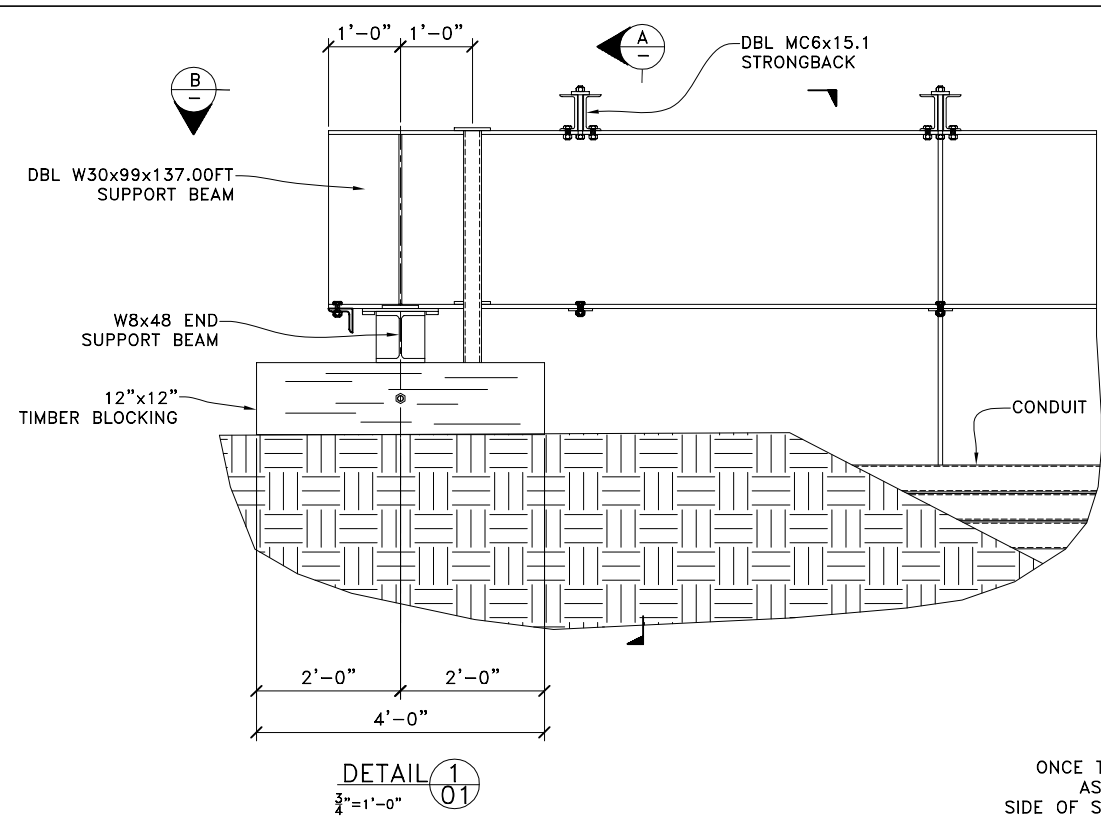
0	FOR APPROVAL	AE	3/07/11
REV	COMMENTS	BY	DATE

RIVER STREET OVER
NORTH NASHUA RIVER
IN FITCHBURG, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE
LOCATION PLAN 3

ANDREW J. ELD, P.E.

JOB NO. 25-10	OWNER: VERIZON
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUHGBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285	
CHECKED BY: AE	DATE: 2-06-11
DRAWN BY: WS	DATE: 2-03-11
DRAWING NO: 25-10-03	SH. 3 OF 7



FOR REFERENCE

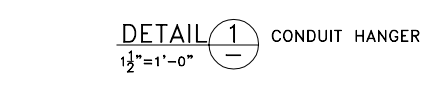
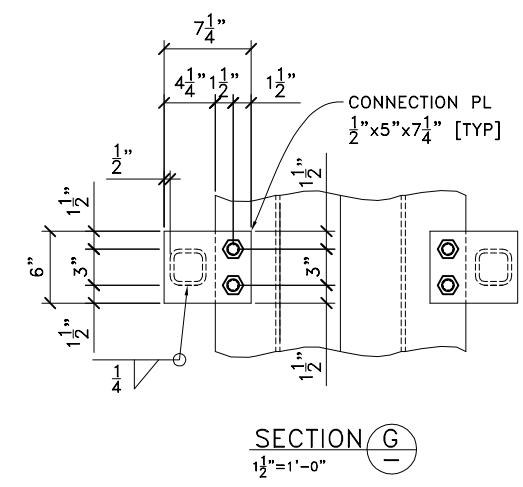
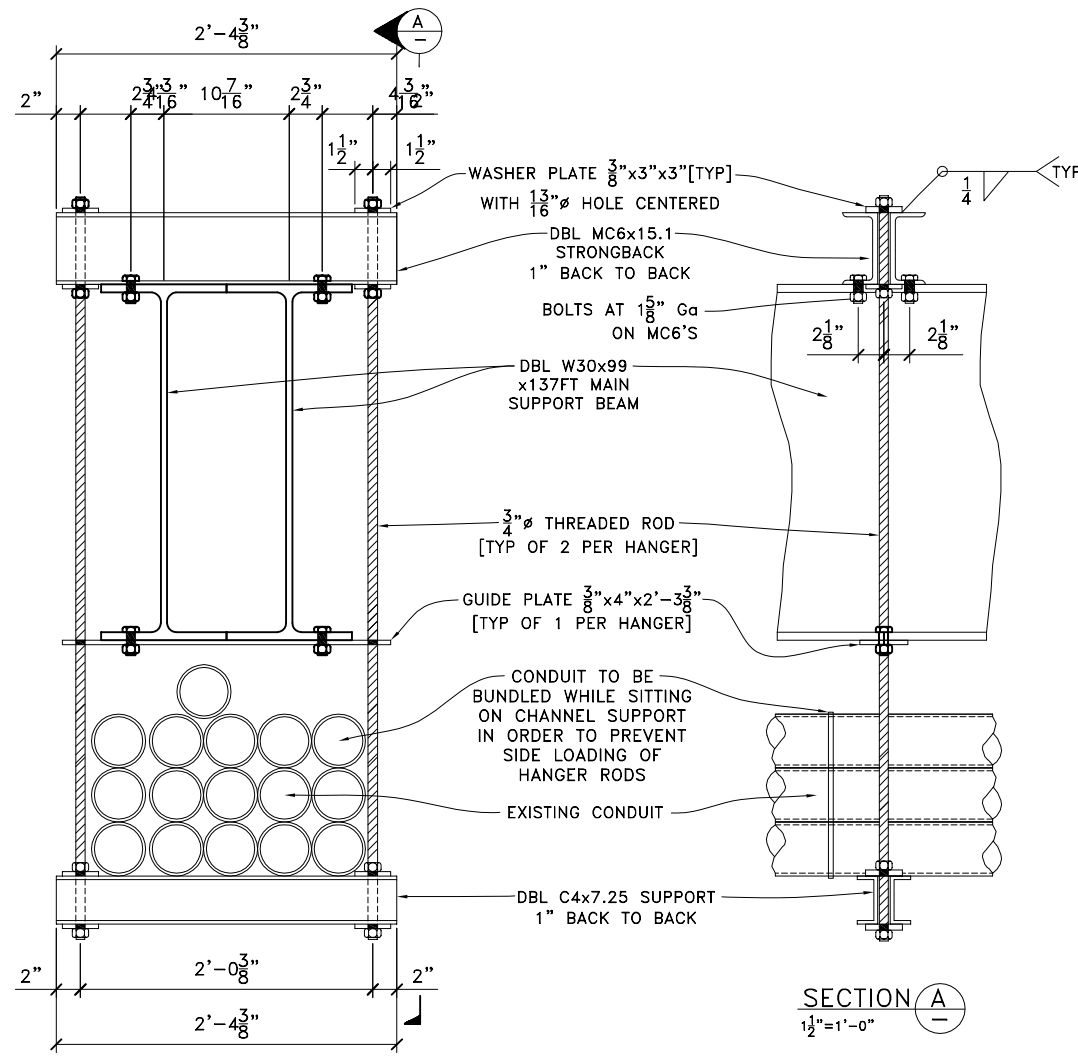
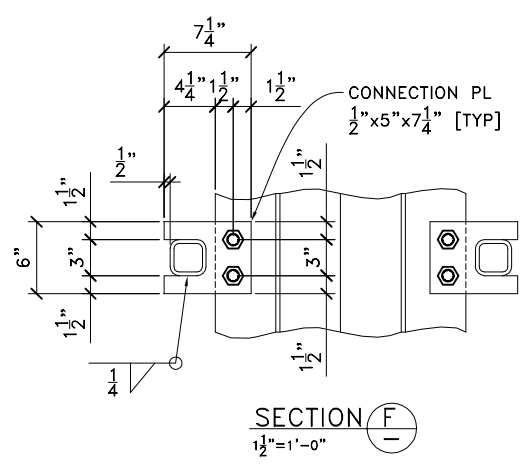
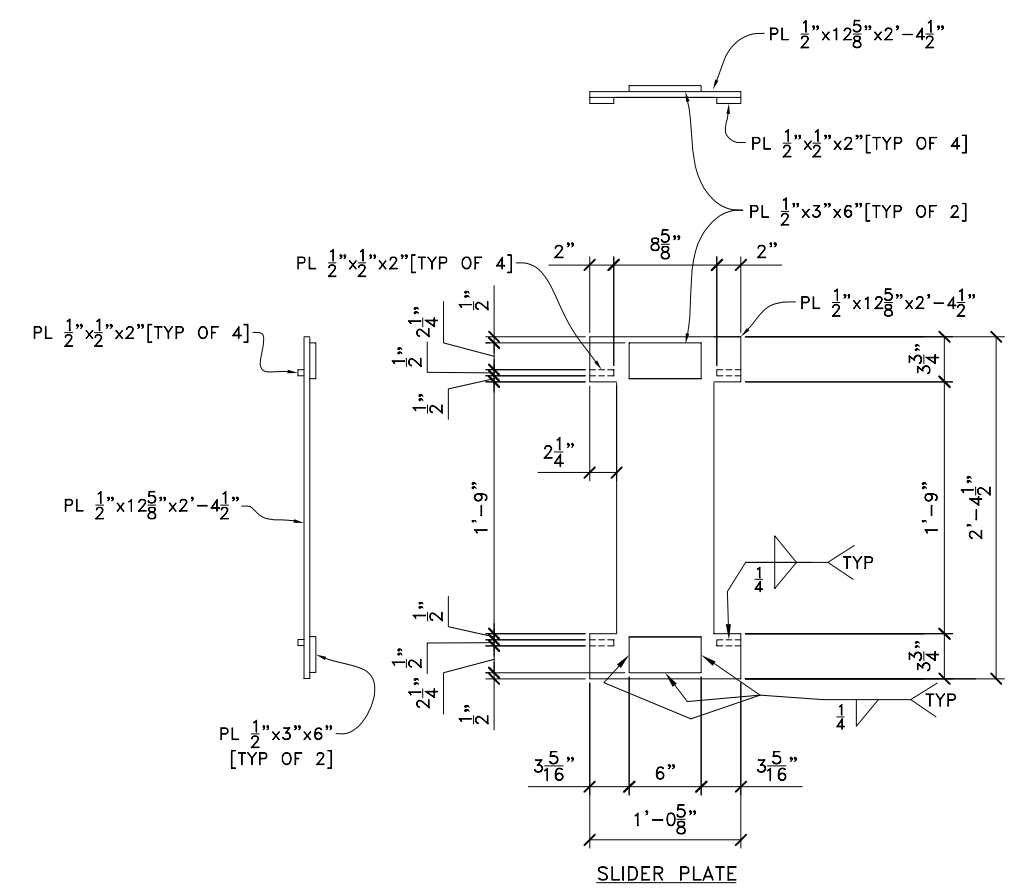
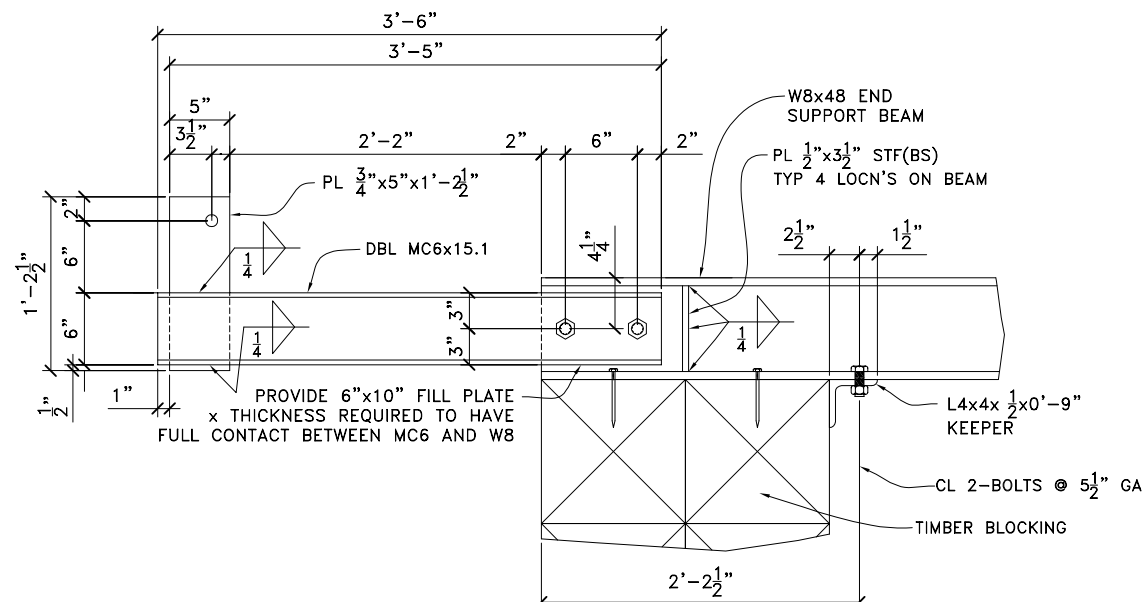
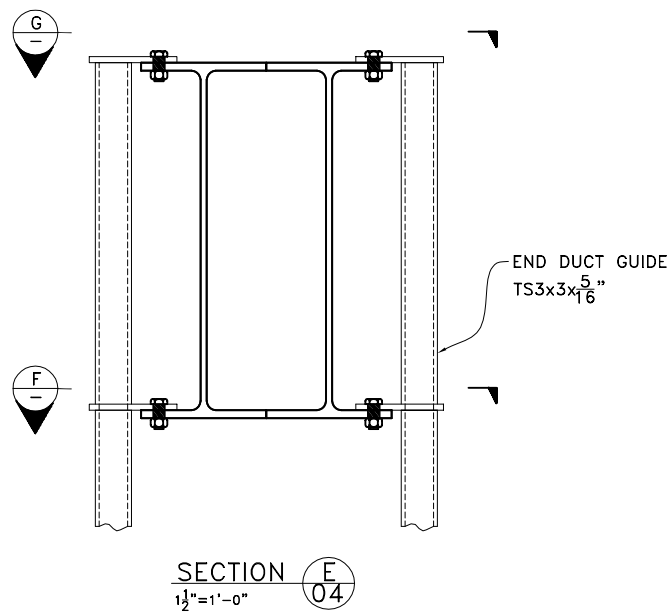
0	FOR APPROVAL	AE	3/07/11
REV	COMMENTS	BY	DATE

RIVER STREET OVER NORTH NASHUA RIVER IN FITCHBURG, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE END SUPPORTS DETAILS 1

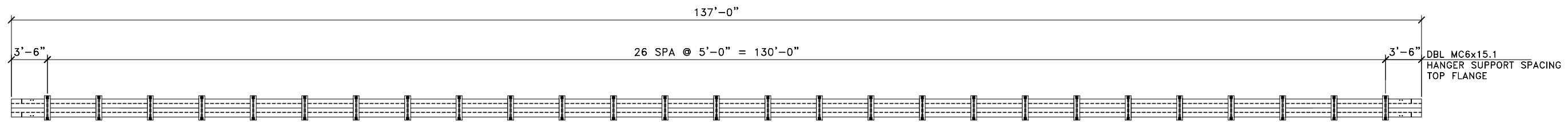
ANDREW J. ELD, P.E.

JOB NO. 25-10	OWNER: VERIZON
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUGHBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285	
CHECKED BY: AE	DATE: 2-06-11
DRAWN BY: WS	DATE: 2-03-11
DRAWING NO: 25-10-04	SH. 4 OF 7

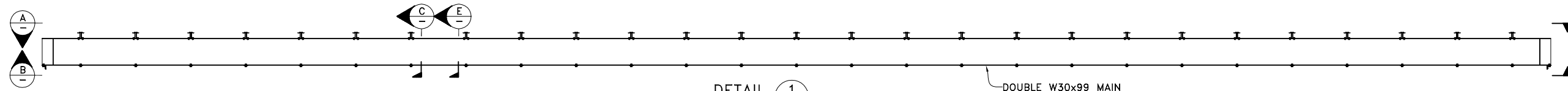


FOR REFERENCE

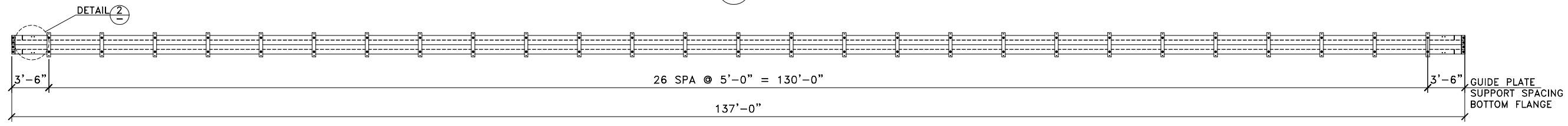
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REV	COMMENTS	BY	DATE
RIVER STREET OVER NORTH NASHUA RIVER IN FITCHBURG, MASSACHUSETTS			
TEMPORARY UTILITY BRIDGE END SUPPORTS DETAILS 2			
ANDREW J. ELD, P.E.			
JOB NO. 25-10	OWNER: VERIZON		
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUGHBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285			
CHECKED BY: AE		DATE: 2-06-11	
DRAWN BY: WS		DATE: 2-03-11	
DRAWING NO: 25-10-05		SH. 5 OF 7	



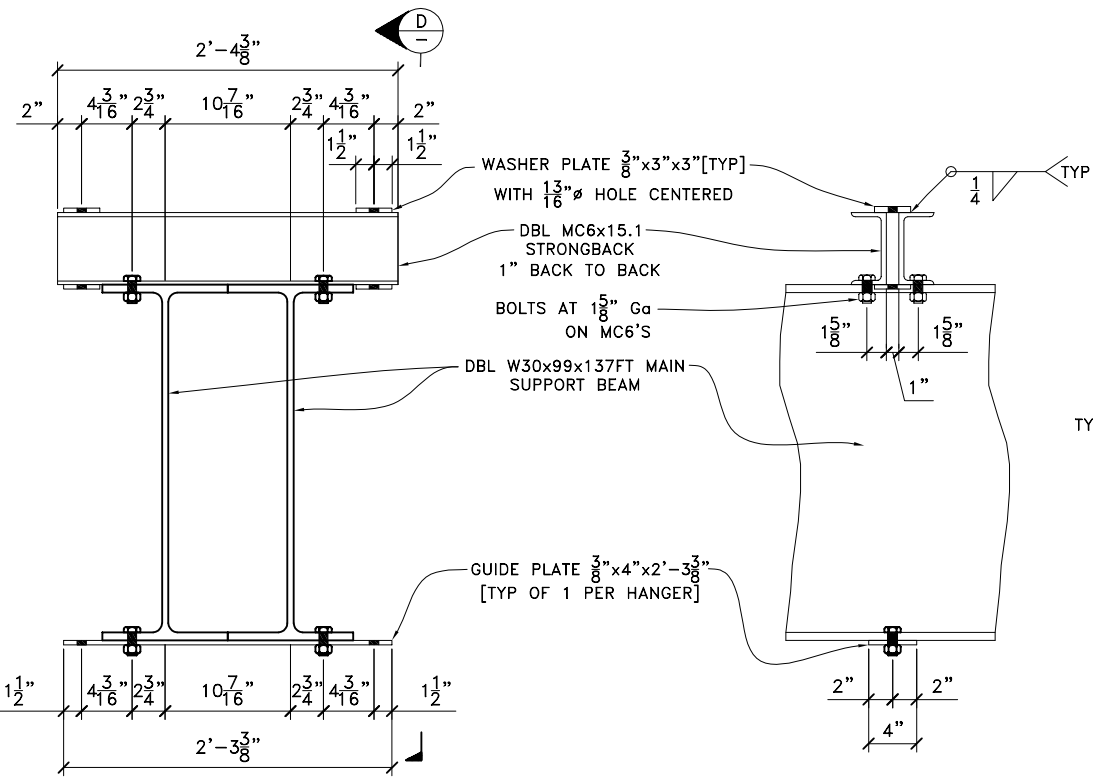
SECTION A



DETAIL 1 SUPPORT BEAM DETAIL

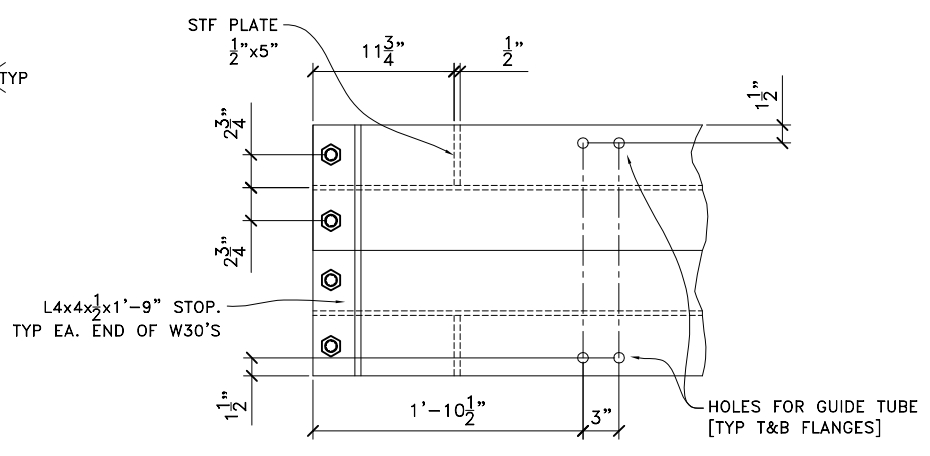


SECTION B



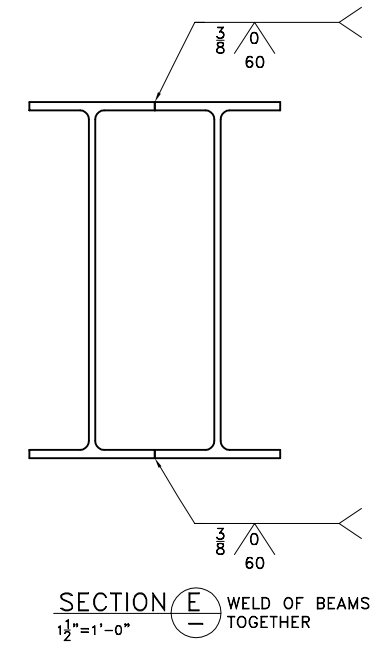
SECTION C CONDUIT HANGER
1 1/2"=1'-0"

SECTION D
1 1/2"=1'-0"



DETAIL 2
1 1/2"=1'-0"

FOR GUIDE: ALL HOLES 1 5/8" HOLES FOR 7/8" A325 BOLTS



SECTION E WELD OF BEAMS TOGETHER
1 1/2"=1'-0"

FOR REFERENCE

0	FOR APPROVAL	AE	3/07/11
REV	COMMENTS	BY	DATE

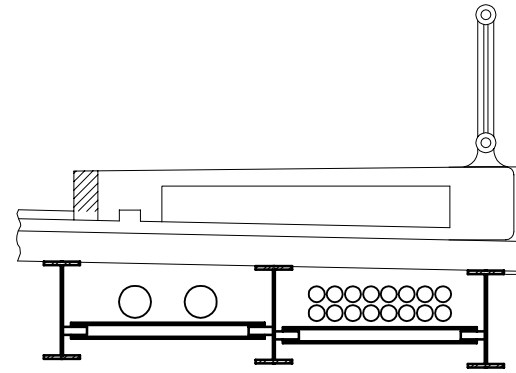
RIVER STREET OVER NORTH NASHUA RIVER IN FITCHBURG, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE MAIN BRIDGE DETAILS

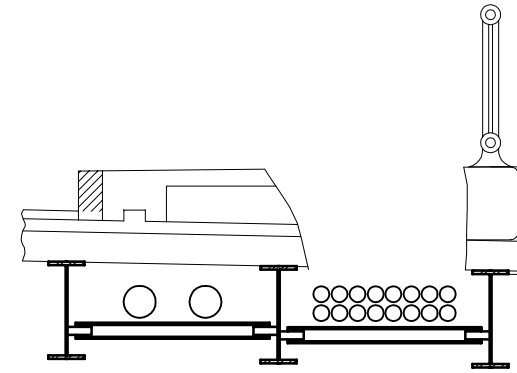
ANDREW J. ELD, P.E.

JOB NO. 25-10	OWNER: VERIZON
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUHGBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285	
CHECKED BY: AE	DATE: 2-06-11
DRAWN BY: WS	DATE: 2-03-11
DRAWING NO: 25-10-06	SH. 6 OF 7

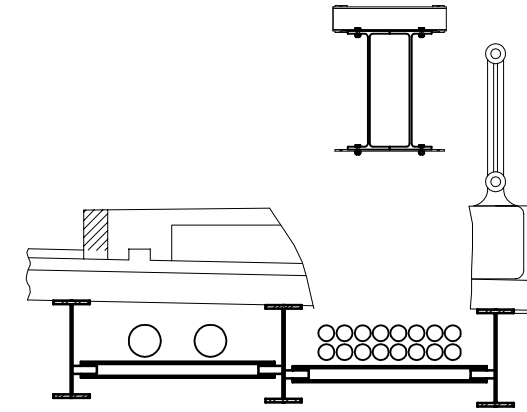
CONSTRUCTION SEQUENCE
 STEP 1: REMOVE FULL LENGTH OF ROADWAY DECK OVER THE EXISTING TELEPHONE DUCTS (BY OTHERS).
 STEP 2: DEMOLISH EXISTING ABUTMENT SEAT AND BACKWALL(BY OTHERS) AS REQUIRED.
 STEP 3: EXCAVATE AS REQUIRED AT BOTH APPROACHES (BY OTHERS) TO THE BOTTOM OF THE EXISTING DUCTS AS REQUIRED TO ENABLE THE CONTRACTOR TO INSTALL END SUPPORTS.
 STEP 4: EXCAVATE AS REQUIRED AT BOTH APPROACHES AT BOTH PROPOSED END SUPPORT LOCATIONS. INSTALL END SUPPORTS. ERECT MAIN SUPPORT BEAMS. SEE DRAWING 25-10-01 FOR DETAILS OF ASSEMBLED UTILITY BRIDGE.
 STEP 5: ASSEMBLE HANGER SUPPORTS TO SUPPORT EXISTING DUCTS AS SHOWN ON DETAIL 1 ON DRAWING 25-10-05. ENCASE EXISTING CABLE INTO NEW DUCT IF REQUIRED. PULL DUCT UP TO TEMPORARY BRIDGE ONTO TEMPORARY HANGER. TEMPORARY HANGER RODS ARE TO BE TIGHTENED UNTIL THE DUCTS ARE FULLY SUPPORTED BY THE TEMPORARY BRIDGE.
 STEP 6: DEMOLISH REMAINING SUPERSTRUCTURE.
 STEP 7: DEMOLISH REMAINING ABUTMENT SEAT AND ROADWAY AS PER THE CONTRACT.
 STEP 8: SLIDE TEMPORARY BRIDGE SIDE TO SIDE IF REQUIRED TO PROVIDE CLEARANCE FOR CONSTRUCTION OF NEW ABUTMENTS.
 STEP 9: ERECT NEW STEEL BEAMS ON EACH SIDE OF THE DUCTS.
 STEP 10: INSTALL PERMANENT TELEPHONE CONDUIT SUPPORTS (DESIGN AND INSTALLATION BY OTHERS).
 STEP 11: LOWER EXISTING CONDUIT UNTIL EXISTING CONDUIT ARE SITTING ON THE PERMANENT CONDUIT SUPPORTS. REMOVE TEMPORARY BRIDGE BEAMS AND END SUPPORTS.
 STEP 12: COMPLETE REMAINING CONTRACT WORK.



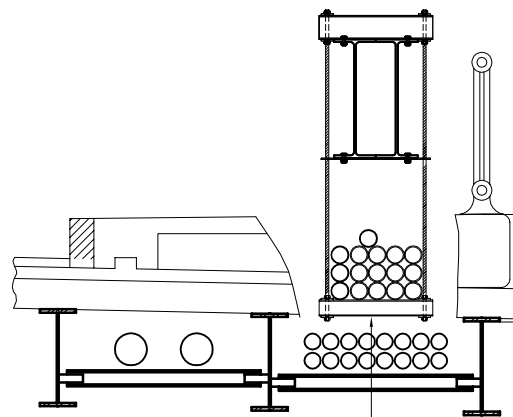
EXISTING CONDITION



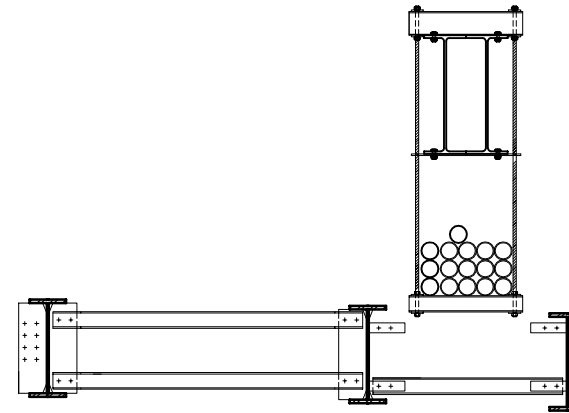
STEP 1



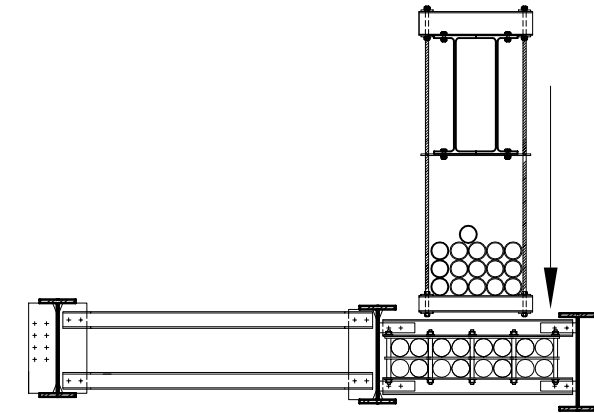
STEP 4



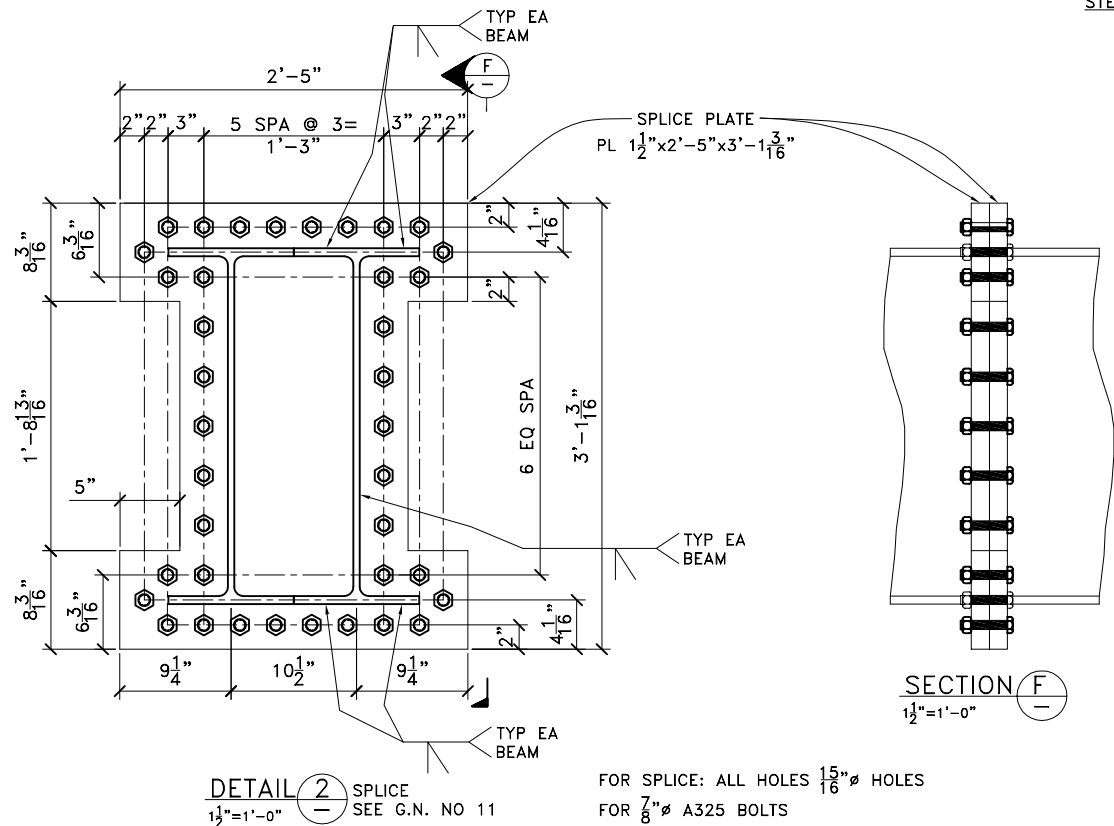
STEP 5



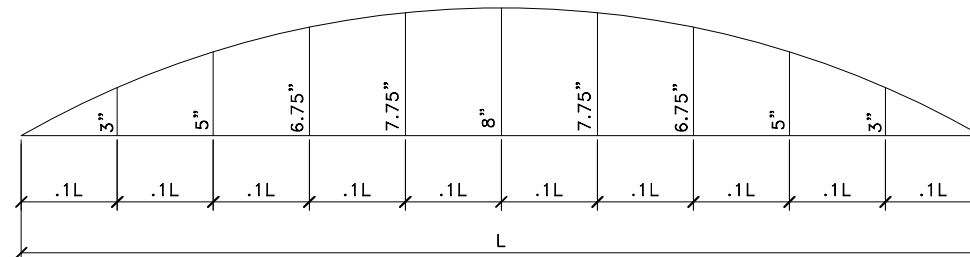
STEP 9 AND 10



STEP 11



FOR REFERENCE



W30x99 CAMBER DIAGRAM

0	FOR APPROVAL	AE	3/07/11
REV	COMMENTS	BY	DATE

RIVER STREET OVER
 NORTH NASHUA RIVER
 IN FITCHBURG, MASSACHUSETTS

TEMPORARY UTILITY BRIDGE
 CONSTRUCTION SEQUENCE

ANDREW J. ELD, P.E.

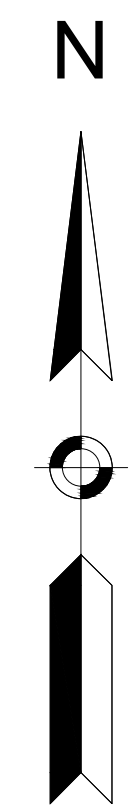
JOB NO. 25-10	OWNER: VERIZON
FURNISHED BY: AMERICAN U-TEL 9760 SMITH ROAD WILLOUHGBY, OHIO 44094 (440)946-6027 FAX:(440)946-7285	
CHECKED BY: AE	DATE: 2-06-11
DRAWN BY: WS	DATE: 2-03-11
DRAWING NO: 25-10-07	SH. 7 OF 7

APPENDIX K

SUBSURFACE UTILITY EXPLORATION (SUE)
PLANS & EXCAVATION SHEETS

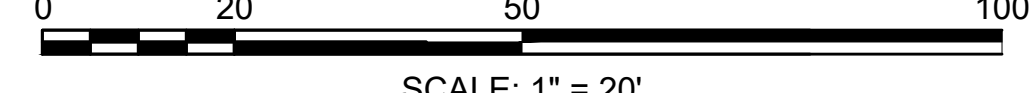
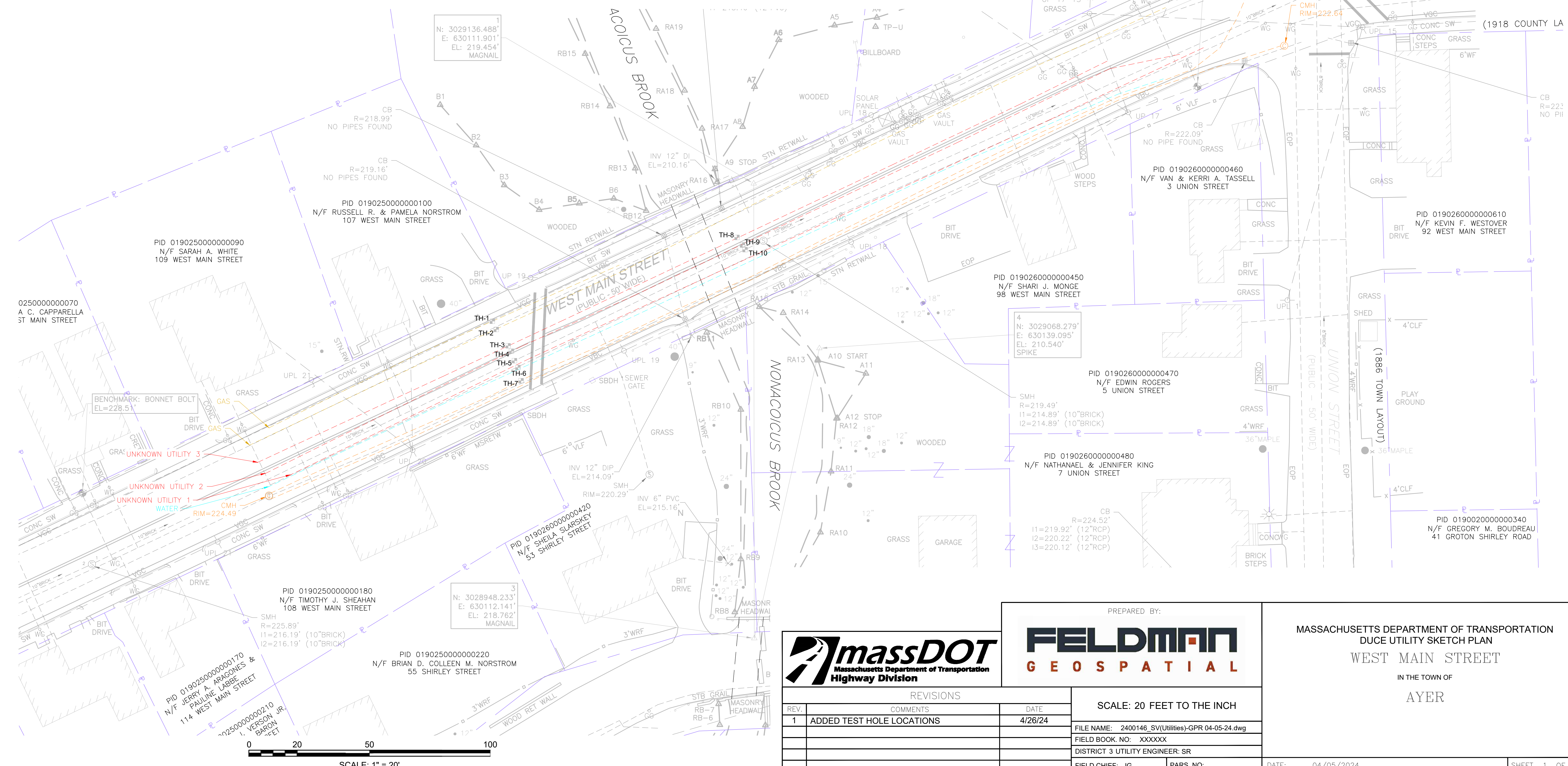
NOTES:

- ELEVATIONS REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). BENCHMARK AND ELEVATION INFORMATION TAKEN FROM FIELD SURVEY PROVIDED BY TIGHE & BOND, DATED FEBRUARY 13, 2024.
- THE INTENT OF THIS PLAN IS TO DEPICT THE RESULTS OF A SUBSURFACE UTILITY ENGINEERING (SUE) INVESTIGATION PERFORMED BY FELDMAN GEOSPATIAL ON MARCH 4, 2024.
- EXISTING CONDITIONS FOR VISUAL REFERENCE ONLY. PLEASE REFER TO EXISTING CONDITIONS PLAN PROVIDED BY TIGHE & BOND, DATED FEBRUARY 13, 2024 (FILE 16-005.01_SV). ALL ELEVATIONS SHOWN REFER TO DATUM AS SHOWN ON 16-005.01_SV REFERENCED ABOVE.
- UTILITY INFORMATION SHOWN IS BASED ON BOTH A FIELD SURVEY AND PLANS OF RECORD. THE LOCATIONS OF UNDERGROUND PIPES AND CONDUITS HAVE BEEN DETERMINED FROM THE AFOREMENTIONED RECORD PLANS AND INTERPRETATIONS OF EM COLLECTED FOR THE PURPOSE OF IDENTIFYING UTILITIES AND ANOMALIES INSIDE THE EXTENTS AND ARE THEREFORE APPROXIMATE ONLY. WE CANNOT ASSUME RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES THAT ARE OMITTED OR INACCURATELY SHOWN ON SAID RECORD PLANS, SINCE SUBSURFACE UTILITIES CANNOT BE VISIBLY VERIFIED. BEFORE PLANNING FUTURE CONNECTIONS, THE PROPER UTILITY ENGINEERING DEPARTMENT SHOULD BE CONSULTED AND THE ACTUAL LOCATION OF SUBSURFACE STRUCTURES SHOULD BE DETERMINED IN THE FIELD. CALL, TOLL FREE, THE DIG SAFE CALL CENTER AT 1-888-344-7233 SEVENTY-TWO HOURS PRIOR TO EXCAVATION.
- ALL INFORMATION PROVIDED IS A RESULT OF A QLD-QLB INVESTIGATION, THIS IS MEANT TO AUGMENT AND FURTHER THE RECORD INFORMATION THAT WAS PREVIOUSLY AVAILABLE WHILE FOLLOWING THE ASCE 38-22 STANDARDS. THIS DOES NOT GUARANTEE THAT EVERY UTILITY (ACTIVE OR ABANDONED) IS PLOTTED. SHOULD MORE VERIFICATION OF THE AREA BE NEEDED, QLA (VACUUM EXCAVATION) IS AVAILABLE.
- GPR IS AN INDIRECT METHOD. GPR-IDENTIFIED POTENTIAL UTILITIES HAVE BEEN CATEGORIZED AS TO TYPE BASED ON THE APPEARANCE OF ANOMALOUS REFLECTIONS AND WITH THE ASSUMPTION THAT CONVENTIONAL UTILITY BURIAL DEPTHS WERE USED THROUGHOUT THE SITE. PLEASE NOTE THAT GROUND TRUTHING (QLA) IS REQUIRED TO CONFIRM THE NATURE OF GPR-IDENTIFIED UTILITIES.
- GPR DEPTH ESTIMATES ARE CALCULATED FROM TWO-WAY TRAVEL TIME CONVERSIONS USING SITE-SPECIFIC OBSERVATIONS OF VELOCITY AND ARE APPROXIMATE.
- THIS DOCUMENT IS AN INSTRUMENT OF SERVICE OF FELDMAN GEOSPATIAL ISSUED TO OUR CLIENT FOR PURPOSES RELATED DIRECTLY AND SOLELY TO FELDMAN GEOSPATIAL'S SCOPE OF SERVICES UNDER CONTRACT TO OUR CLIENT FOR THIS PROJECT. ANY USE OR REUSE OF THIS DOCUMENT FOR ANY REASON BY ANY PARTY FOR PURPOSES UNRELATED DIRECTLY AND SOLELY TO SAID CONTRACT SHALL BE AT THE USER'S SOLE AND EXCLUSIVE RISK AND LIABILITY, INCLUDING LIABILITY FOR VIOLATION OF COPYRIGHT LAWS, UNLESS WRITTEN CONSENT IS PROVIDED BY FELDMAN GEOSPATIAL.



AYER WEST MAIN STREET			
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	#####	1	2
PROJECT FILE NO.		#####	

UTILITIES



MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
DUCE UTILITY SKETCH PLAN
WEST MAIN STREET
IN THE TOWN OF
AYER

REV.	COMMENTS	DATE
1	ADDED TEST HOLE LOCATIONS	4/26/24

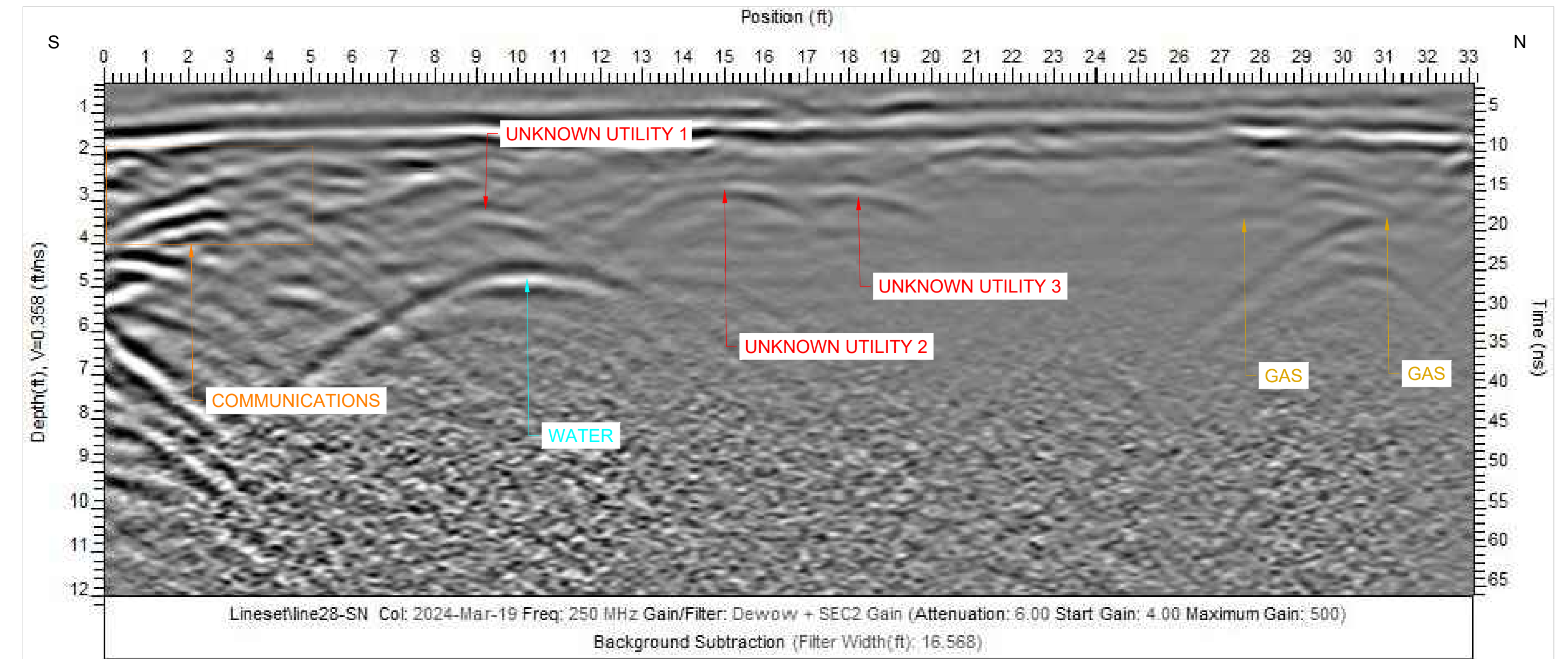
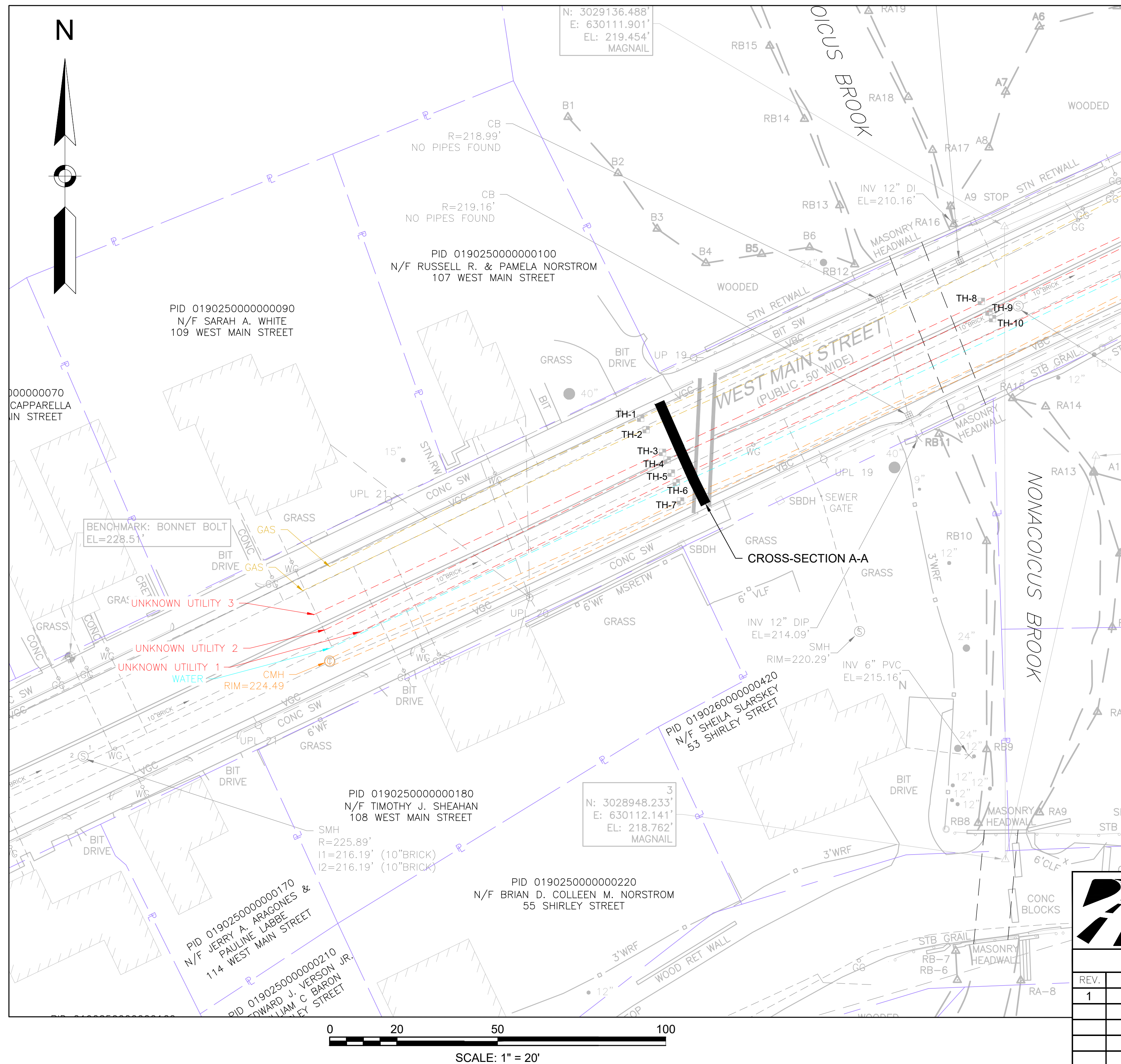
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FILE NAME: 2400146_SV(Utilities)-GPR 04-05-24.dwg
FIELD BOOK NO: XXXXXX
DISTRICT 3 UTILITY ENGINEER: SR
FIELD CHIEF: JG

NOTES:

- ELEVATIONS REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88). BENCHMARK AND ELEVATION INFORMATION TAKEN FROM FIELD SURVEY PROVIDED BY TIGHE & BOND, DATED FEBRUARY 13, 2024.
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AYER WEST MAIN STREET			
STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	#####	2	2
PROJECT FILE NO.		#####	

UTILITIES



MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
DUCE UTILITY SKETCH PLAN
WEST MAIN STREET
IN THE TOWN OF
AYER

REV.	COMMENTS	DATE
1	ADDED TEST HOLE LOCATIONS	4/26/24

SCALE: 20 FEET TO THE INCH	
FILE NAME:	2400146_SV(Utilities)-GPR 04-05-24.dwg
FIELD BOOK NO.:	XXXXXX
DISTRICT 3 UTILITY ENGINEER:	SR
FIELD CHIEF:	JG
PARS. NO.:	

QL-A VACUUM EXCAVATION SHEET
ENGLISH UNITS

Test Hole # 1 Date: 04-19-2024

Client: Hoyle&Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street Shoulder (103 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: 4.00 IN Black Metal Gas Pipe

Utility Owner: National Grid Observed Condition: Good Paint: Yellow

Surface Elevation at Survey Mark: 220.80 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 217.80 FT Utility Bottom Elevation: ---

Utility Top Depth from Surface: 3.00 FT Utility Bottom Depth from Surface: ---

Benchmark Description: Storm Drain Catch Basin Elevation: 218.99 FT Type: Found on Print

Benchmark #2 (if avail): --- Elevation: --- Type: ---

Surface Covering: Asphalt Asphalt: 8.00 IN Concrete: --- Duct Bank Type (if needed): ---

Generalized Soil Profile: Sandy, Rocky Backfill Compaction Test (if required): Pass

Approximate Latitude, Longitude: 42.55990959242224, -71.59713378182761 (Coordinates shown are resource grade only.)

UTILITY IN TEST HOLE



TEST HOLE PHOTOS

TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



QL-A VACUUM EXCAVATION SHEET
ENGLISH UNITS

Test Hole # 2 Date: 04-19-2024

Client: Hoyle & Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street (103 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: 8.00 IN Black Metal Gas Pipe

Utility Owner: National Grid Observed Condition: Good Paint: Yellow

Surface Elevation at Survey Mark: 220.87 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 217.84 FT Utility Bottom Elevation: ---

Utility Top Depth from Surface: 3.03 FT Utility Bottom Depth from Surface: ---

Benchmark Description: Storm Drain Catch Basin Elevation: 218.99 FT Type: Found on Print

Benchmark #2 (if avail.): --- Elevation: --- Type: ---

Surface Covering: Asphalt Asphalt: 8.00 IN Concrete: --- Duct Bank Type (if needed): ---

Generalized Soil Profile: Rocky, Sandy Backfill Compaction Test (if required): Pass

Approximate Latitude, Longitude: 42.55987548828125, -71.59708281985633 (Coordinates shown are resource grade only.)

UTILITY IN TEST HOLE



TEST HOLE PHOTOS

TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



PILOT HOLE EXCAVATION SHEET

ENGLISH UNITS

Test Hole #: 3

Date: 04-19-2024

Client: Hoyle & Tanner

City: Ayer

County: Middlesex

State: MA

Road: W Main Street

General Location: W Main Street (107 W Main Street)

Crew: C. Morgan

Truck: S - 161

Permit #: Town of Ayer - PWD

EXCAVATION INFORMATION

Excavation Type: No Utility Found - Empty Hole

Location Determined by: Dug on Marks by Others

Intended Utility: Unknown

Excavation Marker: Paint

Surface Covering: Asphalt

EXCAVATION DIMENSIONS:

Length: 2.0 ft

Width: 2.0 ft

Cleared Depth: 6.5 ft

Probe Depth: 7.0 ft

Hole Stopped Due to: Depth given by client was reached.

Refusal Type (if any): The crew experienced hard ground (rock) conditions passed expected utility depth.

The crew excavated to the designated depth given without encountering any utilities and clearing to a depth of 6.5' deep.

Field Notes (if needed):

Latitude / Longitude: 42.5598616479361, -71.59727015539221

EXCAVATION PHOTOS



PILOT HOLE EXCAVATION SHEET

ENGLISH UNITS

Test Hole #: 4

Date: 04-18-2024

Client: Hoyle & Tanner

City: Ayer

County: Middlesex

State: MA

Road: W Main Street

General Location: W Main Street (107 W Main Street)

Crew: C. Morgan

Truck: S - 161

Permit #: Town of Ayer - PWD

EXCAVATION INFORMATION

Excavation Type: No Utility Found - Empty Hole

Location Determined by: Dug on Marks by Others

Intended Utility: Unknown

Excavation Marker: Paint

Surface Covering: Asphalt

EXCAVATION DIMENSIONS:

Length: 2.0 ft

Width: 1.0 ft

Cleared Depth: 6.0 ft

Probe Depth: 7.0 ft

Hole Stopped Due to: Depth given by client was reached.

Refusal Type (if any): The crew experienced hard ground (rock) conditions passed expected utility depth.

The crew excavated to the designated depth given without encountering any utilities and clearing to a depth of 6' deep.

Field Notes (if needed):

Latitude / Longitude: 42.5598616479361, -71.59727015539221

EXCAVATION PHOTOS



QL-A VACUUM EXCAVATION SHEET

ENGLISH UNITS

Test Hole # 5

Date: 04-18-2024

Client: Hoyle & Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street Shoulder (103 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: Unknown (Size) Gray Concrete Sanitary Sewer Unknown (Structure)

Utility Owner: Town of Ayer Observed Condition: Good - Referenced Paved Over Manhole Paint: Green

Surface Elevation at Survey Mark: 225.45 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 220.48 FT Utility Bottom Elevation: ---

Utility Top Depth from Surface: 4.97 FT Utility Bottom Depth from Surface: ---

Benchmark Description: Sanitary Sewer Manhole Elevation: 220.29 FT Type: Found on Print

Benchmark #2 (if avail): --- Elevation: --- Type: ---

Surface Covering: Asphalt, Concrete Asphalt: 4.00 IN Concrete: 8.00 IN Duct Bank Type (if needed): ---

Generalized Soil Profile: Rocky, Sandy Backfill Compaction Test (if required): Pass

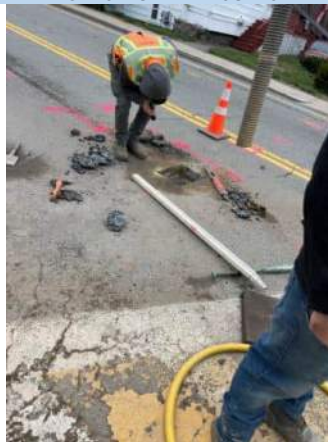
Approximate Latitude, Longitude: 42.55983340092241, -71.59706412821225 (Coordinates shown are resource grade only.)

UTILITY IN TEST HOLE



TEST HOLE PHOTOS

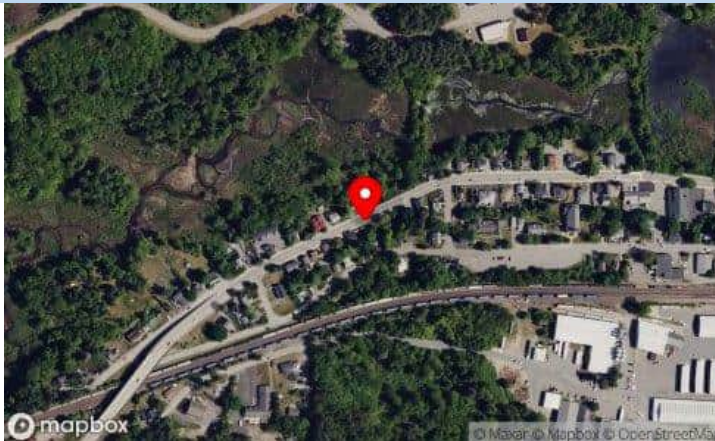
TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



QL-A VACUUM EXCAVATION SHEET

ENGLISH UNITS

Test Hole # 6

Date: 04-18-2024

Client: Hoyle & Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street Shoulder (103 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: 12.00 IN Black Metal Water Pipe

Utility Owner: Town of Ayer Observed Condition: Good Paint: Blue

Surface Elevation at Survey Mark: 222.37 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 217.91 FT Utility Bottom Elevation: ---

Utility Top Depth from Surface: 4.46 FT Utility Bottom Depth from Surface: ---

Benchmark Description: Sanitary Sewer Manhole Elevation: 220.29 FT Type: Found on Print

Benchmark #2 (if avail): --- Elevation: --- Type: ---

Surface Covering: Asphalt, Concrete Asphalt: --- Concrete: --- Duct Bank Type (if needed): ---

Generalized Soil Profile: Sandy, Rocky Backfill Compaction Test (if required): Pass

Approximate Latitude, Longitude: 42.55984194226603, -71.59708910145194 (Coordinates shown are resource grade only.)

UTILITY IN TEST HOLE



TEST HOLE PHOTOS

TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



QL-A VACUUM EXCAVATION SHEET
ENGLISH UNITS

Test Hole # 7 Date: 04-18-2024

Client: Hoyle & Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street Shoulder (103 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: 36.00 IN Gray Concrete Communications Duct Bank

Utility Owner: Verizon Observed Condition: Good Paint: Orange

Surface Elevation at Survey Mark: 222.33 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 219.66 FT Utility Bottom Elevation: 218.99 FT

Utility Top Depth from Surface: 2.67 FT Utility Bottom Depth from Surface: 3.34 FT

Benchmark Description: Sanitary Sewer Manhole Elevation: 220.29 FT Type: Found on Print

Benchmark #2 (if avail.): --- Elevation: --- Type: ---

Surface Covering: Asphalt, Concrete Asphalt: 6.00 IN Concrete: 8.00 IN Duct Bank Type (if needed): Rough Pour

Generalized Soil Profile: Sandy Backfill Compaction Test (if required): Pass

Approximate Latitude, Longitude: 42.55986363870417, -71.59703686659998 (Coordinates shown are resource grade only.)

UTILITY IN TEST HOLE



TEST HOLE PHOTOS

TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



PILOT HOLE EXCAVATION SHEET

ENGLISH UNITS

Test Hole #: 8

Date: 04-19-2024

Client: Hoyle & Tanner

City: Ayer

County: Middlesex

State: MA

Road: W Main Street

General Location: W Main Street (101 W Main Street)

Crew: C. Morgan

Truck: S - 161

Permit #: Town of Ayer - PWD

EXCAVATION INFORMATION

Excavation Type: No Utility Found - Empty Hole

Location Determined by: Dug on Marks by Others

Intended Utility: Unknown

Excavation Marker: Paint

Surface Covering: Asphalt

EXCAVATION DIMENSIONS:

Length: 2.0 ft Width: 2.0 ft Cleared Depth: 7.0 ft Probe Depth: 7.5 ft

Hole Stopped Due to: Depth given by client was reached.

Refusal Type (if any): The crew experienced hard ground (rock) conditions passed expected utility depth.

The crew excavated to the designated depth given without encountering any utilities and clearing to a depth of 7.0' deep.

Field Notes (if needed):

Latitude / Longitude: 42.56005859375, -71.59681904136352

EXCAVATION PHOTOS



QL-A VACUUM EXCAVATION SHEET
ENGLISH UNITS

Test Hole # 9 Date: 04-19-2024

Client: Hoyle & Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street Shoulder (98 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: 12.00 IN Gray Concrete Unknown (Utility) Duct Bank

Utility Owner: Possible Fort Devens Observed Condition: Good - Potential Old Comm Line - Reported As Unknown Paint: Pink

Surface Elevation at Survey Mark: 220.01 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 215.77 FT Utility Bottom Elevation: Exposed One Side & Top Only

Utility Top Depth from Surface: 4.24 FT Utility Bottom Depth from Surface: Exposed One Side & Top Only

Benchmark Description: Storm Drain Catch Basin Elevation: 218.99 FT Type: Found on Print

Benchmark #2 (if avail): --- Elevation: --- Type: ---

Surface Covering: Asphalt Asphalt: 6.00 IN Concrete: 8.00 IN Duct Bank Type (if needed): Formed Concrete

Generalized Soil Profile: Rocky, Sandy Backfill Compaction Test (if required): Pass

Approximate Latitude, Longitude: 42.56002807617188, -71.59680042696283 (Coordinates shown are resource grade only.)

UTILITY IN TEST HOLE



TEST HOLE PHOTOS

TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



QL-A VACUUM EXCAVATION SHEET
ENGLISH UNITS

Test Hole # 10 Date: 04-19-2024

Client: Hoyle & Tanner City: Ayer County: Middlesex State: MA

Road: W Main Street Project Location: W Main Street Shoulder (101 W Main Street)

Crew: C. Morgan Truck: S - 161 Permit: Town of Ayer - PWD

TEST HOLE DATA

Utility Description: 12.00 IN Gray Metal Sanitary Sewer Pipe

Utility Owner: Hoyle & Tanner Observed Condition: Good Paint: Green

Surface Elevation at Survey Mark: 220.01 FT Survey Marker at Hole: PK Nail

Utility Top Elevation: 216.21 FT Utility Bottom Elevation: ---

Utility Top Depth from Surface: 3.80 FT Utility Bottom Depth from Surface: ---

Benchmark Description: Storm Drain Catch Basin Elevation: 218.99 FT Type: Found on Print

Benchmark #2 (if avail): --- Elevation: --- Type: ---

Surface Covering: Asphalt Asphalt: 6.00 IN Concrete: 8.00 IN Duct Bank Type (if needed): ---

Generalized Soil Profile: Sandy Backfill Compaction Test (if required): Pass

Approximate Latitude, Longitude: 42.56002807617188, -71.59678714351784 (Coordinates shown are resource grade only.)

TEST HOLE PHOTOS

UTILITY IN TEST HOLE



TEST HOLE GENERAL LOCATION



RESTORATION



APPROXIMATE TEST HOLE LOCATION



APPENDIX L

HYDRAULIC STUDY REPORT
(PREPARED BY HOYLE, TANNER & ASSOCIATES)

April 22, 2019



Pease International Tradeport
100 International Drive, Suite 360
Portsmouth, New Hampshire 03801
603-431-2520
603-431-8067 fax
www.hoyletanner.com

Mr. Bill Mertz, PE
Vice President
WorldTech Engineering, LLC
300 TradeCenter, Suite 5580
Woburn, Massachusetts 01801

RE: West Main Street Bridge, over Nonacoicus Brook – Ayer, MA
Bridge No. A-19-014 (79A)
Hydraulic Study Report, Revision 2
Hoyle, Tanner Project No. 924001

Dear Bill:

Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner) herein submits to WorldTech Engineering, LLC (WorldTech), the Hydraulic Study Report, revised per MassDOT's comments dated February 7, 2019, presenting the hydraulic studies for the proposed bridge replacement project of the West Main Street Bridge crossing over Nonacoicus Brook in Ayer, Massachusetts. In accordance with the agreement between WorldTech and Hoyle, Tanner, the objectives of this report are to present hydraulic analysis and scour/stability analysis for the proposed structure and ultimately provide recommendations, as necessary.

We trust that this letter meets your expectations. Please feel free to contact me at (603) 431-2520 extension 23, or at alachance@hoyletanner.com, if you have any questions or require additional information regarding these findings.

Sincerely,

Hoyle, Tanner & Associates, Inc.

A handwritten signature in black ink that reads "Aaron Lachance". The signature is fluid and cursive.

Aaron Lachance, PE
Senior Structural Engineer / Associate

Enclosures

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1. Executive Summary

1.1. Purpose

The purpose of this report is to present the results of a study conducted at the subject bridge site to evaluate the hydraulic performance of the replacement alternative considered in the Preliminary Design Report. This investigation was conducted in a manner consistent with American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Department of Transportation (MassDOT) guidelines for preparation of hydraulic studies at bridge sites.

1.2. Scope

The scope of work for this investigation consisted of review of pertinent hydrologic and hydraulic data for Nonacoicus Brook at the project site, and a detailed hydraulic analysis. Data collected and hydraulic model computer input/output are presented in the appendices of this report. A narrative discussion of the problem statement, engineering methods, as well as results and conclusions of the hydraulic study follow.

1.3. Executive Summary

Hoyle, Tanner proposes to replace the existing single-span bridge that is conveying West Main Street over Nonacoicus Brook in the Town of Ayer, Massachusetts. The existing bridge has an AASHTO sufficiency rating of 17.0 and a National Bridge Inspection Standards (NBIS) Item 113 (Scour Critical Bridges) of 6, scour calculation/evaluation has not been made as part of NBIS review; field review indicates scour is evident and action is required to protect foundations.

Hoyle, Tanner proposes to replace the existing structure with a three-sided concrete rigid frame supported on spread footings.

Nonacoicus Brook has been studied in the 1982 National Flood Insurance Program (NFIP) Flood Insurance Study (FIS) for Middlesex County, Massachusetts.

2. Project Description

2.1. Existing Structure

The subject bridge is located in the Town of Ayer, Massachusetts. It is designated as Bridge No. A-19-014 (79A) within the NBIS inventory. According to the Structure Inventory and Appraisal (SI&A) sheet, the existing bridge was built in 1850 and reconstructed in 1900; no construction plans or drawings of the bridge were available for review in preparation of this Report. The bridge is comprised of a concrete slab deck on top of steel railroad rails; the steel railroad rails are assumed to be formwork that was left in-place. The substructure consists of mortared stone masonry abutments and four masonry U-shaped wingwalls. The masonry stones of the substructure have been covered with an unreinforced concrete facing at the outlet of the structure. The hydraulic opening measures approximately 10' wide at the opening and reduces to 7' wide at the outlet due to the concrete facing. The inlet end suffers from scour beneath the structure and erosion around the wingwalls due to runoff from surface drainage. There are no

scour countermeasures within the area of the structure. The hydraulic opening of the existing structure is slightly skewed to the Nonacoicus Brook and flow is directed along the southeast wingwall rather than directly through the hydraulic opening. The total length of the bridge is 52' and provides a total paved roadway width of 35', which contains 2' shoulders on each side. There is a 4' paved sidewalk along the downstream side of the bridge. The bridge is structurally deficient and hydraulically undersized.

2.1.1. Crossed Waterway at Bridge Location

Nonacoicus Brook originates from Grove Pond, in the Town of Ayer, which is dam controlled, and flows into Plow Shop Pond, in the community of Devens. Nonacoicus flows northwest, north of West Main Street, and becomes tributary to the Nashua River about one mile downstream of West Main Street Bridge. The brook's drainage area at the bridge crossing location is about 16.7 square miles.

2.1.2. Highway Conveyed

West Main Street is classified as an Urban Minor Arterial street. The 2016 MassDOT Structures Inventory and Appraisal sheet noted the 2000 average daily traffic (ADT) volume conveyed on West Main Street is about 8,532 vehicles per day, 6% of which may be trucks.

2.1.3. Land Use in the Vicinity of the Bridge

Land use near the bridge is residential.

2.1.4. Special Site Considerations

The West Main Street crossing spans the National Flood Insurance Program (NFIP) Special Flood Hazard Area (SFHA) Zone AE and Regulatory Floodway delineations determined for the Nonacoicus Brook during the 1982 Ayer NFIP Flood Insurance Study (FIS).

2.2. Proposed Action

The principal project objective is to upgrade the load capacity of the existing West Main Street bridge to current Highway standards and improve the hydraulic performance of the structure. The existing West Main Street bridge will be replaced with a three-sided concrete rigid frame consisting of a 28-foot clear waterway. The concrete rigid frame will be supported on spread footings. The proposed structure will be constructed such that the alignment of the hydraulic opening to the Nonacoicus Brook is improved.

The roadway horizontal and vertical alignment is to remain approximately the same as the existing alignment with no reduction in the under clearance.

Within this hydraulic study, the existing bridge and a 28-foot clear waterway single span bridge type were evaluated for hydraulic adequacy and scour safety. A 36-foot span structure was investigated to evaluate whether a longer-span structure would result in improved hydraulic performance. The water surface elevations were similar at the crossing between the 28-foot span and 36-foot span structures. It was determined that the crossing is considered to be outlet

controlled and hydraulic performance is not improved by further increasing the span of the hydraulic opening for the bridge.

3. Data Collection

The hydraulic models were developed using topographic survey acquired for the project base plans provided to Hoyle, Tanner by WorldTech. Two streambed samples were obtained at the project site; one upstream and one downstream of the crossing. Based on laboratory testing, the D₅₀ of the samples are 1.8mm upstream and 1.1 mm downstream.

The Nonacoicus Brook at the West Main Street crossing was previously studied through the National Flood Insurance Program (NFIP, Reference 1); see Appendix 7.1.

4. Engineering Methods

4.1. Hydrologic Analyses

Peak 10-, 25-, 50-, and 100-year flood discharges for the Nonacoicus Brook were calculated by using the Wandle Method's Regression Equations for Eastern Massachusetts, as recommended by and described in the MassDOT Design of Bridges and Culverts for Wildlife Passage document. Peak discharges are presented in Table 1. See Reference 5 for computational procedures. The brook's drainage area at the West Main Street crossing was delineated using the USGS StreamStats application (Reference 6).

Table 1. Summary of Discharges

Nonacoicus Brook	Drainage Area (mi ²)	10 - Year (Ft ³ /S)	25 - Year (Ft ³ /S)	50 - Year (Ft ³ /S)	100 - Year (Ft ³ /S)
West Main Street	16.7	465	605	730	865

4.2. Hydraulic Analysis

4.2.1. No-Rise Hydraulic Analysis

Refer to the "No-Rise" Hydraulic Analysis letter prepared by Hoyle, Tanner, dated December 21, 2018.

4.2.2. Duplicate Effective Model

Refer to the "No-Rise" Hydraulic Analysis letter prepared by Hoyle, Tanner, dated December 21, 2018.

4.2.3. Existing Conditions Model

Water surface profiles for the brook's local 10-, 25-, 50-, and 100-year return frequency flood events were developed using USACOE HEC-RAS (Reference 7) computer application. A surface was created in AutoCAD Civil 3D using survey information that was acquired for the project base plans. A river alignment and cross-sections were defined in AutoCAD Civil 3D and exported into

HEC-RAS, which was used as a basis for assembling a flood elevation profile hydraulic model of the project site. The existing bridge geometry was defined using field measurements taken by Hoyle, Tanner. In the completed model, the channel and overbanks were assigned roughness coefficients (Manning's "n") of 0.035 and 0.060, respectively. These values were selected on the basis of field observations and aerial maps. The existing crossing was analyzed using HEC-RAS's 1D Steady State capabilities. Peak discharge data presented in Table 1 was used to perform the flood simulation calculations.

Boundary conditions for the 10%, 2%, and 1% Annual Chance of Exceedance Flood were taken from the Nonacoicus Brook 1 FEMA Cross Section E. For the 50% and 2% Annual Chance of Exceedance Flood, a normal depth of 0.0008 ft/ft was determined from the streambed elevations from Nonacoicus Brook 1 FEMA Cross Section F to A. Refer to the FEMA Flood Profile included in Appendix 7.1. For the 4% Annual Chance Flood, the following methodology was used:

1. Determine the Downstream Normal Depth (Friction) Slope needed to develop similar flood profiles for the Q10, Q50 and Q100 flood events with the aid of HEC-RAS.
 - a. Q10 Friction Slope – 0.00007 ft/ft
 - b. Q50 Friction Slope – 0.000032 ft/ft
 - c. Q100 Friction Slope – 0.000023 ft/ft
2. Based on the results above, the downstream friction slope decreases as the storm event increases. Therefore, a friction slope between 0.00007 ft/ft (Q10) and 0.000032 ft/ft (Q50) will occur for the Q25 flood event.
 - a. An average friction (normal) slope of 0.00051 ft/ft is used.

All models were analyzed using the Subcritical Flow Regime. This regime was selected because profiles are constrained to critical depth and above. This is a conservative approach when determining freeboard at crossings.

4.2.4. Proposed Conditions Model

A water surface profile model of proposed conditions was generated by modifying the geometry of the West Main Street bridge section in the existing conditions model to reflect the configurations of the proposed bridge's waterway opening. The boundary conditions and Manning's n values remained the same for the proposed conditions.

Based on Table 1.3.4-1 of the MassDOT LRFD Bridge Manual, the hydraulic design flood return frequency is the 25-year flood event.

Pertinent computational results are presented in Tables 2 and 4.

Table 2. Summary of Hydraulic Performance

Project Alternative	Return Frequency (Years)	Discharge (Ft ³ /S)	Stage, 40 Ft U/S (Ft, NAVD)	Contracted Velocity (Ft/S)
Existing Conditions	10	465	215.4	2.2
	25	605	217.1	2.4
	50	730	219.6	1.8
	100	865	220.1	1.7
Proposed 28-Foot Clear Waterway Single Span Bridge	10	465	213.1	2.2
	25	605	214.8	2.2
	50	730	216.0	2.3
	100	865	217.2	2.4

4.3. Scour/Stability Analysis

The scour safety of the proposed single span bridge waterway opening was evaluated using the guidelines set forth in the FHWA HEC-18 (Reference 7) and in Section 1.3.4 of the MassDOT LRFD Bridge Manual (Reference 4). In accordance with Table 1.3.4-1 in Reference 4, the 50-year and 100-year floods were used as the design event for scour and the check event for scour, respectively, in the scour safety assessment of the proposed bridge opening. In the evaluation process, long term stream bed elevation changes (aggradation or degradation), contraction (conveyance reduction) scour, and local (vortex induced) scour depths are summed to estimate the total potential depth of scour along the bridge’s foundation.

In both the scour design and scour check event analyses, the brook’s channel bed elevation profile at the project location was assumed to not measurably degrade over the service life of the proposed bridge. A summary of computed 50-year and 100-year flood scour depths under proposed conditions is presented in Table 3.

Table 3. Summary of Calculated Scour

Alternative	Return Period (Yrs)	Flow (Ft ³ /S)	Long Term Degradation (Feet)	Contraction Scour (Feet)	Local Abut. Scour (Feet)	Total Abut. Scour (Feet)
Proposed 28-Foot Clear Waterway Single Span Bridge	50	730	0.0	-0.9	8.3	8.3
	100	865	0.0	0.3	8.7	8.7

5. Conclusions and Recommendations

5.1. Conclusions

- 1) The existing conditions hydraulic model indicates that the existing West Main Street crossing provides little to no freeboard at the 10-year and 25-year flood events. Further, there is potential for roadway overtopping during the 100-year flood event.
- 2) The proposed conditions hydraulic model indicates that the proposed 28' clear waterway bridge can convey the brook's design 25-year flood event with one foot of freeboard. The proposed structure can also accommodate the 50-year and 100-year flood events without overtopping the roadway.
- 3) At this date, it appears that project activities will neither result in any increase in flood elevations within the community during the occurrence of the Nonacoicus Brook's NFIP Base Flood discharge, nor necessitate increasing the horizontal limits of the brook's effective Regulatory Floodway delineation in proximity to the West Main Street crossing location.
- 4) The calculated scour depths of scour reported in Table 3, for the proposed bridge, are supported by evidence of scour distress along the existing bridge abutments observed by Hoyle, Tanner. This crossing site should be considered scour active.

5.2. Recommendations

- 1) The information presented in Table 4 should be posted within the General Notes of the Bridge Sketch Plans.
- 2) Bridge substructures, for full bridge replacement projects, shall be property armored against scour.
- 3) Flexible revetments should be installed along the perimeter of both abutment footings. The median stone size of the revetment shall be 6", which corresponds to Class I Riprap, in accordance with Reference 9. The riprap shall be placed in a minimum layer thickness of approximately 1'.

Table 4. Hydraulic Data

Br. No. A-19-014 (79A)
West Main Street/Nonacoicus Brook
Ayer, Massachusetts

Hydraulic Design Data

Drainage Area	16.7 Square Miles
Design Flood Discharge	605 Cubic Feet Per Second
Design Flood Frequency	25 Years
Design Flood Velocity	2.2 Feet Per Second
Design Flood Elevation	214.8 Feet, NAVD

Base (100-Year) Flood Data

Base Flood Discharge	865 Cubic Feet Per Second
Base Flood Elevation	217.2 Feet, NAVD

Design and Check Scour Data

Design Scour Flood Event Return	50 Years
Check Scour Flood Event Return	100 Years

Flood of Record

Discharge	Unknown
Frequency	Unknown
Maximum Elevation	Unknown
Date	Unknown

History of Ice Floes: None Documented In NBIS Database

Evidence of Scour And Erosion: Southeast corner undermined up to 2' deep, severe embankment erosion adjacent to southeast wingwall.

6. References

6.1. Sources and Applications

- | Reference No. | Title |
|---------------|---|
| 1) | Middlesex County, Massachusetts, Flood Insurance Study, Volumes 1 – 8, Revised July 6, 2016 (FIS #25017CV001C) |
| 2) | MassDOT Structures Inspection Field Report, Br. No. A-19-014, Nov. 12, 2016 |
| 3) | MassGIS Data, USGS Topographic Quadrangle Images |
| 4) | MassDOT Load and Resistance Factor Design (LRFD) Bridge Manual, June 2013 |
| 5) | Equations for Estimating Bankfull Channel Geometry and Discharge for Streams in Massachusetts, Scientific Investigations Report 2013-5515, by Gardner C. Bent and Andrew M. Waite |
| 6) | United States Geological Survey (USGS), USGS Streamstats Version 3 in Massachusetts website http://water.usgs.gov/osw/streamstats/massachusetts.html |
| 7) | US Army Corps of Engineers (USACOE), Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 4.1 |
| 8) | Federal Highway Administration (FHWA), Hydraulic Engineering Circular, HEC-18 Evaluating Scour at Bridges, 5th Edition |
| 9) | Federal Highway Administration (FHWA), Hydraulic Engineering Circular, HEC-23 Bridge Scour and Stream Instability Countermeasures, Volumes 1 and 2, 3rd Edition |

7. Appendices

7.1. FEMA Documents

7.2. Hydrologic Analyses

7.3. Hydraulic Analyses

7.4. Scour and Countermeasure Calculations

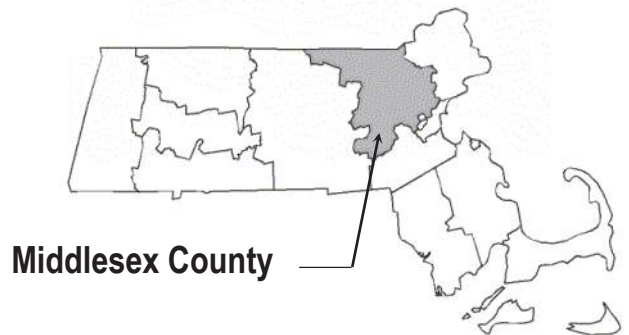
APPENDIX 7.1
FEMA Documents
of Hydraulic Study Report

FLOOD INSURANCE STUDY



VOLUME 1 OF 8

MIDDLESEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)



COMMUNITY NAME

ACTON, TOWN OF
ARLINGTON, TOWN OF
ASHBY, TOWN OF
ASHLAND, TOWN OF
AYER, TOWN OF
BEDFORD, TOWN OF
BELMONT, TOWN OF
BILLERICA, TOWN OF
BOXBOROUGH, TOWN OF
BURLINGTON, TOWN OF
CAMBRIDGE, CITY OF
CARLISLE, TOWN OF
CHELMSFORD, TOWN OF
CONCORD, TOWN OF
DRACUT, TOWN OF
DUNSTABLE, TOWN OF
EVERETT, CITY OF
FRAMINGHAM, TOWN OF
GROTON, TOWN OF
HOLLISTON, TOWN OF
HOPKINTON, TOWN OF
HUDSON, TOWN OF
LEXINGTON, TOWN OF
LINCOLN, TOWN OF
LITTLETON, TOWN OF
LOWELL, CITY OF
MALDEN, CITY OF
MARLBOROUGH, CITY OF
MAYNARD, TOWN OF
MEDFORD, CITY OF

COMMUNITY NUMBER

250176
250177
250178
250179
250180
255209
250182
250183
250184
250185
250186
250187
250188
250189
250190
250191
250192
250193
250194
250195
250196
250197
250198
250199
250200
250201
250202
250203
250204
250205

Middlesex County

COMMUNITY NAME

MELROSE, CITY OF
NATICK, TOWN OF
NEWTON, CITY OF
NORTH READING, TOWN OF
PEPPERELL, TOWN OF
READING, TOWN OF
SHERBORN, TOWN OF
SHIRLEY, TOWN OF
SOMERVILLE, CITY OF
STONEHAM, TOWN OF
STOW, TOWN OF
SUDBURY, TOWN OF
TEWKSBURY, TOWN OF
TOWNSEND, TOWN OF
TYNGSBOROUGH, TOWN OF
WAKEFIELD, TOWN OF
WALTHAM, CITY OF
WATERTOWN, TOWN OF
WAYLAND, TOWN OF
WESTFORD, TOWN OF
WESTON, TOWN OF
WILMINGTON, TOWN OF
WINCHESTER, TOWN OF
WOBURN, CITY OF

COMMUNITY NUMBER

250206
250207
250208
250209
250210
250211
250212
250213
250214
250215
250216
250217
250218
250219
250220
250221
250222
250223
250224
250225
250226
250227
250228
250229

REVISED:
July 6, 2016



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
25017CV001C

TABLE 8 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
NASHUA RIVER					
At the Massachusetts/New Hampshire State Line	396.0	8,300	14,300	17,800	28,300
At the Dunstable/Groton corporate limits	390.0	8,400	15,400	19,800	33,900
At confluence of Nissitissit River	352.0	7,055	11,945	14,651	22,829
At Fitch Bridge Road	312.6	6,950	11,700	14,400	22,600
At confluence of Squannacook River	220.5	5,850	9,900	12,500	19,200
At confluence of Mulpus Brook	204.5	5,650	9,600	12,200	18,600
At confluences of Walker Brook 1 and Nonacoicus Brook 1	183.9	5,400	9,100	11,600	18,000
At confluence of Catacoonamug Brook	161.0	5,100	8,600	11,800	17,000
NISSITISSIT RIVER					
At confluence with the Nashua River	59.8	1,497	2,642	3,642	5,000
NONACOICUS BROOK 1					
At confluence with Nashua River	18.4	840	2,120	2,370	4,160
At Main Street	160.7	400	670	720	1,070
NONACOICUS BROOK 2					
At confluence with Nonacoicus Brook 1	11.0	370	980	1,120	2,230
NORTH LEXINGTON BROOK					
At Bedford/Lexington corporate limits	4.9	396	817	1,072	1,986
At Hartwell Avenue	3.2	273	548	708	1,217
Approximately 1,260 feet downstream of Interstate 95 Interchange	1.7	168	330	421	746
At Interstate 95 Interchange	1.0	100	183	235	395
PAGES BROOK					
At confluence with Concord River	4.0	171	286	349	538
At Maple Street	1.8	95	162	199	309

Typo- DA = 16.7

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Nonacoicus Brook 1								
A	4,165 ¹	190	1,123	2.1	217.1	211.1 ³	211.8	0.7
B	4,990 ¹	290	1,737	1.4	217.1	211.3 ³	212.0	0.7
C	5,500 ¹	575	1,660	1.4	217.1	211.5 ³	212.2	0.7
D	6,130 ¹	491	1,987	1.2	217.1	211.6 ³	212.3	0.7
E	6,900 ¹	315	1,436	1.7	217.1	211.8 ³	212.5	0.7
F	7,285 ¹	40	228	3.2	217.1	214.1 ³	214.1	0.0
G	7,510 ¹	110	768	0.9	217.8	217.8	217.8	0.0
H	8,100 ¹	390	2,389	0.3	220.8	220.8	220.8	0.0
I	8,370 ¹	255	1,543	0.5	220.8	220.8	220.8	0.0
J	8,532 ¹	162	675	1.1	220.9	220.9	220.9	0.0
K	8,890 ¹	185	1,791	0.4	221.0	221.0	221.0	0.0
L	12,066 ¹	990	9,370	0.1	226.9	226.9	226.9	0.0
M	13,125 ¹	450	6,752	0.1	226.9	226.9	226.9	0.0
N	14,250 ¹	320	4,210	0.2	226.9	226.9	226.9	0.0
O	14,600 ¹	100	1,137	0.6	227.0	227.0	227.0	0.0
Nonacoicus Brook 2								
A	360 ²	240	1,187	0.9	227.2	221.2 ⁴	221.4	0.2

¹ Feet above confluence with Nashua River

² Feet above confluence with Nonacoicus Brook 1

³ Elevation computed without consideration of backwater effects from Nashua River

⁴ Elevation computed without consideration of backwater effects from Nonacoicus Brook 2

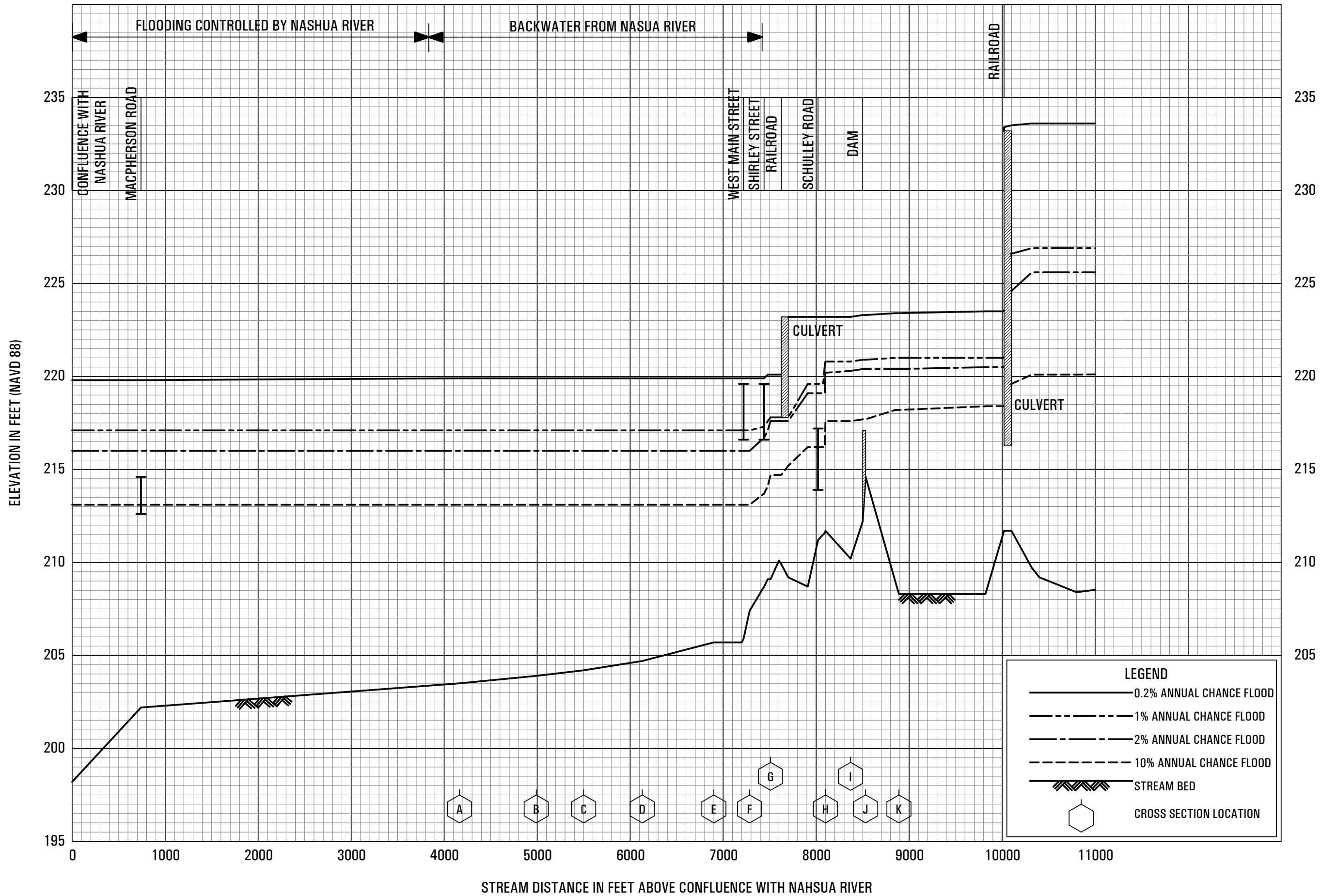
TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)**

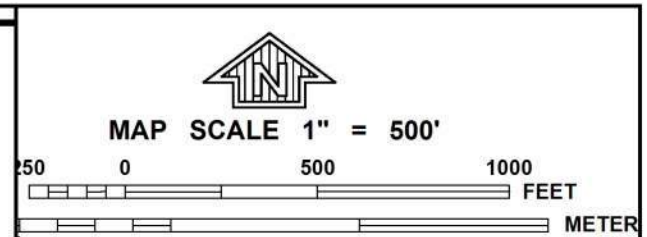
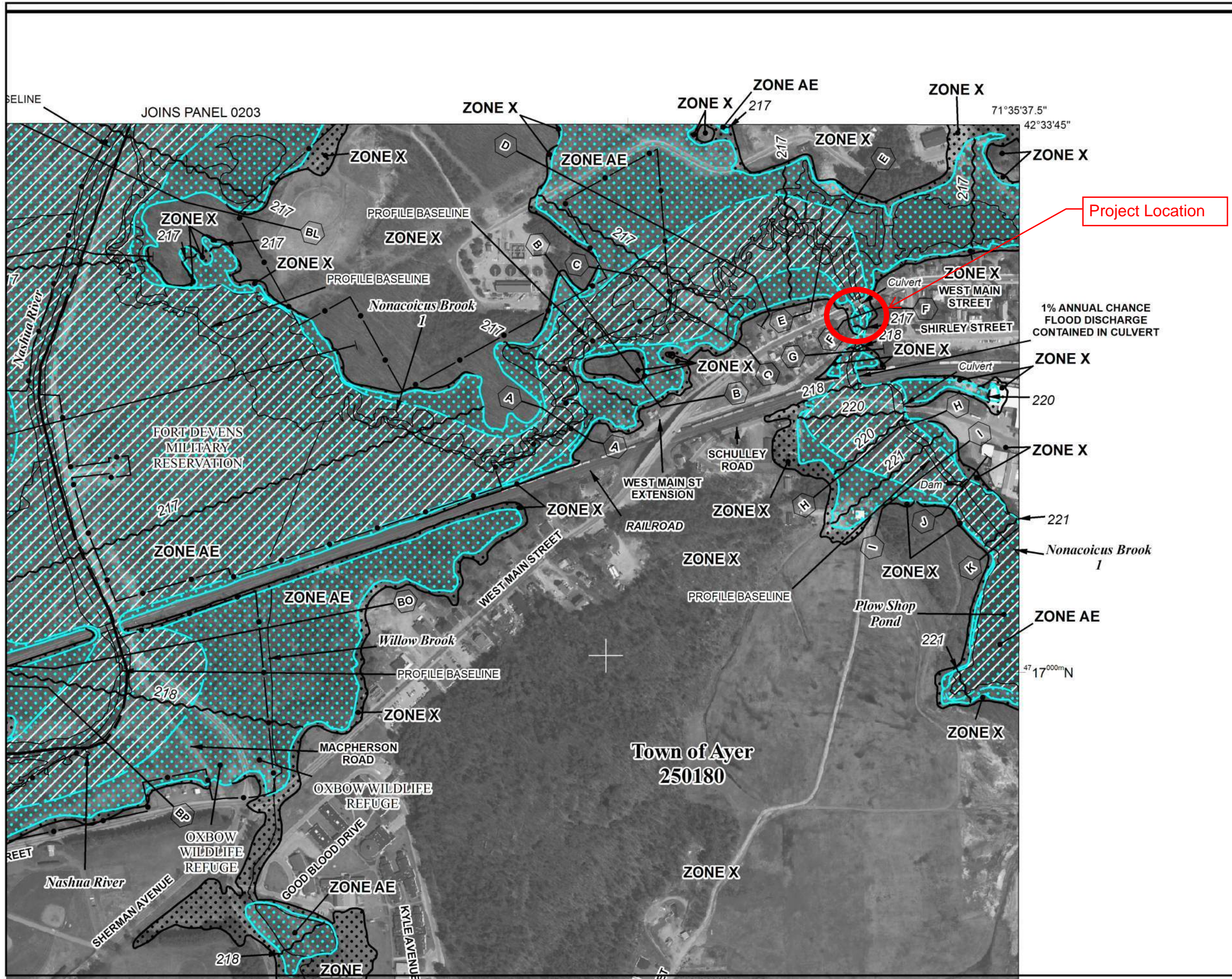
FLOODWAY DATA

NONACOICUS BROOK 1 – NONACOICUS BROOK 2



FLOOD PROFILES
NONACOICUS BROOK 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)



Project Location

1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT

NFIP PANEL 0211E

FIRM
FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY,
MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 211 OF 656
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AYER, TOWN OF	250180	0211	E
SHIRLEY, TOWN OF	250213	0211	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
25017C0211E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

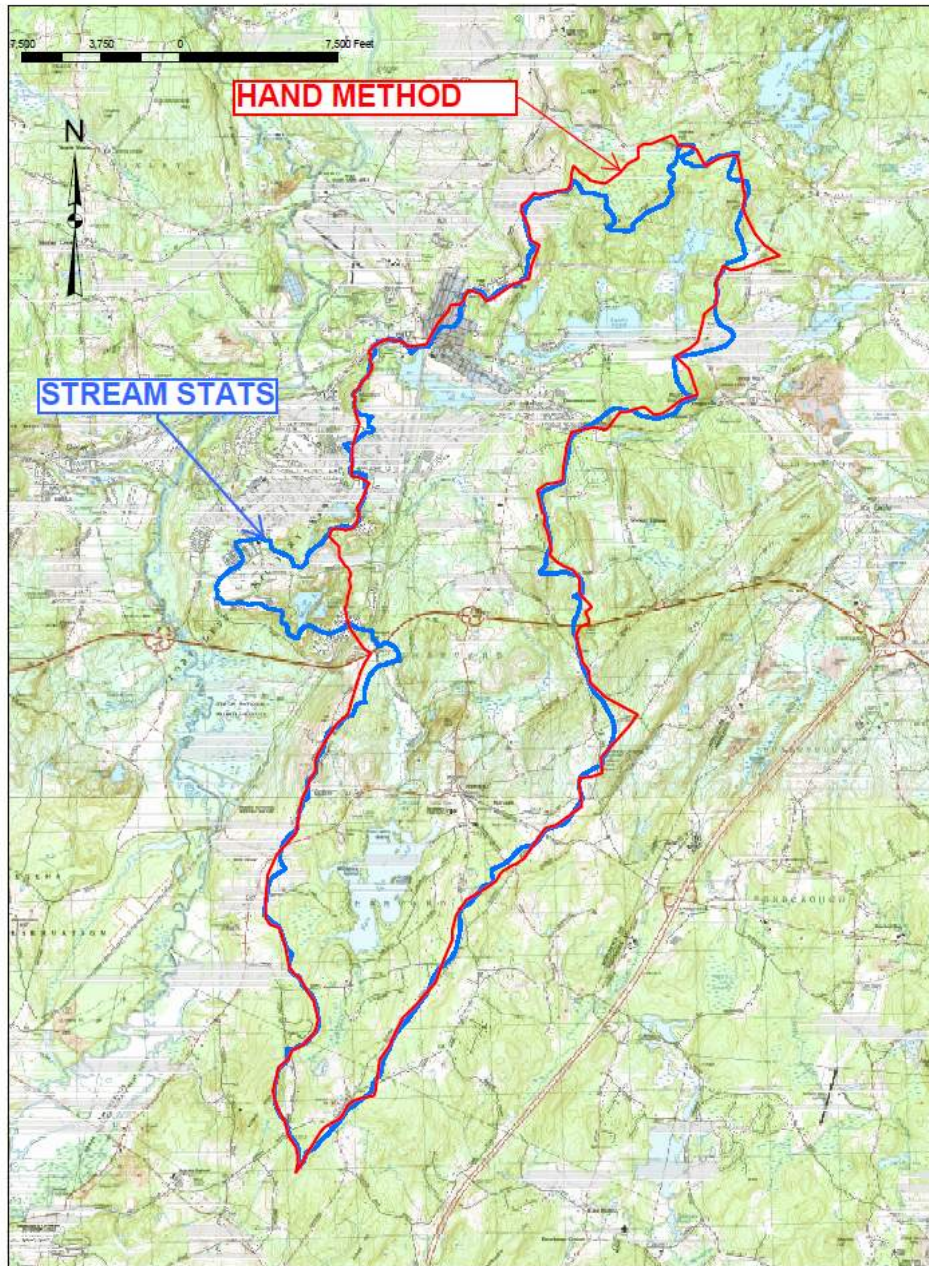
APPENDIX 7.2
Hydrologic Analyses
of Hydraulic Study Report

NOTES AND ASSUMPTIONS

References:

1. MassDOT LRFD Bridge Design Manual
 2. MassDOT Design of Bridges and Culverts for Wildlife Passage at Freshwater Streams
 3. MassDOT Project Development and Design Guide, January 2006
 4. Massachusetts River and Stream Crossing Standards, March 1, 2006
 5. Massachusetts Stream Crossing Handbook, 2nd Edition, June 2012
 6. Equations for Estimating Bankfull Channel Geometry and Discharge for Streams in Massachusetts, Scientific Investigations Report 2013-5515
 7. Estimating Peak Discharges of Small, Rural Streams in Massachusetts, U.S. Geological Survey Water-Supply Paper 2214
 8. USGS StreamStats Version 3
 9. MassGIS Data - USGS Topographic Quadrangle Images
 10. Middlesex County, Massachusetts Flood Insurance Study Volumes 1 - 8, Revised July 7, 2014 (FIS # 25017CV001B)
- USGS StreamStats Version 3's watershed is used to compare the delineated watershed by "hand" method
 - The Wandle Method (Reference 6) is used to calculate peak flow values per Reference 2
 - Rational Method and NRCS Method are not applicable to this watershed since the watershed is greater than 50 acres and 2000 acre limits, respectively. (Reference 2)
 - Compare Flow values from FIS and Wandle Method and use larger of two for design

Watershed Delineation



Delineated Watershed Areas

Discrepancies are found between the delineated Stream Stats and Hand Method Watershed Areas. After close inspection, the Hand Method Watershed Area is used.

Hand Method Area	$DA_{hand} := 16.72 \text{ mi}^2$
Stream Stats Area	$DA_{StreamStats} := 16.7 \text{ mi}^2$
Area to be used	$DA := DA_{hand} = 16.72 \text{ mi}^2$

Calculate Flows (Wandle Method, Reference 1, Reference 6)

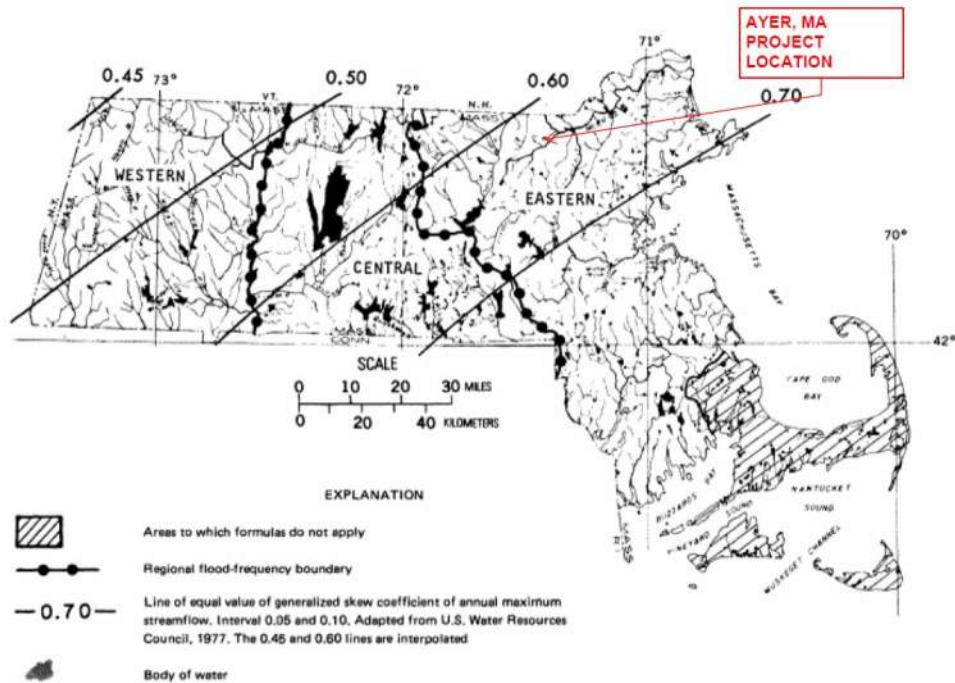


Figure 1. Study area and generalized skew coefficient.

**Ayer, MA is located in Eastern Massachusetts, Therefore use Eastern Mass. Wandle Equations (Ref. 6)

<u>Storm Event:</u>	<u>Eastern Mass. Regression Equation:</u>	<u>USE:</u>
2 Year Storm Event	$Q_{2_Wand} := 36.30 \cdot cfs \cdot DA^{0.682} = 247.83 \text{ cfs}$	$Q_{2_Wand} := 250 \text{ cfs}$
5 Year Storm Event	$Q_{5_Wand} := 55.38 \cdot cfs \cdot DA^{0.670} = 365.53 \text{ cfs}$	$Q_{5_Wand} := 370 \text{ cfs}$
10 Year Storm Event	$Q_{10_Wand} := 72.12 \cdot cfs \cdot DA^{0.660} = 462.80 \text{ cfs}$	$Q_{10_Wand} := 465 \text{ cfs}$
25 Year Storm Event	$Q_{25_Wand} := 96.71 \cdot cfs \cdot DA^{0.651} = 605.06 \text{ cfs}$	$Q_{25_Wand} := 605 \text{ cfs}$
50 Year Storm Event	$Q_{50_Wand} := 118.1 \cdot cfs \cdot DA^{0.645} = 726.50 \text{ cfs}$	$Q_{50_Wand} := 730 \text{ cfs}$
100 Year Storm Event	$Q_{100_Wand} := 143.1 \cdot cfs \cdot DA^{0.638} = 863.11 \text{ cfs}$	$Q_{100_Wand} := 865 \text{ cfs}$
500 Year Storm Event	See Sheet 6	$Q_{500_Wand} := 1093 \text{ cfs}$

FIS Flows (Reference 9)

10 Year Storm Event	$Q_{10_FIS} := 400 \text{ cfs}$
50 Year Storm Event	$Q_{50_FIS} := 670 \text{ cfs}$
100 Year Storm Event	$Q_{100_FIS} := 720 \text{ cfs}$
500 Year Storm Event	$Q_{500_FIS} := 1070 \text{ cfs}$

Flow Summary & Design Flows

<i>Flow</i>	Q_2	Q_5	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
<i>(Method)</i>	<i>(cfs)</i>	<i>(cfs)</i>	<i>(cfs)</i>	<i>(cfs)</i>	<i>(cfs)</i>	<i>(cfs)</i>	<i>(cfs)</i>
Wandle	250	370	465	605	730	865	1093
<i>FIS</i>			400		670	720	1070

Storm Event:

Design Flows:

2 Year Storm Event	$Q_2 := 250 \text{ cfs}$
5 Year Storm Event	$Q_5 := 370 \text{ cfs}$
10 Year Storm Event	$Q_{10} := 465 \text{ cfs}$
25 Year Storm Event	$Q_{25} := 605 \text{ cfs}$
50 Year Storm Event	$Q_{50} := 730 \text{ cfs}$
100 Year Storm Event	$Q_{100} := 865 \text{ cfs}$
500 Year Storm Event	$Q_{500} := 1093 \text{ cfs}$

Expected Bankfull Geometry (Reference 5, Table 4)

Expected Bankfull Width $BFW := 15.0418 \text{ ft} \cdot DA^{0.4038} = 46.91 \text{ ft}$

Expected Bankfull Depth $BFW_{Depth} := 0.9502 \text{ ft} \cdot DA^{0.2960} = 2.19 \text{ ft}$

Expected Bankfull
Cross-sectional Area $BFW_{Area} := 14.1156 \text{ ft}^2 \cdot DA^{0.7026} = 102.13 \text{ ft}^2$

Expected Bankfull Discharge $BFW_{Discharge} := 37.1364 \cdot cfs \cdot DA^{0.7996} = 353.10 \text{ cfs}$

Calculate Minimum Clear Span Width based on Satisfying Stream Crossing Standards (Reference 3)

Expected Minimum Clear Span $Clear_{Span} := 1.2 \cdot BFW = 56.29 \text{ ft}$

Calculate Flows (Wandle Method, Reference 1, Reference 6), Cont.

Calculated Design Flow Values

Return Period (Yr)	AEP	Flow (CFS)
100	1.0%	865
50	2.0%	730
25	4.0%	605
10	10.0%	465
5	20.0%	370
2	50.0%	250

Calculated 500 Year Flow Value

Return Period (Yr)	AEP	Flow (CFS)
500	0.2%	1093

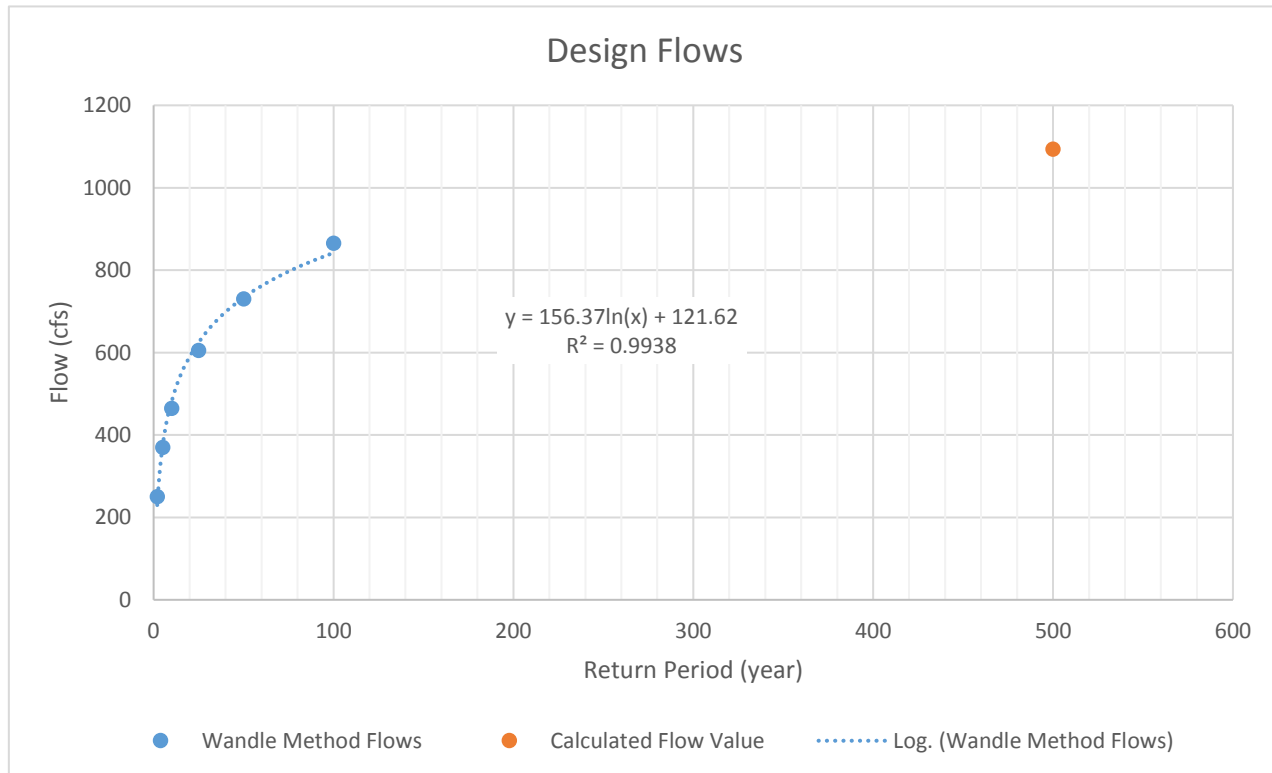


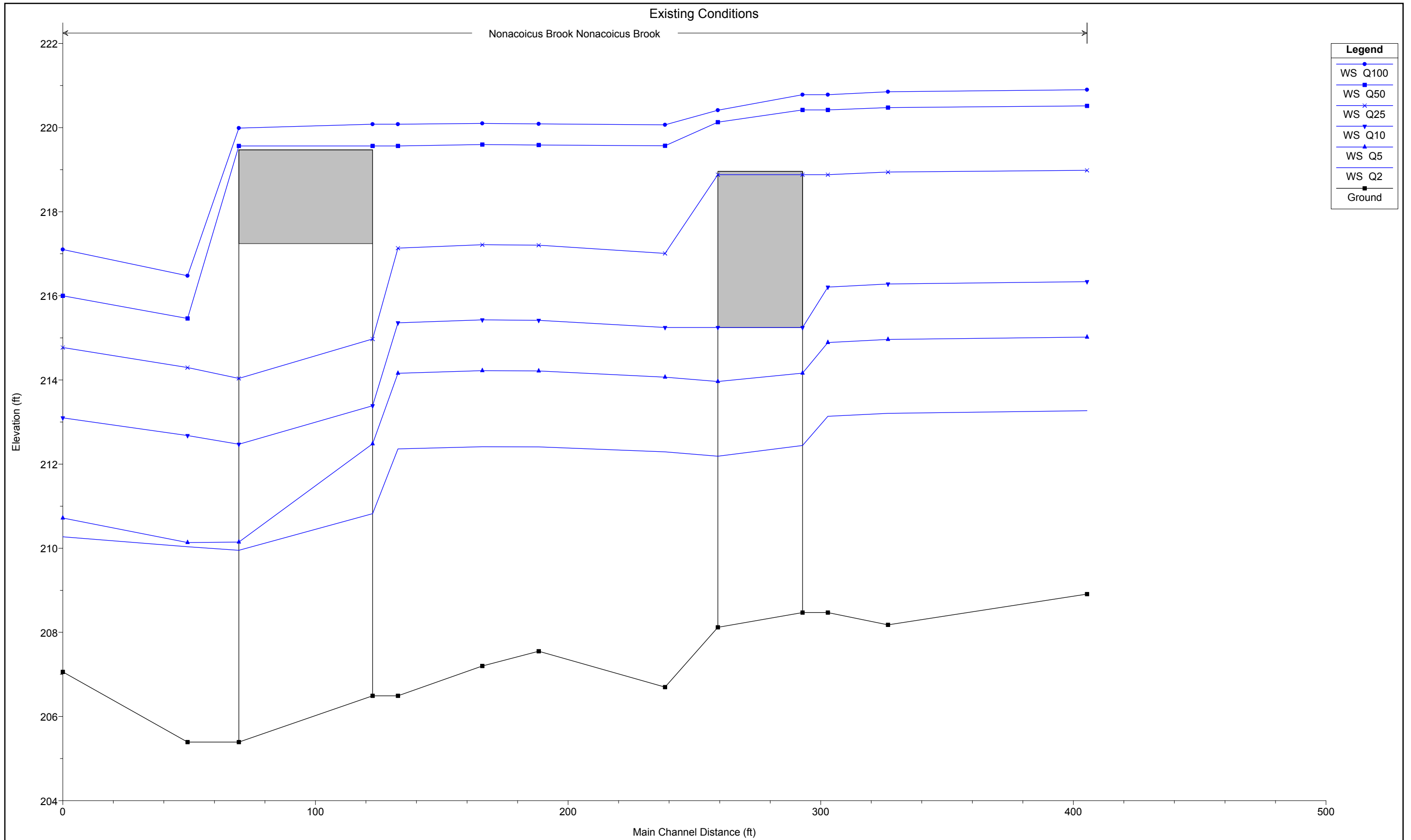
TABLE 8 - SUMMARY OF DISCHARGES – continued

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-PERCENT</u>	<u>2-PERCENT</u>	<u>1-PERCENT</u>	<u>0.2-PERCENT</u>
NASHUA RIVER					
At the Massachusetts/New Hampshire State Line	396.0	8,300	14,300	17,800	28,300
At the Dunstable/Groton corporate limits	390.0	8,400	15,400	19,800	33,900
At confluence of Nissitissit River	352.0	7,055	11,945	14,651	22,829
At Fitch Bridge Road	312.6	6,950	11,700	14,400	22,600
At confluence of Squannacook River	220.5	5,850	9,900	12,500	19,200
At confluence of Mulpus Brook	204.5	5,650	9,600	12,200	18,600
At confluences of Walker Brook 1 and Nonacoicus Brook 1	183.9	5,400	9,100	11,600	18,000
At confluence of Catacoonamug Brook	161.0	5,100	8,600	11,800	17,000
NISSITISSIT RIVER					
At confluence with the Nashua River	59.8	1,497	2,642	3,642	5,000
NONACOICUS BROOK 1					
At confluence with Nashua River	18.4	840	2,120	2,370	4,160
At Main Street	160.7	400	670	720	1,070
NONACOICUS BROOK 2					
At confluence with Nonacoicus Brook 1	11.0	370	980	1,120	2,230
NORTH LEXINGTON BROOK					
At Bedford/Lexington corporate limits	4.9	396	817	1,072	1,986
At Hartwell Avenue	3.2	273	548	708	1,217
Approximately 1,260 feet downstream of Interstate 95 Interchange	1.7	168	330	421	746
At Interstate 95 Interchange	1.0	100	183	235	395
PAGES BROOK					
At confluence with Concord River	4.0	171	286	349	538
At Maple Street	1.8	95	162	199	309

Typo- DA = 16.7

APPENDIX 7.3
Hydraulic Analyses
of Hydraulic Study Report

Existing Conditions Water Surface Profile

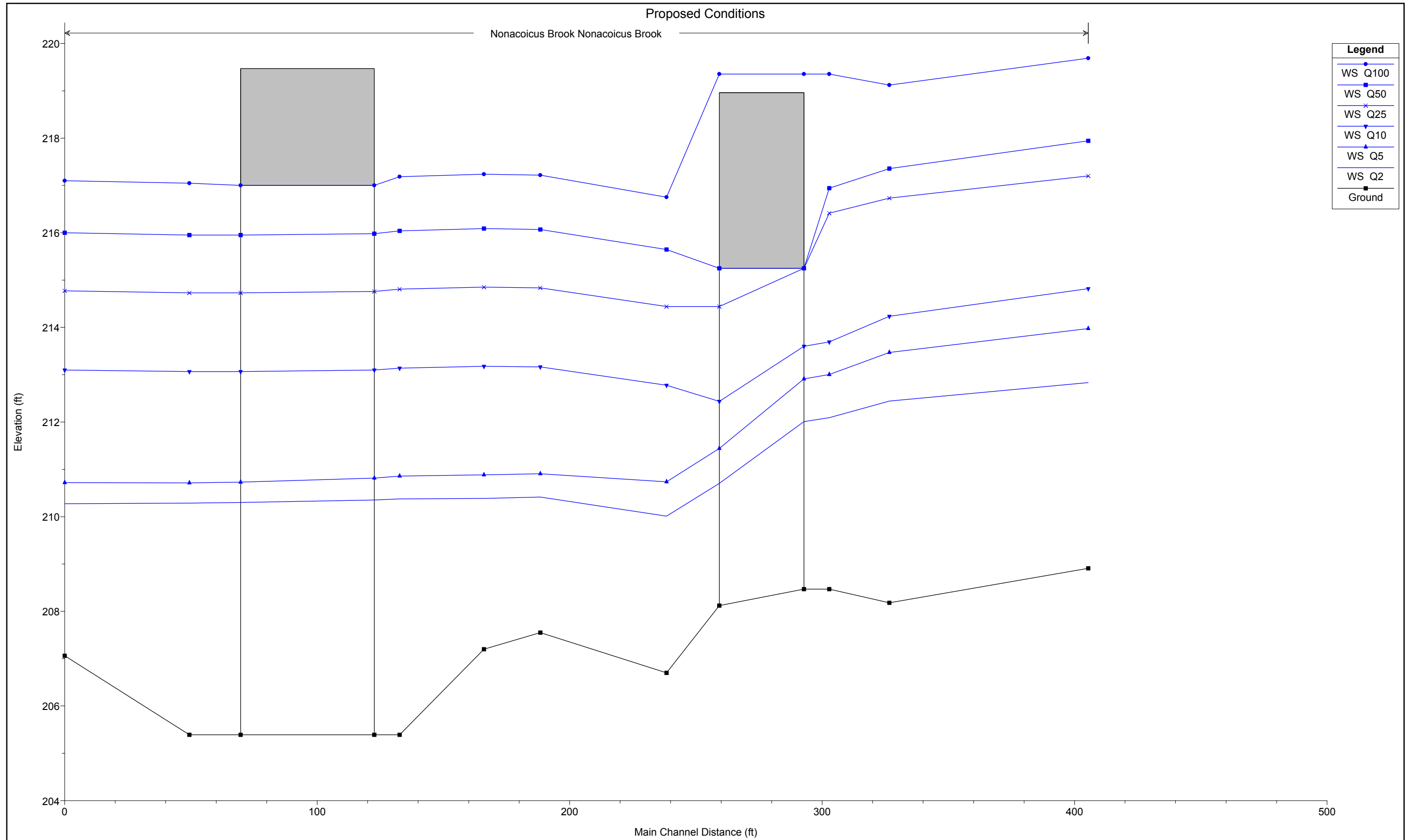


Existing Conditions Summary Table

HEC-RAS Plan: Ex Cond River: Nonacoicus Brook Reach: Nonacoicus Brook

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Nonacoicus Brook	13469.96	Q2	250.00	208.91	213.27	210.99	213.31	0.000393	1.76	186.71	75.23	0.17
Nonacoicus Brook	13469.96	Q5	370.00	208.91	215.02	211.59	215.05	0.000169	1.55	324.17	81.81	0.12
Nonacoicus Brook	13469.96	Q10	465.00	208.91	216.34	211.88	216.36	0.000113	1.48	435.12	86.76	0.10
Nonacoicus Brook	13469.96	Q25	605.00	208.91	218.99	212.13	219.00	0.000053	1.28	678.19	96.72	0.08
Nonacoicus Brook	13469.96	Q50	730.00	208.91	220.52	212.34	220.53	0.000043	1.28	830.38	103.25	0.07
Nonacoicus Brook	13469.96	Q100	865.00	208.91	220.90	212.54	220.92	0.000053	1.46	871.24	108.26	0.08
Nonacoicus Brook	13391.22	Q2	250.00	208.18	213.21	210.55	213.27	0.000426	2.15	133.22	39.56	0.19
Nonacoicus Brook	13391.22	Q5	370.00	208.18	214.96	210.97	215.03	0.000262	2.14	207.32	44.77	0.16
Nonacoicus Brook	13391.22	Q10	465.00	208.18	216.28	211.26	216.35	0.000199	2.14	268.95	48.68	0.14
Nonacoicus Brook	13391.22	Q25	605.00	208.18	218.94	211.64	218.99	0.000107	1.94	409.85	58.21	0.11
Nonacoicus Brook	13391.22	Q50	730.00	208.18	220.48	211.96	220.53	0.000092	1.98	533.14	103.65	0.10
Nonacoicus Brook	13391.22	Q100	865.00	208.18	220.85	212.27	220.91	0.000112	2.24	574.12	114.98	0.12
Nonacoicus Brook	13367.36	Q2	250.00	208.47	213.14	210.55	213.26	0.000655	2.80	95.43	25.64	0.24
Nonacoicus Brook	13367.36	Q5	370.00	208.47	214.89	211.05	215.01	0.000436	2.87	143.64	29.35	0.21
Nonacoicus Brook	13367.36	Q10	465.00	208.47	216.21	211.40	216.33	0.000342	2.90	182.82	36.48	0.19
Nonacoicus Brook	13367.36	Q25	605.00	208.47	218.88	211.88	218.99	0.000193	2.69	263.00	53.88	0.15
Nonacoicus Brook	13367.36	Q50	730.00	208.47	220.42	212.29	220.52	0.000159	2.68	417.72	101.45	0.14
Nonacoicus Brook	13367.36	Q100	865.00	208.47	220.78	212.68	220.91	0.000195	3.03	456.50	112.96	0.15
Nonacoicus Brook	13340		Bridge									
Nonacoicus Brook	13302.96	Q2	250.00	206.70	212.29	209.96	212.59	0.001468	4.42	56.50	30.55	0.36
Nonacoicus Brook	13302.96	Q5	370.00	206.70	214.07	210.67	214.42	0.001107	4.75	77.82	34.96	0.33
Nonacoicus Brook	13302.96	Q10	465.00	206.70	215.25	211.19	215.65	0.001000	5.05	92.01	38.45	0.32
Nonacoicus Brook	13302.96	Q25	605.00	206.70	217.01	211.87	217.45	0.000850	5.35	113.12	44.80	0.31
Nonacoicus Brook	13302.96	Q50	730.00	206.70	219.57	212.45	219.64	0.000125	2.27	432.52	73.20	0.12
Nonacoicus Brook	13302.96	Q100	865.00	206.70	220.07	213.03	220.15	0.000148	2.55	470.72	80.40	0.13
Nonacoicus Brook	13252.91	Q2	250.00	207.55	212.41	209.00	212.44	0.000165	1.41	182.29	47.55	0.12
Nonacoicus Brook	13252.91	Q5	370.00	207.55	214.21	209.35	214.24	0.000109	1.45	272.84	52.76	0.10
Nonacoicus Brook	13252.91	Q10	465.00	207.55	215.42	209.60	215.45	0.000092	1.50	338.56	56.22	0.10
Nonacoicus Brook	13252.91	Q25	605.00	207.55	217.20	209.93	217.24	0.000073	1.54	444.84	63.35	0.09
Nonacoicus Brook	13252.91	Q50	730.00	207.55	219.59	210.21	219.61	0.000046	1.43	650.00	102.93	0.07
Nonacoicus Brook	13252.91	Q100	865.00	207.55	220.09	210.49	220.12	0.000054	1.60	702.51	106.29	0.08
Nonacoicus Brook	13230.59	Q2	250.00	207.20	212.41	209.11	212.43	0.000128	1.22	244.84	78.88	0.11
Nonacoicus Brook	13230.59	Q5	370.00	207.20	214.22	209.47	214.24	0.000073	1.17	394.38	86.65	0.09
Nonacoicus Brook	13230.59	Q10	465.00	207.20	215.43	209.72	215.45	0.000058	1.18	502.49	92.36	0.08
Nonacoicus Brook	13230.59	Q25	605.00	207.20	217.21	210.11	217.23	0.000043	1.18	674.04	99.73	0.07
Nonacoicus Brook	13230.59	Q50	730.00	207.20	219.60	210.38	219.61	0.000026	1.07	964.36	137.39	0.06
Nonacoicus Brook	13230.59	Q100	865.00	207.20	220.10	210.62	220.12	0.000031	1.20	1034.46	140.64	0.06
Nonacoicus Brook	13197.21	Q2	250.00	206.49	212.36	208.99	212.42	0.000294	1.98	126.41	42.51	0.16
Nonacoicus Brook	13197.21	Q5	370.00	206.49	214.16	209.46	214.23	0.000218	2.11	174.98	57.61	0.15
Nonacoicus Brook	13197.21	Q10	465.00	206.49	215.36	209.78	215.44	0.000195	2.24	207.36	67.86	0.14
Nonacoicus Brook	13197.21	Q25	605.00	206.49	217.14	210.17	217.22	0.000165	2.37	255.32	84.55	0.14
Nonacoicus Brook	13197.21	Q50	730.00	206.49	219.56	210.52	219.61	0.000071	1.79	575.82	137.36	0.09
Nonacoicus Brook	13197.21	Q100	865.00	206.49	220.08	210.85	220.11	0.000062	1.68	795.78	140.55	0.09
Nonacoicus Brook	13158		Bridge									
Nonacoicus Brook	13113.75	Q2	250.00	205.39	210.03	208.71	210.71	0.003628	6.59	37.93	74.39	0.57
Nonacoicus Brook	13113.75	Q5	370.00	205.39	210.13	209.57	211.55	0.007354	9.53	38.82	76.70	0.81
Nonacoicus Brook	13113.75	Q10	465.00	205.39	212.68	210.19	213.56	0.002477	7.53	61.72	108.60	0.51
Nonacoicus Brook	13113.75	Q25	605.00	205.39	214.30	211.00	215.27	0.002070	7.93	76.28	122.77	0.48
Nonacoicus Brook	13113.75	Q50	730.00	205.39	215.46	211.71	216.56	0.001962	8.41	86.76	134.84	0.48
Nonacoicus Brook	13113.75	Q100	865.00	205.39	216.48	212.41	217.74	0.001971	9.02	95.92	145.29	0.49
Nonacoicus Brook	13064.35	Q2	250.00	207.06	210.27	209.12	210.32	0.000801	2.16	191.86	148.23	0.24
Nonacoicus Brook	13064.35	Q5	370.00	207.06	210.72	209.49	210.78	0.000800	2.42	259.63	154.76	0.25
Nonacoicus Brook	13064.35	Q10	465.00	207.06	213.10	209.73	213.11	0.000092	1.22	650.00	172.26	0.09
Nonacoicus Brook	13064.35	Q25	605.00	207.06	214.77	209.95	214.78	0.000051	1.09	947.56	183.77	0.07
Nonacoicus Brook	13064.35	Q50	730.00	207.06	216.00	210.12	216.01	0.000039	1.07	1178.41	192.02	0.07
Nonacoicus Brook	13064.35	Q100	865.00	207.06	217.10	210.27	217.11	0.000034	1.07	1393.76	199.51	0.06

Proposed Conditions Water Surface Profile



Proposed Conditions Summary Table

HEC-RAS Plan: Prop River: Nonacoicus Brook Reach: Nonacoicus Brook

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Nonacoicus Brook	13469.96	Q2	250.00	208.91	212.83	210.99	212.89	0.000686	2.11	154.25	73.59	0.22
Nonacoicus Brook	13469.96	Q5	370.00	208.91	213.98	211.59	214.03	0.000407	2.05	240.84	77.89	0.18
Nonacoicus Brook	13469.96	Q10	465.00	208.91	214.82	211.87	214.87	0.000311	2.04	307.90	81.06	0.16
Nonacoicus Brook	13469.96	Q25	605.00	208.91	217.20	212.14	217.23	0.000119	1.65	511.43	90.01	0.11
Nonacoicus Brook	13469.96	Q50	730.00	208.91	217.94	212.34	217.98	0.000121	1.78	579.32	92.80	0.11
Nonacoicus Brook	13469.96	Q100	865.00	208.91	219.69	212.54	219.72	0.000081	1.67	747.12	99.22	0.09
Nonacoicus Brook	13391.22	Q2	250.00	208.18	212.44	210.73	212.78	0.002022	4.63	54.02	37.29	0.42
Nonacoicus Brook	13391.22	Q5	370.00	208.18	213.47	211.37	213.93	0.002015	5.41	68.41	40.34	0.43
Nonacoicus Brook	13391.22	Q10	465.00	208.18	214.23	211.83	214.77	0.001964	5.88	79.07	42.60	0.44
Nonacoicus Brook	13391.22	Q25	605.00	208.18	216.73	212.46	217.17	0.000980	5.30	114.06	50.02	0.33
Nonacoicus Brook	13391.22	Q50	730.00	208.18	217.36	212.97	217.91	0.001116	5.95	122.79	52.06	0.35
Nonacoicus Brook	13391.22	Q100	865.00	208.18	219.12	213.50	219.65	0.000851	5.87	147.48	62.67	0.32
Nonacoicus Brook	13367.36	Q2	250.00	208.47	212.09	211.02	212.68	0.003983	6.18	40.47	23.93	0.58
Nonacoicus Brook	13367.36	Q5	370.00	208.47	213.00	211.76	213.82	0.004045	7.26	50.96	25.40	0.61
Nonacoicus Brook	13367.36	Q10	465.00	208.47	213.69	212.28	214.66	0.003945	7.90	58.90	26.82	0.62
Nonacoicus Brook	13367.36	Q25	605.00	208.47	216.41	212.99	217.11	0.001614	6.71	90.18	37.14	0.42
Nonacoicus Brook	13367.36	Q50	730.00	208.47	216.94	213.57	217.84	0.001890	7.58	96.26	38.76	0.46
Nonacoicus Brook	13367.36	Q100	865.00	208.47	219.35	214.18	219.53	0.000327	3.60	328.06	63.10	0.20
Nonacoicus Brook	13340		Bridge									
Nonacoicus Brook	13302.96	Q2	250.00	206.70	210.01	210.01	211.23	0.014081	8.86	28.21	23.99	1.00
Nonacoicus Brook	13302.96	Q5	370.00	206.70	210.74	210.74	212.33	0.013025	10.13	36.54	26.04	1.00
Nonacoicus Brook	13302.96	Q10	465.00	206.70	212.78	211.27	213.71	0.003939	7.75	59.99	31.72	0.60
Nonacoicus Brook	13302.96	Q25	605.00	206.70	214.44	211.98	215.35	0.002649	7.65	79.13	35.96	0.51
Nonacoicus Brook	13302.96	Q50	730.00	206.70	215.64	212.57	216.60	0.002254	7.85	92.98	39.93	0.49
Nonacoicus Brook	13302.96	Q100	865.00	206.70	216.75	213.16	217.79	0.002065	8.18	105.69	43.93	0.48
Nonacoicus Brook	13252.91	Q2	250.00	207.55	210.42	209.00	210.52	0.001295	2.64	94.75	40.33	0.30
Nonacoicus Brook	13252.91	Q5	370.00	207.55	210.91	209.35	211.07	0.001528	3.22	114.97	42.03	0.34
Nonacoicus Brook	13252.91	Q10	465.00	207.55	213.17	209.60	213.24	0.000329	2.22	219.15	49.74	0.17
Nonacoicus Brook	13252.91	Q25	605.00	207.55	214.84	209.93	214.90	0.000209	2.14	306.21	54.55	0.15
Nonacoicus Brook	13252.91	Q50	730.00	207.55	216.07	210.21	216.14	0.000170	2.15	375.75	58.55	0.13
Nonacoicus Brook	13252.91	Q100	865.00	207.55	217.22	210.49	217.29	0.000149	2.20	445.60	63.41	0.13
Nonacoicus Brook	13230.59	Q2	250.00	207.20	210.38	209.11	210.49	0.001510	2.64	98.89	61.52	0.32
Nonacoicus Brook	13230.59	Q5	370.00	207.20	210.89	209.47	211.03	0.001535	3.08	131.24	67.42	0.34
Nonacoicus Brook	13230.59	Q10	465.00	207.20	213.18	209.72	213.23	0.000235	1.85	306.61	82.06	0.15
Nonacoicus Brook	13230.59	Q25	605.00	207.20	214.85	210.11	214.89	0.000134	1.70	450.10	89.64	0.12
Nonacoicus Brook	13230.59	Q50	730.00	207.20	216.09	210.38	216.12	0.000103	1.67	564.41	95.24	0.11
Nonacoicus Brook	13230.59	Q100	865.00	207.20	217.24	210.62	217.27	0.000087	1.69	676.37	100.09	0.10
Nonacoicus Brook	13197.21	Q2	250.00	205.39	210.38	207.89	210.45	0.000605	2.23	112.11	34.41	0.22
Nonacoicus Brook	13197.21	Q5	370.00	205.39	210.86	208.37	210.99	0.000839	2.88	129.20	36.36	0.26
Nonacoicus Brook	13197.21	Q10	465.00	205.39	213.14	208.70	213.22	0.000266	2.22	222.93	47.66	0.16
Nonacoicus Brook	13197.21	Q25	605.00	205.39	214.81	209.12	214.88	0.000191	2.22	300.91	63.37	0.14
Nonacoicus Brook	13197.21	Q50	730.00	205.39	216.04	209.45	216.12	0.000164	2.27	360.02	73.89	0.13
Nonacoicus Brook	13197.21	Q100	865.00	205.39	217.19	209.76	217.27	0.000151	2.35	414.99	84.84	0.13
Nonacoicus Brook	13158		Bridge									
Nonacoicus Brook	13113.75	Q2	250.00	205.39	210.29	208.08	210.38	0.000691	2.46	101.54	79.86	0.24
Nonacoicus Brook	13113.75	Q5	370.00	205.39	210.71	208.49	210.88	0.001021	3.24	114.28	89.64	0.29
Nonacoicus Brook	13113.75	Q10	465.00	205.39	213.06	208.80	213.16	0.000325	2.52	184.84	111.58	0.18
Nonacoicus Brook	13113.75	Q25	605.00	205.39	214.73	209.19	214.83	0.000248	2.58	234.77	127.27	0.16
Nonacoicus Brook	13113.75	Q50	730.00	205.39	215.95	209.54	216.06	0.000222	2.69	271.45	139.96	0.16
Nonacoicus Brook	13113.75	Q100	865.00	205.39	217.05	209.86	217.17	0.000213	2.84	304.24	150.20	0.16
Nonacoicus Brook	13064.35	Q2	250.00	207.06	210.27	209.12	210.32	0.000801	2.16	191.86	148.23	0.24
Nonacoicus Brook	13064.35	Q5	370.00	207.06	210.72	209.49	210.78	0.000800	2.42	259.63	154.76	0.25
Nonacoicus Brook	13064.35	Q10	465.00	207.06	213.10	209.73	213.11	0.000092	1.22	650.00	172.26	0.09
Nonacoicus Brook	13064.35	Q25	605.00	207.06	214.77	209.95	214.78	0.000051	1.09	947.56	183.77	0.07
Nonacoicus Brook	13064.35	Q50	730.00	207.06	216.00	210.12	216.01	0.000039	1.07	1178.41	192.02	0.07
Nonacoicus Brook	13064.35	Q100	865.00	207.06	217.10	210.27	217.11	0.000034	1.07	1393.76	199.51	0.06

APPENDIX 7.4
Scour and Countermeasure
Calculations
of Hydraulic Study Report

NOTES AND ASSUMPTIONS

References

1. FHWA HEC 18, 5th Edition, Publication No. FHWA-HIF-12-003
2. FHWA HEC 23 Vol. 1, 3rd Edition, Publication No. FHWA-NHI-09-111
3. FHWA HEC 23 Vol. 2, 3rd Edition, Publication No. FHWA-NHI-09-112
4. MassDOT LRFD Bridge Design Manual, Part I, 2013

- Scour is to be analyzed per FHWA Hydraulic Engineering Circular (HEC) 18.
- Rock riprap revetment shall be designed to resist scour and protect the abutments per the set-back ratio (SBR) approach detailed in the "Design Guideline 14" in the FHWA Hydraulic Engineering Circular (HEC) 23.
- Proposed hydraulic data including flood velocity and elevations are taken from Proposed HEC-RAS Model. Copies of Tables and Cross-sections used are attached.
- Measurements were taken from HEC-RAS Cross-sections and Plans in conjunction with AutoCAD.
- Rock riprap sizes shall meet those as detailed in Section 983 and M2.02.0 of the MassDOT Standard Specifications. MassDOT only requires that "each stone shall weigh not less than 50 pounds and at least 75% of the volume shall consist of stones weighing not less than 500 pounds each. Therefore, determine the required riprap sized based on HEC 23 Vol. 1 riprap gradation (Table 5.1), and compare this to MassDOT's requirements.
- Per the MassDOT Bridge Design Manual Table 1.3.4-1, for a Highway Functional Classification of Urban Minor Arterial Street, the proposed bridge's hydraulic opening was designed for a 25 Year Flood Frequency. The Riprap Revetment is to be designed for the 50 Year Flood Frequency and the 100 Year Flood Frequency is to be used as a check.
- Matrices will be used to calculate the scour for the design flood and check flood events. The top entry will be for Q50 and the bottom entry will be for Q100.

Mathcad Matrix Definition: $i := 1..2$

HEC-RAS TABLES

- The following tables are taken from the HEC-RAS model Plan "Prelim - Proposed: West Main Only" in which the West Main Street bridge is replaced with a 28' clear span and the Shirley Street Bridge is unchanged from the existing conditions.
- The West Main Street bridge is located at River Station 131+58.
- The Shirley Street bridge is located at River Station 133+40.
- The upstream approach section for the West Main Street bridge will be taken at River Station 132+30.59.

HEC-RAS TABLES (CONT.)

Profile Output Table - Standard Table 1												
HEC-RAS Plan: Prop West River: Nonacoicus Brook Reach: Nonacoicus Brook												Reload Data
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Nonacoicus Brook	13469.96	Q50	730.00	208.91	218.16		218.19	0.000109	1.72	599.73	93.62	0.11
Nonacoicus Brook	13469.96	Q100	865.00	208.91	219.51		219.54	0.000087	1.71	729.44	98.64	0.10
Nonacoicus Brook	13391.22	Q50	730.00	208.18	218.09		218.18	0.000218	2.60	361.85	54.47	0.15
Nonacoicus Brook	13391.22	Q100	865.00	208.18	219.43		219.53	0.000186	2.64	441.61	72.17	0.15
Nonacoicus Brook	13367.36	Q50	730.00	208.47	217.95	212.28	218.14	0.000397	3.61	235.12	44.50	0.21
Nonacoicus Brook	13367.36	Q100	865.00	208.47	219.30	212.68	219.49	0.000343	3.68	275.44	61.21	0.20
Nonacoicus Brook	13340		Bridge									
Nonacoicus Brook	13302.96	Q50	730.00	206.70	216.97		217.11	0.000323	3.08	282.12	44.68	0.18
Nonacoicus Brook	13302.96	Q100	865.00	206.70	217.16		217.34	0.000421	3.56	290.39	45.30	0.21
Nonacoicus Brook	13252.91	Q50	730.00	207.55	217.00		217.06	0.000115	1.91	432.28	62.41	0.11
Nonacoicus Brook	13252.91	Q100	865.00	207.55	217.20		217.27	0.000150	2.21	444.54	63.33	0.13
Nonacoicus Brook	13230.59	Q50	730.00	207.20	217.02		217.05	0.000068	1.46	654.79	98.66	0.09
Nonacoicus Brook	13230.59	Q100	865.00	207.20	217.22		217.26	0.000088	1.69	674.70	99.84	0.10
Nonacoicus Brook	13197.21	Q50	730.00	206.49	216.96	210.55	217.03	0.000166	2.25	365.78	83.53	0.13
Nonacoicus Brook	13197.21	Q100	865.00	206.49	217.14	210.87	217.24	0.000217	2.61	374.38	84.56	0.15
Nonacoicus Brook	13158		Bridge									
Nonacoicus Brook	13113.75	Q50	730.00	205.39	215.99		216.03	0.000106	1.82	516.82	140.33	0.11
Nonacoicus Brook	13113.75	Q100	865.00	205.39	217.09		217.13	0.000097	1.88	592.06	150.53	0.10
Nonacoicus Brook	13064.35	Q50	730.00	207.06	216.00	210.12	216.01	0.000039	1.07	1178.41	192.02	0.07
Nonacoicus Brook	13064.35	Q100	865.00	207.06	217.10	210.27	217.11	0.000034	1.07	1393.76	199.51	0.06
Total flow in cross section.												

HEC-RAS TABLES (CONT.)

Profile Output Table - Six XS Bridge

File Options Std. Tables Locations Help

HEC-RAS Plan: Prop West River: Nonacoicus Brook Reach: Nonacoicus Brook Reload Data

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Nonacoicus Brook	13391.22	Q50	218.18	218.09		0.01	0.03	54.47	17.94	615.10	96.95	2.60
Nonacoicus Brook	13391.22	Q100	219.53	219.43		0.01	0.03	72.17	19.04	718.90	127.06	2.64
Nonacoicus Brook	13367.36	Q50	218.14	217.95	212.28	0.01	0.34	44.50	41.26	673.71	15.03	3.61
Nonacoicus Brook	13367.36	Q100	219.49	219.30	212.68			61.21	54.80	788.44	21.75	3.68
Nonacoicus Brook	13340 BR U	Q50	217.79	216.48	214.04	0.08	0.15	10.00		730.00		9.20
Nonacoicus Brook	13340 BR U	Q100	219.49	219.30	214.70			55.33	6.92	855.45	2.47	8.94
Nonacoicus Brook	13340 BR D	Q50	217.56	216.55	212.98	0.01	0.44	10.00		730.00		8.06
Nonacoicus Brook	13340 BR D	Q100	219.41	219.30	213.64			53.64	6.92	855.45	2.47	7.90
Nonacoicus Brook	13302.96	Q50	217.11	216.97		0.01	0.04	44.68	21.74	678.00	30.26	3.08
Nonacoicus Brook	13302.96	Q100	217.34	217.16		0.01	0.06	45.30	26.91	800.95	37.13	3.56
Nonacoicus Brook	13252.91	Q50	217.06	217.00		0.00	0.01	62.41	18.53	694.69	16.78	1.91
Nonacoicus Brook	13252.91	Q100	217.27	217.20		0.00	0.01	63.33	22.74	821.57	20.69	2.21
Nonacoicus Brook	13230.59	Q50	217.05	217.02		0.00	0.01	98.66	18.88	580.06	131.06	1.46
Nonacoicus Brook	13230.59	Q100	217.26	217.22		0.00	0.02	99.84	22.79	684.81	157.40	1.69
Nonacoicus Brook	13197.21	Q50	217.03	216.96	210.55			83.53	14.44	669.81	45.75	2.25
Nonacoicus Brook	13197.21	Q100	217.24	217.14	210.87	0.00	0.02	84.56	17.80	791.98	55.22	2.61
Nonacoicus Brook	13158 BR U	Q50	217.04	216.91	210.51			28.00		730.00		2.84
Nonacoicus Brook	13158 BR U	Q100	217.21	217.04	210.84	0.01	0.02	28.00		865.00		3.32
Nonacoicus Brook	13158 BR D	Q50	216.06	215.93	209.55			28.00		730.00		2.85
Nonacoicus Brook	13158 BR D	Q100	217.18	217.04	209.87	0.00	0.05	28.00		865.00		3.01
Nonacoicus Brook	13113.75	Q50	216.03	215.99		0.00	0.02	140.33	106.84	538.30	84.87	1.82
Nonacoicus Brook	13113.75	Q100	217.13	217.09		0.00	0.02	150.53	132.44	625.18	107.39	1.88
Nonacoicus Brook	13064.35	Q50	216.01	216.00	210.12			192.02	212.06	278.00	239.94	1.07
Nonacoicus Brook	13064.35	Q100	217.11	217.10	210.27			199.51	252.59	317.87	294.54	1.07

Energy gradeline for given WSEL.

HEC-RAS TABLES (CONT.)

Cross Section Output

File Type Options Help

River: Nonacoicus Brook Profile: Q50

Reach: Nonacoicus Brook RS: 13230.59 Plan: Pre Prop West

Plan: Prop West Nonacoicus Brook Nonacoicus Brook RS: 13230.59 Profile: Q50					
		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	217.05	Wt. n-Val.	0.060	0.035	0.060
Vel Head (ft)	0.03	Reach Len. (ft)	33.38	33.38	33.38
W.S. Elev (ft)	217.02	Flow Area (sq ft)	44.36	396.11	214.32
Crit W.S. (ft)		Area (sq ft)	44.36	396.11	214.32
E.G. Slope (ft/ft)	0.000068	Flow (cfs)	18.88	580.06	131.06
Q Total (cfs)	730.00	Top Width (ft)	12.96	45.57	40.12
Top Width (ft)	98.66	Avg. Vel. (ft/s)	0.43	1.46	0.61
Vel Total (ft/s)	1.11	Hydr. Depth (ft)	3.42	8.69	5.34
Max Chl Dpth (ft)	9.82	Conv. (cfs)	2292.3	70418.7	15910.1
Conv. Total (cfs)	88621.1	Wetted Per. (ft)	14.72	46.23	41.29
Length Wtd. (ft)	33.38	Shear (lb/sq ft)	0.01	0.04	0.02
Min Ch El (ft)	207.20	Stream Power (lb/ft s)	0.01	0.05	0.01
Alpha	1.43	Cum Volume (acre-ft)	0.49	1.09	0.58
Frctn Loss (ft)	0.00	Cum SA (acres)	0.09	0.12	0.13
C & E Loss (ft)	0.01				

Errors, Warnings and Notes

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Select Profile

Cross Section Output

File Type Options Help

River: Nonacoicus Brook Profile: Q50

Reach: Nonacoicus Brook RS: 13158 BR U Plan: Pre Prop West

Plan: Prop West Nonacoicus Brook Nonacoicus Brook RS: 13158 BR U Profile: Q50					
		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	217.04	Wt. n-Val.		0.035	
Vel Head (ft)	0.13	Reach Len. (ft)	53.00	53.00	53.00
W.S. Elev (ft)	216.91	Flow Area (sq ft)		256.78	
Crit W.S. (ft)	210.51	Area (sq ft)		256.78	
E.G. Slope (ft/ft)	0.000248	Flow (cfs)		730.00	
Q Total (cfs)	730.00	Top Width (ft)		28.00	
Top Width (ft)	28.00	Avg. Vel. (ft/s)		2.84	
Vel Total (ft/s)	2.84	Hydr. Depth (ft)		9.17	
Max Chl Dpth (ft)	10.42	Conv. (cfs)		46362.2	
Conv. Total (cfs)	46362.2	Wetted Per. (ft)		29.28	
Length Wtd. (ft)	53.00	Shear (lb/sq ft)		0.14	
Min Ch El (ft)	206.49	Stream Power (lb/ft s)		0.39	
Alpha	1.00	Cum Volume (acre-ft)	0.46	0.76	0.44
Frctn Loss (ft)		Cum SA (acres)	0.08	0.09	0.09
C & E Loss (ft)					

Errors, Warnings and Notes

Warning: For the final momentum answer at the bridge, the upstream energy was computed lower than the energy inside of the bridge deck. This is not physically possible. Please review your bridge data and results for reasonableness.

Enter to move to next downstream river station location

HEC-RAS TABLES (CONT.)

Cross Section Output

File Type Options Help

River: Nonacoicus Brook Profile: Q100

Reach: Nonacoicus Brook RS: 13230.59 Plan: Pre Prop West

Plan: Prop West Nonacoicus Brook Nonacoicus Brook RS: 13230.59 Profile: Q100					
		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	217.26	Wt. n-Val.	0.060	0.035	0.060
Vel Head (ft)	0.04	Reach Len. (ft)	33.38	33.38	33.38
W.S. Elev (ft)	217.22	Flow Area (sq ft)	47.04	405.26	222.41
Crit W.S. (ft)		Area (sq ft)	47.04	405.26	222.41
E.G. Slope (ft/ft)	0.000088	Flow (cfs)	22.79	684.81	157.40
Q Total (cfs)	865.00	Top Width (ft)	13.78	45.57	40.48
Top Width (ft)	99.84	Avg. Vel. (ft/s)	0.48	1.69	0.71
Vel Total (ft/s)	1.28	Hydr. Depth (ft)	3.41	8.89	5.49
Max Chl Dpth (ft)	10.02	Conv. (cfs)	2434.6	73150.4	16812.7
Conv. Total (cfs)	92397.8	Wetted Per. (ft)	15.57	46.23	41.70
Length Wtd. (ft)	33.38	Shear (lb/sq ft)	0.02	0.05	0.03
Min Ch El (ft)	207.20	Stream Power (lb/ft s)	0.01	0.08	0.02
Alpha	1.43	Cum Volume (acre-ft)	0.59	1.17	0.69
Frctn Loss (ft)	0.00	Cum SA (acres)	0.10	0.12	0.14
C & E Loss (ft)	0.02				

Errors, Warnings and Notes

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Enter to move to next upstream river station location

Cross Section Output

File Type Options Help

River: Nonacoicus Brook Profile: Q100

Reach: Nonacoicus Brook RS: 13158 BR U Plan: Pre Prop West

Plan: Prop West Nonacoicus Brook Nonacoicus Brook RS: 13158 BR U Profile: Q100					
		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	217.21	Wt. n-Val.		0.035	
Vel Head (ft)	0.17	Reach Len. (ft)	53.00	53.00	53.00
W.S. Elev (ft)	217.04	Flow Area (sq ft)		260.32	
Crit W.S. (ft)	210.84	Area (sq ft)		260.32	
E.G. Slope (ft/ft)	0.000333	Flow (cfs)		865.00	
Q Total (cfs)	865.00	Top Width (ft)		28.00	
Top Width (ft)	28.00	Avg. Vel. (ft/s)		3.32	
Vel Total (ft/s)	3.32	Hydr. Depth (ft)		9.30	
Max Chl Dpth (ft)	10.55	Conv. (cfs)		47431.5	
Conv. Total (cfs)	47431.5	Wetted Per. (ft)		29.28	
Length Wtd. (ft)	53.00	Shear (lb/sq ft)		0.18	
Min Ch El (ft)	206.49	Stream Power (lb/ft s)		0.61	
Alpha	1.00	Cum Volume (acre-ft)	0.56	0.83	0.55
Frctn Loss (ft)	0.01	Cum SA (acres)	0.09	0.09	0.10
C & E Loss (ft)	0.02				

Errors, Warnings and Notes

Note: Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum answer has been disregarded.

Select Profile

GEOMETRY DATA

Left Approach

Upstream Bridge Water Surface Elevation: $WSEL_{BR} := \begin{bmatrix} 216.91 \\ 217.04 \end{bmatrix} ft$ Refer to HEC-RAS

Station of Face of Abutment: $STA_{abut.left} := -14.00 ft$ Refer to HEC-RAS

Station of Overbank or Proposed Toe: $STA_{BR.LOB} := -2.5 ft$

Station of WSEL @ Outer Edge of Cross-section: $STA_{WSEL.LOB} := \begin{bmatrix} -30.20 \\ -30.48 \end{bmatrix} ft$ Refer to HEC-RAS

Abutment Set Back Distance: $L_{SBR.L} := |STA_{BR.LOB} - STA_{abut.left}| = 11.500 ft$

Length of Left Approach: $L_{left.approach_i} := |STA_{WSEL.LOB_i} - STA_{abut.left}| = \begin{bmatrix} 16.200 \\ 16.480 \end{bmatrix} ft$

Right Approach

Upstream Bridge Water Surface Elevation: $WSEL_{BR} = \begin{bmatrix} 216.910 \\ 217.040 \end{bmatrix} ft$ Refer to HEC-RAS

Station of Face of Abutment: $STA_{abut.right} := 14.00 ft$ Refer to HEC-RAS

Station of Overbank or Proposed Toe: $STA_{BR ROB} := 2.5 ft$

Station of WSEL @ Outer Edge of Cross-section: $STA_{WSEL.ROB} := \begin{bmatrix} 53.07 \\ 53.52 \end{bmatrix} ft$ Refer to HEC-RAS

Abutment Set Back Distance: $L_{SBR.R} := |STA_{BR.ROB} - STA_{abut.right}| = 11.500 ft$

Length of Right Approach: $L_{right.approach_i} := |STA_{WSEL.ROB_i} - STA_{abut.right}| = \begin{bmatrix} 39.070 \\ 39.520 \end{bmatrix} ft$

HYDRAULIC DATA

Upstream Cross-Section (132+30.59)

Upstream Left Overbank Discharge: $Q_{US.LOB} := \left[\begin{matrix} 18.88 \\ 22.79 \end{matrix} \right] \frac{ft^3}{s}$ HEC-RAS Tables

Upstream Main Channel Discharge: $Q_{US.Main} := \left[\begin{matrix} 580.06 \\ 684.81 \end{matrix} \right] \frac{ft^3}{s}$ HEC-RAS Tables

Upstream Right Overbank Discharge: $Q_{US.ROB} := \left[\begin{matrix} 131.06 \\ 157.40 \end{matrix} \right] \frac{ft^3}{s}$ HEC-RAS Tables

Upstream Left Overbank Flow Area: $A_{US.LOB} := \left[\begin{matrix} 44.36 \\ 47.04 \end{matrix} \right] ft^2$ HEC-RAS Tables

Upstream Main Channel Flow Area: $A_{US.Main} := \left[\begin{matrix} 396.11 \\ 405.26 \end{matrix} \right] ft^2$ HEC-RAS Tables

Upstream Right Overbank Flow Area: $A_{US.ROB} := \left[\begin{matrix} 214.32 \\ 222.41 \end{matrix} \right] ft^2$ HEC-RAS Tables

Top Width of Left Overbank: $TW_{US.LOB} := \left[\begin{matrix} 12.96 \\ 13.78 \end{matrix} \right] ft$ HEC-RAS Tables

Top Width of Main Channel: $TW_{US.Main} := \left[\begin{matrix} 45.57 \\ 45.57 \end{matrix} \right] ft$ HEC-RAS Tables

Top Width of Right Overbank: $TW_{US.ROB} := \left[\begin{matrix} 40.12 \\ 40.48 \end{matrix} \right] ft$ HEC-RAS Tables

Average Flow Depth of Entire Channel: $y_{US_i} := \frac{\left(A_{US.LOB_i} + A_{US.Main_i} + A_{US.ROB_i} \right)}{\left(TW_{US.LOB_i} + TW_{US.Main_i} + TW_{US.ROB_i} \right)}$

$y_{US} = \left[\begin{matrix} 6.638 \\ 6.759 \end{matrix} \right] ft$

HYDRAULIC DATA (CONT.)

Upstream Cross-Section (132+30.59) (Cont.)

Average Left Overbank Flow Depth: $y_{US.LOB_i} := \frac{A_{US.LOB_i}}{TW_{US.LOB_i}} = \left[\begin{matrix} 3.423 \\ 3.414 \end{matrix} \right] ft$

Average Main Channel Flow Depth: $y_{US.Main_i} := \frac{A_{US.Main_i}}{TW_{US.Main_i}} = \left[\begin{matrix} 8.692 \\ 8.893 \end{matrix} \right] ft$

Average Right Overbank Flow Depth: $y_{US.ROB_i} := \frac{A_{US.ROB_i}}{TW_{US.ROB_i}} = \left[\begin{matrix} 5.342 \\ 5.494 \end{matrix} \right] ft$

Left Overbank Manning's n: $n_{US.LOB} := 0.06$

Right Overbank Manning's n: $n_{US.ROB} := 0.06$

Max Upstream Main Channel Flow Depth: $y_{US.Main.Max} := \left[\begin{matrix} 9.82 \\ 10.02 \end{matrix} \right] ft$

Upstream Energy Grade Line Slope: $S_{1.US} := \left[\begin{matrix} 0.000068 \\ 0.000088 \end{matrix} \right] \frac{ft}{ft}$

Bridge Cross-Section (131+58)

Upstream Water Surface Elevation
(*Use Max. El. Immediately Upstream/
Downstream of Bridge): $WSEL_{Design} := 216.91 ft$ HEC-RAS Tables

Bridge Left Overbank Discharge: $Q_{BR.LOB} := \left[\begin{matrix} 0 \\ 0 \end{matrix} \right] \frac{ft^3}{s}$ HEC-RAS Tables

Bridge Main Channel Discharge: $Q_{BR.Main} := \left[\begin{matrix} 730 \\ 865 \end{matrix} \right] \frac{ft^3}{s}$ HEC-RAS Tables

Bridge Right Overbank Discharge: $Q_{BR.ROB} := \left[\begin{matrix} 0 \\ 0 \end{matrix} \right] \frac{ft^3}{s}$ HEC-RAS Tables

HYDRAULIC DATA (CONT.)

Bridge Cross-Section (131+58) (Cont.)

Bridge Left Overbank Flow Area: $A_{BR.LOB} := \begin{bmatrix} 0 \\ 0 \end{bmatrix} ft^2$ HEC-RAS Tables

Bridge Main Channel Flow Area: $A_{BR.Main} := \begin{bmatrix} 256.78 \\ 260.32 \end{bmatrix} ft^2$ HEC-RAS Tables

Bridge Right Overbank Flow Area: $A_{BR.ROB} := \begin{bmatrix} 0 \\ 0 \end{bmatrix} ft^2$ HEC-RAS Tables

Top Width of Left Overbank: $TW_{BR.LOB} := \begin{bmatrix} 0 \\ 0 \end{bmatrix} ft$ HEC-RAS Tables

Top Width of Main Channel: $TW_{BR.Main} := \begin{bmatrix} 28 \\ 28 \end{bmatrix} ft$ HEC-RAS Tables

Top Width of Right Overbank: $TW_{BR.ROB} := \begin{bmatrix} 0 \\ 0 \end{bmatrix} ft$ HEC-RAS Tables

Average Flow Depth of Entire Channel: $y_{BR_i} := \frac{(A_{BR.LOB_i} + A_{BR.Main_i} + A_{BR.ROB_i})}{(TW_{BR.LOB_i} + TW_{BR.Main_i} + TW_{BR.ROB_i})}$

$y_{BR} = \begin{bmatrix} 9.171 \\ 9.297 \end{bmatrix} ft$

Average Main Channel Flow Depth: $y_{BR.Main_i} := \frac{A_{BR.Main_i}}{TW_{BR.Main_i}} = \begin{bmatrix} 9.171 \\ 9.297 \end{bmatrix} ft$

Max Main Channel Flow Depth: $y_{BR.Main.Max} := \begin{bmatrix} 10.42 \\ 10.55 \end{bmatrix} ft$

Energy Grade Line Slope at Bridge: $S_{1.BR} := \begin{bmatrix} 0.000248 \\ 0.000333 \end{bmatrix} \frac{ft}{ft}$

HYDRAULIC DATA (CONT.)

Bridge Contraction Scour Variables

Depth in Contracted Section before Scour:

$$y_{BR.Main} = \begin{bmatrix} 9.171 \\ 9.297 \end{bmatrix} \text{ ft}$$

Average Depth in Upstream Main Channel:

$$y_{US.Main} = \begin{bmatrix} 8.692 \\ 8.893 \end{bmatrix} \text{ ft}$$

Top Width of Upstream Main Channel:

$$TW_{US.Main} = \begin{bmatrix} 45.570 \\ 45.570 \end{bmatrix} \text{ ft}$$

Top Width of Contracted Section Main Channel:

$$TW_{BR.Main} = \begin{bmatrix} 28.000 \\ 28.000 \end{bmatrix} \text{ ft}$$

Flow in Upstream Main Channel Transporting Sediment:

$$Q_{US.Main} = \begin{bmatrix} 580.060 \\ 684.810 \end{bmatrix} \frac{\text{ft}^3}{\text{s}}$$

Flow in Contracted Channel:

$$Q_{BR.Main} = \begin{bmatrix} 730.000 \\ 865.000 \end{bmatrix} \frac{\text{ft}^3}{\text{s}}$$

Average Velocity in Upstream (Main) Channel Transporting Sediment:

$$V_{US.Main_i} := \frac{Q_{US.Main_i}}{A_{US.Main_i}} = \begin{bmatrix} 1.464 \\ 1.690 \end{bmatrix} \frac{\text{ft}}{\text{s}}$$

Shear Velocity in Upstream Channel:

$$V'_{Main_i} := \sqrt{g \cdot y_{US.Main_i} \cdot S_{1.US_i}} = \begin{bmatrix} 0.138 \\ 0.159 \end{bmatrix} \frac{\text{ft}}{\text{s}}$$

MATERIAL DATA

Main Channel

Median Diameter of Bed Material: $D_{50.Main} := 1.8 \text{ mm}$ Per S.W. Cole Gradation Report of Site Soil Sample (W. Main St. - Upstream)

Diameter of the smallest nontransportable particle: $D_{m.Main} := 1.25 \cdot D_{50.Main} = 2.250 \text{ mm}$

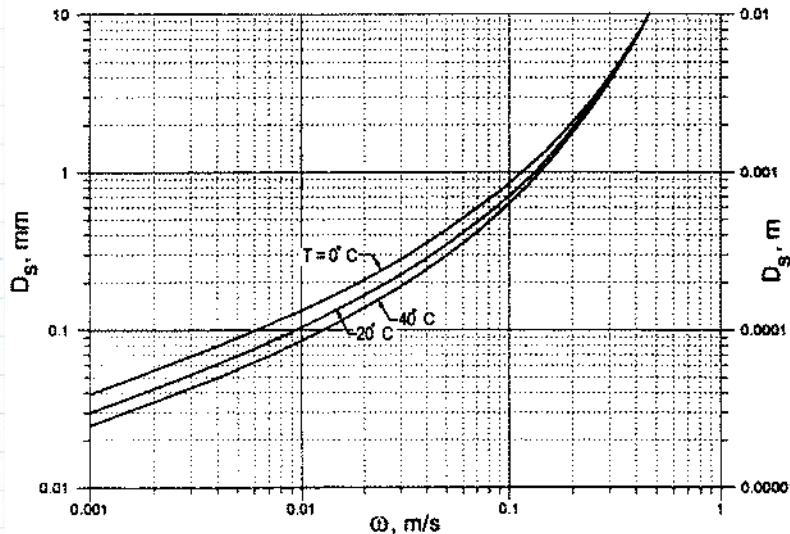
Note: If $D50 < 0.2\text{mm}$, use 0.2mm for clear-water scour

Water Unit Weight: $\gamma_w := 62.4 \frac{\text{lb}}{\text{ft}^3}$

Particle Unit Weight: $\gamma_s := 2.65 \cdot \gamma_w = 165.360 \frac{\text{lb}}{\text{ft}^3}$

D50 Fall Velocity @ 20C: $\omega_{Main} := 0.18 \frac{\text{m}}{\text{sec}}$

Ref. 1, Fig. 6.8
(as seen below)



English Unit Constant for Critical Velocity Eq.: $K_{u_c} := 11.17$

Critical Velocity that Bed Material of Size D50 and smaller will be transported: $V_{c.Main_i} := K_{u_c} \cdot y_{US.Main_i}^{\frac{1}{6}} \cdot (D_{50.Main})^{\frac{1}{3}} \cdot \frac{\text{ft}^{\frac{1}{2}}}{\text{sec}}$

$$V_{c.Main} = \begin{bmatrix} 2.895 \\ 2.906 \end{bmatrix} \frac{\text{ft}}{\text{s}}$$

Ref. 1, Eq. 6.1

CONTRACTION SCOUR

Main Channel

English Unit Constant for Clear-Water Scour:

$$K_{u_clear} := 0.0077$$

Check if Live-Bed or Clear-Water Scour is present:

$$check_cont_scour_i := \begin{cases} \text{if } V_{c.Main_i} > V_{US.Main_i} \\ \quad \parallel \text{ "Clear-Water Scour" } \\ \text{else if } V_{US.Main_i} > V_{c.Main_i} \\ \quad \parallel \text{ "Live-Bed Scour" } \end{cases}$$

$$check_cont_scour = \begin{bmatrix} \text{"Clear-Water Scour"} \\ \text{"Clear-Water Scour"} \end{bmatrix}$$

Exponent determined for Live-Bed Contraction Scour:

V/T	k ₁	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge
>2.0	0.69	Mostly suspended bed material discharge

$$k_{1_i} := \begin{cases} \text{if } \frac{V'_{Main_i}}{\omega_{Main}} < 0.50 \\ \quad \parallel 0.59 \\ \text{else if } 0.50 \leq \frac{V'_{Main_i}}{\omega_{Main}} \leq 2.0 \\ \quad \parallel 0.64 \\ \text{else if } \frac{V'_{Main_i}}{\omega_{Main}} > 2.0 \\ \quad \parallel 0.69 \end{cases}$$

Ref. 1, Art. 6.3

$$k_1 = \begin{bmatrix} 0.590 \\ 0.590 \end{bmatrix}$$

CONTRACTION SCOUR (CONT.)

Main Channel (Cont.)

Average Equilibrium Depth
in Contracted Section:

$y_{2_main_i} := \text{if } V_{c.Main_i} > V_{US.Main_i} \text{ Ref. 1, Eq. 6.2 \& 6.4}$

$$\left\| \left(\frac{K_{u_clear} \cdot Q_{BR.Main_i}^2}{(\max(D_{m.Main_i}, 0.2 \text{ mm}))^{\frac{2}{3}} \cdot TW_{BR.Main_i}^2} \cdot \frac{sec^2}{ft} \right)^{\frac{3}{7}} \right\|$$

else if $V_{US.Main_i} > V_{c.Main_i}$

$$\left\| y_{US.Main_i} \cdot \left(\frac{Q_{BR.Main_i}}{Q_{US.Main_i}} \right)^{\frac{6}{7}} \cdot \left(\frac{TW_{US.Main_i}^{k_{1_i}}}{TW_{BR.Main_i}} \right) \right\|$$

$y_{2_main} = \begin{bmatrix} 8.263 \\ 9.557 \end{bmatrix} ft$

Depth in Contracted
Section before Scour:

$y_{BR.Main} = \begin{bmatrix} 9.171 \\ 9.297 \end{bmatrix} ft$

Contraction Scour Depth:

$y_{s.main_i} := y_{2_main_i} - y_{BR.Main_i} \text{ Ref. 1, Eq. 6.3 \& 6.5}$

$y_{s.main} = \begin{bmatrix} -0.907 \\ 0.260 \end{bmatrix} ft$

TOTAL SCOUR

NCHRP 24-20 Abutment Scour Approach

Refer to Ref. 1, Section 8.6.3

Left Abutment Variables:

Set-Back Ratio:
$$SBR_{Left_i} := \frac{L_{SBR.L}}{y_{BR.Main_i}} = \left[\begin{array}{l} 1.254 \\ 1.237 \end{array} \right]$$

Upstream Floodplain Width:
$$TW_{US.LOB} = \left[\begin{array}{l} 12.960 \\ 13.780 \end{array} \right] ft$$

Projected Approach Length:
$$L_{left.approach} = \left[\begin{array}{l} 16.200 \\ 16.480 \end{array} \right] ft$$

Check if the Live-Bed or Clear-Water Contraction Scour is present:

$$check_NCHRP_scour_left_i := \text{if } \frac{L_{left.approach_i}}{TW_{US.LOB_i}} \geq 0.75$$

|| "Live-Bed Scour"

else

|| "Clear Water Scour"

$$check_NCHRP_scour_left = \left[\begin{array}{l} \text{"Live-Bed Scour"} \\ \text{"Live-Bed Scour"} \end{array} \right]$$

Right Abutment Variables:

Set-Back Ratio:
$$SBR_{Right_i} := \frac{L_{SBR.R}}{y_{BR.Main_i}} = \left[\begin{array}{l} 1.254 \\ 1.237 \end{array} \right]$$

Upstream Floodplain Width:
$$TW_{US ROB} = \left[\begin{array}{l} 40.120 \\ 40.480 \end{array} \right] ft$$

Projected Approach Length:
$$L_{right.approach} = \left[\begin{array}{l} 39.070 \\ 39.520 \end{array} \right] ft$$

TOTAL SCOUR (CONT.)

NCHRP 24-20 Abutment Scour Approach (Cont.)

Right Abutment Variables (Cont.):

Check if the Live-Bed or Clear-Water Contraction Scour is present:

$$check_NCHRP_scour_right_i := \text{if } \frac{L_{right.approach_i}}{TW_{US.ROB_i}} \geq 0.75$$

$$\left\{ \begin{array}{l} \text{“Live-Bed Scour”} \\ \text{else} \\ \text{“Clear Water Scour”} \end{array} \right.$$

$$check_NCHRP_scour_right = \left[\begin{array}{l} \text{“Live-Bed Scour”} \\ \text{“Live-Bed Scour”} \end{array} \right]$$

Bridge Cross-Section Unit Discharges for Live-Bed Scour:

Bridge Channel Unit Discharge:

$$q_{2.live_i} := \frac{Q_{BR.Main_i} + Q_{BR.ROB_i} + Q_{BR.LOB_i}}{TW_{BR.Main_i} + TW_{BR.ROB_i} + TW_{BR.LOB_i}}$$

$$q_{2.live} = \left[\frac{26.071}{30.893} \right] \frac{ft^2}{s}$$

Upstream Cross-Section Unit Discharges:

Upstream Channel Unit Discharge:

$$q_{1.live_i} := \frac{Q_{US.Main_i}}{TW_{US.Main_i}} = \left[\frac{12.729}{15.028} \right] \frac{ft^2}{s}$$

TOTAL SCOUR (CONT.)
NCHRP 24-20 Abutment Scour Approach (Cont.)
Abutment Live-Bed Scour:

Unit Discharge Ratio: $\frac{q_{2.live_i}}{q_{1.live_i}} = \left[\frac{2.048}{2.056} \right]$

Flow Depth Including Live-Bed Scour: $y_{c_i} := y_{US.Main_i} \cdot \left(\frac{q_{2.live_i}}{q_{1.live_i}} \right)^{\frac{6}{7}} = \left[\frac{16.070}{16.493} \right] ft$ Ref. 1, Eq. 8.5

Scour Amplification Factor for Live-Bed Conditions: $\alpha_A := \left[\frac{1.166}{1.167} \right]$ Ref. 1, Fig. 8.9 (As seen Below)

Maximum Flow Depth Resulting from Abutment Scour: $y_{max_i} := \alpha_{A_i} \cdot y_{c_i}$ Ref. 1, Eq. 8.3

$y_{max} = \left[\frac{18.738}{19.248} \right] ft$

Abutment Scour Depth: $y_{s.NCHRP.live_i} := y_{max_i} - y_{BR.Main.Max_i}$ Ref. 1, Eq. 8.4

$y_{s.NCHRP.live} = \left[\frac{8.318}{8.698} \right] ft$

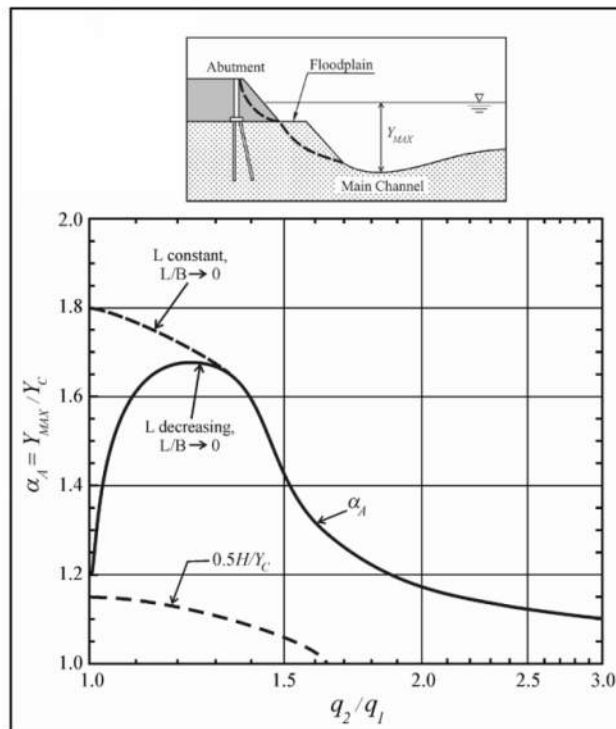


Figure 8.9. Scour amplification factor for spill-through abutments and live-bed conditions (NCHRP 2010b).

SCOUR SUMMARY

Main Channel

Contraction Scour:

$$y_{s.main} = \begin{bmatrix} -0.907 \\ 0.260 \end{bmatrix} \text{ ft}$$

Abutments

Local Scour (NCHRP):

$$check_NCHRP_scour_left = \begin{bmatrix} \text{"Live-Bed Scour"} \\ \text{"Live-Bed Scour"} \end{bmatrix}$$

$$check_NCHRP_scour_right = \begin{bmatrix} \text{"Live-Bed Scour"} \\ \text{"Live-Bed Scour"} \end{bmatrix}$$

Local Scour:

$$y_{s.NCHRP.live} = \begin{bmatrix} 8.318 \\ 8.698 \end{bmatrix} \text{ ft}$$

Bottom Elevation of Scour Pool

Channel Thawleg Elevation:

$$El_{Thawleg} := 206 \text{ ft}$$

Max Scour Depth:

$$Max_{scour}_i := \max(y_{s.main}_i, y_{s.NCHRP.live}_i)$$

$$Max_{scour} = \begin{bmatrix} 8.318 \\ 8.698 \end{bmatrix} \text{ ft}$$

Scour Pool Elevation:

$$Scour_{el}_i := El_{Thawleg} - Max_{scour}_i$$

$$Scour_{el} = \begin{bmatrix} 197.682 \\ 197.302 \end{bmatrix} \text{ ft}$$

MATERIAL, GEOMETRY DATA AND CONSTANTS

Specific Gravity of Riprap: $S_s := 2.60$

Gravitational Acceleration: $g = 32.174 \frac{ft}{s^2}$

Vertical Wall or Spill-through Abutment? $abut := \text{"Vertical"}$ • Enter "Vertical" if Vertical Wall or "Spill" if Spill-through

Left Abutment Geometry

Station of Overbank or Proposed Toe: $STA_{BR.LOB} = -2.500 \text{ ft}$ Refer to HEC-RAS

Station of tip of Abutment: $STA_{abut.left} = -14.000 \text{ ft}$ Refer to HEC-RAS

Abutment Set Back Distance: $L_{SBR.L} = 11.500 \text{ ft}$

Right Abutment Geometry

Station of Overbank or Proposed Toe: $STA_{BR.ROB} = 2.500 \text{ ft}$ Refer to HEC-RAS

Station of tip of Abutment: $STA_{abut.right} = 14.000 \text{ ft}$ Refer to HEC-RAS

Abutment Set Back Distance: $L_{SBR.R} = 11.500 \text{ ft}$

Riprap Sizes

- MassDOT does not provide different sizes for riprap. Therefore, determine the required riprap sized based on HEC 23 Vol. 1 riprap gradation, and compare this to MassDOT's requirements. Below are the riprap sizes from Table 5.1 of HEC 23 (also shown on the next page)

	<u>Median size</u>	<u>Maximum size</u>	
Class I:	$D_{50_I} := 6 \text{ in}$	$D_{100_I} := 12 \text{ in}$	Ref. 2, Table 5.1
Class III:	$D_{50_{III}} := 12 \text{ in}$	$D_{100_{III}} := 24 \text{ in}$	Ref. 2, Table 5.1
Class V:	$D_{50_V} := 18 \text{ in}$	$D_{100_V} := 36 \text{ in}$	Ref. 2, Table 5.1
Class VII:	$D_{50_{VII}} := 24 \text{ in}$	$D_{100_{VII}} := 48 \text{ in}$	Ref. 2, Table 5.1
Class IX:	$D_{50_{IX}} := 36 \text{ in}$	$D_{100_{IX}} := 72 \text{ in}$	Ref. 2, Table 5.1

MATERIAL, GEOMETRY DATA AND CONSTANTS (CONT.)

Riprap Sizes (Cont.)

- Below are the riprap size tables from HEC 23 Vol. 1. MassDOT requires 75% of the volume of stone weighing not less than 500 pounds each. Based on Table 5.2, this approximately corresponds to Riprap Class V.

Table 5.1. Minimum and Maximum Allowable Particle Size in Inches.

Nominal Riprap Class by Median Particle Diameter		d ₁₅		d ₅₀		d ₈₅		d ₁₀₀
<u>Class</u>	<u>Size</u>	Min	Max	Min	Max	Min	Max	Max
I	6 in	3.7	5.2	5.7	6.9	7.8	9.2	12.0
II	9 in	5.5	7.8	8.5	10.5	11.5	14.0	18.0
III	12 in	7.3	10.5	11.5	14.0	15.5	18.5	24.0
IV	15 in	9.2	13.0	14.5	17.5	19.5	23.0	30.0
V	18 in	11.0	15.5	17.0	20.5	23.5	27.5	36.0
VI	21 in	13.0	18.5	20.0	24.0	27.5	32.5	42.0
VII	24 in	14.5	21.0	23.0	27.5	31.0	37.0	48.0
VIII	30 in	18.5	26.0	28.5	34.5	39.0	46.0	60.0
IX	36 in	22.0	31.5	34.0	41.5	47.0	55.5	72.0
X	42 in	25.5	36.5	40.0	48.5	54.5	64.5	84.0

Note: Particle size d corresponds to the intermediate ("B") axis of the particle.

Table 5.2. Minimum and Maximum Allowable Particle Weight in Pounds.

Nominal Riprap Class by Median Particle Weight		W ₁₅		W ₅₀		W ₈₅		W ₁₀₀
<u>Class</u>	<u>Weight</u>	Min	Max	Min	Max	Min	Max	Max
I	20 lb	4	12	15	27	39	64	140
II	60 lb	13	39	51	90	130	220	470
III	150 lb	32	93	120	210	310	510	1100
IV	300 lb	62	180	240	420	600	1000	2200
V	1/4 ton	110	310	410	720	1050	1750	3800
VI	3/8 ton	170	500	650	1150	1650	2800	6000
VII	1/2 ton	260	740	950	1700	2500	4100	9000
VIII	1 ton	500	1450	1900	3300	4800	8000	17600
IX	2 ton	860	2500	3300	5800	8300	13900	30400
X	3 ton	1350	4000	5200	9200	13200	22000	48200

Note: Weight limits for each class are estimated from particle size by: $W = 0.85(\gamma_s d^3)$ where d corresponds to the intermediate ("B") axis of the particle, and particle specific gravity is taken as 2.65.

SIZE ABUTMENT RIPRAP

1. Determine Set-back Ratios

Left Abutment Set-back Ratio:
$$SBR_{Left} := \frac{L_{SBR.L}}{y_{BR.Main}} = \left[\begin{array}{l} 1.254 \\ 1.237 \end{array} \right]$$

Right Abutment Set-back Ratio:
$$SBR_{Right} := \frac{L_{SBR.R}}{y_{BR.Main}} = \left[\begin{array}{l} 1.254 \\ 1.237 \end{array} \right]$$

2a. Determine the Abutment Characteristic Velocity per HEC-23 DG 14, SBR Approach

Abutment Characteristic Velocity:
$$V_{Abut_i} := \text{if } SBR_{Left_i} \leq 5 \wedge SBR_{Right_i} \leq 5 \left| \begin{array}{l} \left(\frac{Q_{US.Main_i} + Q_{US.LOB_i} + Q_{US.ROB_i}}{A_{BR.Main_i} + A_{BR.LOB_i} + A_{BR.ROB_i}} \right) \\ \text{else if } SBR_{Left_i} \leq 5 \wedge SBR_{Right_i} > 5 \\ \left(\frac{Q_{US.Main_i} + Q_{US.LOB_i}}{A_{BR.Main_i} + A_{BR.LOB_i}} \right) \\ \text{else if } SBR_{Left_i} > 5 \\ \left(\frac{Q_{US.LOB_i}}{A_{BR.LOB_i}} \right) \end{array} \right.$$

$$V_{Abut} = \left[\begin{array}{l} 2.843 \\ 3.323 \end{array} \right] \frac{ft}{s}$$

Bridge Main Channel Velocity:
$$V_{BR.Main} := \frac{Q_{BR.Main}}{A_{BR.Main}} = \left[\begin{array}{l} 2.843 \\ 3.323 \end{array} \right] \frac{ft}{s}$$

- By inspection, the abutment characteristic velocity is the same as the bridge main channel velocity. Therefore, use the bridge main channel velocity to determine the riprap size.

SIZE ABUTMENT RIPRAP (CONT.)

3a. Determine the Froude Number

Froude Number:
$$F_{r.main_i} := \frac{V_{BR.Main_i}}{(g \cdot y_{BR.Main_i})^{0.5}} = \begin{bmatrix} 0.166 \\ 0.192 \end{bmatrix}$$

4a. Determine Velocity Multiplier

Velocity Multiplier:
$$k_i := \begin{cases} \text{if } abut = \text{"Vertical"} \wedge F_{r.main_i} \leq 0.8 & = \begin{bmatrix} 1.020 \\ 1.020 \end{bmatrix} \\ \quad \parallel 1.02 \\ \text{else if } abut = \text{"Spill"} \wedge F_{r.main_i} \leq 0.8 \\ \quad \parallel 0.89 \\ \text{else if } abut = \text{"Vertical"} \wedge F_{r.main_i} > 0.8 \\ \quad \parallel 0.69 \\ \text{else if } abut = \text{"Spill"} \wedge F_{r.main_i} > 0.8 \\ \quad \parallel 0.61 \end{cases}$$

5a. Compute Required Riprap Size

Equation_i :=
$$\begin{cases} \text{if } F_{r.main_i} \leq 0.80 & = \begin{bmatrix} \text{"HEC 23 Eq. 14.1"} \\ \text{"HEC 23 Eq. 14.1"} \end{bmatrix} \\ \quad \parallel \text{"HEC 23 Eq. 14.1"} \\ \text{else} \\ \quad \parallel \text{"HEC 23 Eq. 14.2"} \end{cases}$$

Required D50:
$$D_{50_i} := \begin{cases} \text{if } F_{r.main_i} \leq 0.80 & = \begin{bmatrix} 1.922 \\ 2.625 \end{bmatrix} \text{ in} \\ \quad \parallel \left(y_{BR.Main_i} \cdot \frac{k_i \cdot V_{BR.Main_i}^2}{(S_s - 1) \cdot g \cdot y_{BR.Main_i}} \right) \\ \text{else} \\ \quad \parallel \left(y_{BR.Main_i} \cdot \frac{k_i \cdot \left(\frac{V_{BR.Main_i}^2}{g \cdot y_{BR.Main_i}} \right)^{0.14}}{(S_s - 1)} \right) \end{cases}$$

SIZE ABUTMENT RIPRAP (CONT.)

5a. Compute Required Riprap Size (Cont.)

Minimum HEC 23 Riprap Class to specify:

$$\begin{aligned}
 HEC23_Riprap_i := & \text{if } D_{50_i} \leq D_{50_I} & = & \left[\begin{array}{l} \text{"Class I, D50 = 6in"} \\ \text{"Class I, D50 = 6in"} \end{array} \right] \\
 & \left\| \begin{array}{l} \text{"Class I, D50 = 6in"} \\ \text{else if } D_{50_i} \leq D_{50_III} \end{array} \right. \\
 & \left\| \begin{array}{l} \text{"Class III, D50 = 12in"} \\ \text{else if } D_{50_i} \leq D_{50_V} \end{array} \right. \\
 & \left\| \begin{array}{l} \text{"Class V, D50 = 18in"} \\ \text{else if } D_{50_i} \leq D_{50_VII} \end{array} \right. \\
 & \left\| \begin{array}{l} \text{"Class VII, D50 = 24in"} \\ \text{else if } D_{50_i} \leq D_{50_IX} \end{array} \right. \\
 & \left\| \text{"Class IX, D50 = 36 in"}
 \end{aligned}$$

- Per the design, Riprap Class I is required. However, per MassDOT Specifications, Riprap Class V is required. This is municipal project though, so we propose to use MassDOT's Modified Rock Fill from the MassDOT Standard Specifications section M2.02.04 (see blow). This is approximately equivalent to Class I Riprap. Therefore, determine the required thickness of the stone fill. Use **D50 = 6in, D100 = 12in.**

Proposed Median Diameter: $D_{50.prop} := 6 \text{ in}$

Proposed Maximum Diameter: $D_{100.prop} := 8 \text{ in}$

M2.02.4 Modified Rockfill

Modified rockfill shall consist of hard, durable angular shaped stones which are the product of the primary crushing of a stone crusher. Rounded stone, boulders, sandstone and similar soft stone or relatively thin slabs will not be acceptable.

Stone shall be free from overburden, spoil, shale, organic material and meet the following gradation requirements:

<u>Size of Stone</u>	<u>Passing Percentages</u>
8 in.	95-100
4 in.	0-25
2½ in.	0-5

SIZE ABUTMENT RIPRAP (CONT.)

6a. Determine the Extent of the Riprap Apron

Is Stone Fill Placed Under Water: $stone_w := \text{"yes"}$

Minimum Thickness:
$$t_{min} := \begin{cases} \text{if } stone_w = \text{"yes"} \\ \left\| \left(1.5 \cdot \left(1.5 \cdot D_{50.prop} \right) \right) \right\| \\ \text{else} \\ \left\| \left(1.5 \cdot D_{50.prop} \right) \right\| \end{cases} = 1.125 \text{ ft} \quad \text{HEC 23 14.3.4.c}$$

$$t_{riprap} := \text{if} (t_{min} \geq D_{100.prop}, t_{min}, D_{100.prop}) = 1.125 \text{ ft}$$

- Per the guidelines in HEC 23, the apron shall extend from the toe 2 times the depth of flow or 25', whichever is less.

Length of Apron:
$$l_{apron} := \min (2 \cdot y_{BR.Main}, 25 \text{ ft}) = 18.341 \text{ ft} \quad \text{Measured from Face of Abutment}$$

$$l_{apron.prop} := 18.5 \text{ ft}$$

Top Elevation of Riprap:
$$El_{riprap} := WSEL_{Design} + 2 \text{ ft} = 218.910 \text{ ft}$$

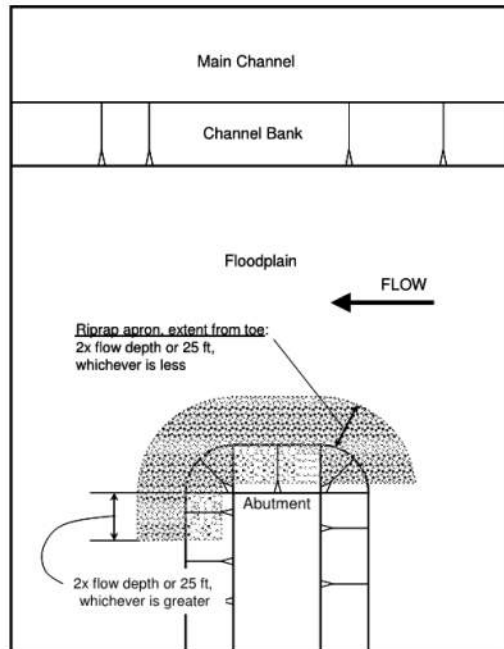


Figure 14.7. Plan view of the extent of rock riprap apron (Lagasse et al. 2006).

RIPRAP SUMMARY

Both Abutments

Median Stone Size: $D_{50.prop} = 6.000 \text{ in}$ (Class I Riprap, approx. Modified Rockfill)

Riprap Mattress Thickness: $t_{riprap} = 1.125 \text{ ft}$

Apron Length: $l_{apron.prop} = 18.500 \text{ ft}$ Measured from Face of Abutment

Top Elevation of Riprap: $El_{riprap} = 218.910 \text{ ft}$

June 5, 2020



Mr. Bill Mertz, PE
Vice President
WorldTech Engineering, LLC
300 TradeCenter, Suite 5580
Woburn, Massachusetts 01801

RE: West Main Street Bridge over Nonacoicus Brook (A-19-014)
Ayer, MA
Hydraulic Study Report Memorandum
Hoyle, Tanner Project No. 924001

Dear Mr. Mertz:

Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner) herein submits to WorldTech Engineering, LLC (WorldTech), this Hydraulic Study Report Memorandum. The purpose of this Memorandum is to respond to MassDOT Chapter 85 review comments dated May 3, 2019, regarding the hydraulic design of the above-referenced project. Specifically, this document contains explanation and supporting information related to the hydrology and scour considerations for the subject project (including documentation of the engineering methodology and assumptions utilized in the analysis and design), a discussion of the impact of revising hydrologic and hydraulic parameters, the proposed hydrologic data to be used in final design of the West Main Street Bridge, and an explanation of the revised approach to scour countermeasure design.

Hydrology & Hydraulic Analysis

A Hydraulic Study Report (HSR) was prepared by Hoyle, Tanner for this project to satisfy the requirements of the MassDOT Small Bridge Program (initial report was dated April 16, 2018 and the revised report was dated April 22, 2019). However, the hydraulic performance of the existing and proposed structures was evaluated during the Preliminary Design Report (PDR) phase of the project, and the PDR was completed and submitted to the Town for review and approval in April 2017. The Wandle Method was used to determine the hydrology for this project as part of the PDR which was completed prior to release of the USGS Regression Equations for Massachusetts (first published in May 2017). The Wandle Method was the best available method for determining flows on ungagged streams when the hydraulic analysis was completed.

The MassDOT Hydraulic Section offered the following comment on the revised HSR:

The Design Engineer should provide the stated evaluation of the current USGS Regression Equations (Zarriello, 2017) affect on predicted flood profiles of Nonacoicus Brook. This evaluation should be conducted assuming a normal depth boundary condition as presented in the hydraulic study report. Coinciding peaks of the Nashua River and Nonacoicus Brook of highly unlikely and as such backwater should not be considered unless can be proven otherwise.

Table 1 presents a comparison of the discharges calculated using the Wandle Method (the design flows) and the USGS Regression Equations (via StreamStats), as well as the discharges reported in the Flood Insurance Study (FIS) published by the Federal Emergency Management Agency (FEMA). StreamStats is a web-based application that provides estimates of various streamflow statistics by solving region-specific regression equations developed by the United States Geological Survey (USGS). The USGS Regression Equations produce higher flows than both the Wandle Method and the FIS values; however, the design flows (calculated via the Wandle Method) are within the 95% confidence interval of the of the USGS regression equations, as reported by StreamStats (see enclosure).

Table 1. Nonacoicus Brook Discharge Comparison

Return Period (Years)	Design Flow ¹ (cfs)	StreamStats ² (cfs)	FIS ³ (cfs)
2	250	329	-
5	370	536	-
10	465	697	400
25	605	930	-
50	730	1120	670
100	865	1320	720
500	1095	1860	1070

1. Determined using the Wandle Method's Regression Equations for Eastern Massachusetts
2. Determined using the USGS Regression Equations (Zarriello, 2017)
3. Determined using FIS for Middlesex County, Massachusetts, revised July 6, 2016

Based on the available hydraulic information published in the FIS, the hydraulic performance of this crossing is governed by the backwater of the Nashua River, even at lower flows. We concur with MassDOT that it is unlikely that these waterbodies will have coinciding peak flows due to the large difference in the size of contributing watersheds. However, it is reasonable to assume that the Nashua River will be above normal stage when Nonacoicus Brook experiences a 25-year storm event (the design event for the West Main Street Bridge); the National Cooperative Highway Research Program (NCHRP) Project 15-36 final report titled *Estimating Joint Probabilities of Design Coincident Flows at Stream Confluences* provides guidance on this issue. For the 25-year return period event in Nonacoicus Brook, the most frequent return period (i.e. lowest tailwater/backwater) event recommended by the NHCRP 15-36 report for the Nashua River is the 2-year return period event.

A detailed hydrologic and hydraulic study of the Nashua River would be necessary to determine the lowest flow in the Nashua River that creates backwater at the West Main Street crossing. The best information currently available is from the FIS detailed study of the Nashua River. The lowest return period reported in the FIS for the Nashua River is the 10-year storm event with a corresponding flow of 5,400 cubic feet per second (cfs) at the confluence with Nonacoicus Brook. Per the FIS, this flow produces backwater conditions at the West Main Street Bridge.

If USGS Regression Equations are used to estimate flows for Nonacoicus Brook, it would be appropriate to also use USGS Regression Equations to estimate flows for the Nashua River. The USGS Regression

Equations estimate a flow in the Nashua River at the confluence with Nonacoicus Brook of 3,990 cfs for the 2-year return period and 6,360 cfs for the 5-year return period; the FIS flow of 5,400 cfs that causes backwater at the West Main Street crossing falls between these values. Therefore, if the 25-year return period flow determined by the USGS Regression Equations is used for Nonacoicus Brook to evaluate the West Main Street crossing, it would be appropriate to consider backwater from the Nashua River of some magnitude. Table 2 presents a comparison of the discharges at the Nashua River at the confluence with Nonacoicus Brook based on the USGS Regression Equations and the FIS information.

Table 2. Nashua River @ Confluence w/ Nonacoicus Brook Discharge Comparison

Return Period (Years)	StreamStats ¹ (cfs)	FIS ² (cfs)
2	3990	-
5	6360	-
10	8190	5400
25	10800	-
50	13000	9100
100	15300	11600
500	21300	18000

1. Determined using the USGS Regression Equations (Zarriello, 2017)

2. Determined using FIS for Middlesex County, Massachusetts, revised July 6, 2016

If the backwater from the Nashua River is neglected and the USGS Regression Equations (via StreamStats) are used to estimate discharge in Nonacoicus Brook, results of existing condition model do not match historic accounts of hydraulic performance. The existing conditions model was run using the USGS Regression Equation 25-year return period discharge of 930 cfs with a normal depth downstream boundary condition, and without including backwater (as requested by MassDOT). The friction slope for the downstream boundary condition was set as 0.000023 ft/ft based on the original 100-year return period flood profile that was determined using a discharge of 865 cfs, as presented in the HSR. As shown in Figure 1, this existing condition model results in overtopping of both the West Main Street and Shirley Street Bridges. Accounts from the Town and project abutters indicate no history of roadway overtopping at either bridge, even during the most significant storm events. Conversely, results of existing condition modeling using the Wandle Method discharges, as presented in the HSR, are consistent with local observations and indicate the existing structure is potentially overtopped only during the 100-year return period event.

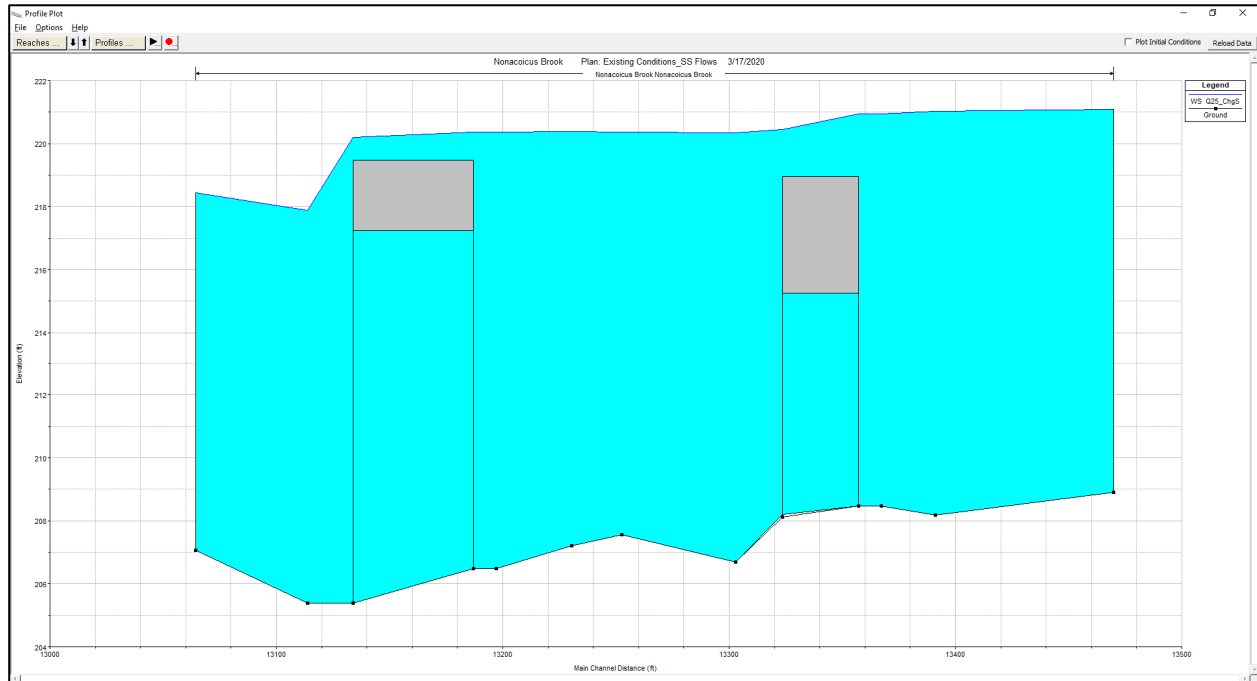


Figure 1. Existing Conditions Model using USGS Regression Equation Q25 discharge with Normal Depth Downstream Boundary Condition

It is important to also note that Nonacoicus Brook outlets from Plow Shop Pond through a dam located approximately 1,100' upstream of the West Main Street Bridge. Details of the operation of this dam, and how it may influence the flow in Nonacoicus brook, were not made available in the preparation of the HSR. The USGS report by Zarriello outlining the parameters of the USGS regression equations states that “rivers with large regulated impoundments for water supply or flood control, for example, would not be appropriate for use of these equations.” Nonacoicus Brook appears to be regulated by the Plow Shop Pond dam, and Plow Shop Pond may be considered large relative to the size of the contributing watershed. Based on the possible flow regulation of the brook and the lack of correlation between the existing model and historic accounts, the discharges determined by the USGS Regression Equations do not seem appropriate to use for this crossing. The discharges determined by the Wandle Method are similar to, though slightly higher than, the published FIS values. Therefore, it is Hoyle, Tanner’s opinion that it is reasonable and appropriate to use the discharges determined by the Wandle Method.

During consideration of the USGS Regression Equations, it was discovered that the elevations and velocities for the proposed conditions reported in HSR Table 2, *Summary of Hydraulic Performance*, were taken from the model considering the Shirley Street Bridge replaced with a 20' clear span bridge (in addition to the replacement of the West Main Street Bridge with a 28' clear span structure). Replacement of the Shirley Street Bridge concurrently with the West Main Street Bridge was one alternative considered during preparation of the PDR, but it was not selected as the preferred alternative. Table 3, below, summarizes hydraulic analysis results for both the existing conditions model and for the correct proposed conditions model (replacing the West Main Street Bridge with a 28' clear span bridge and maintaining the existing Shirley Street Bridge); this table shall replace Table 2 in the above-referenced HSR. Note that the scour calculations, the hydraulic data included in the Sketch Plans, and the no-rise analysis were all completed using the correct proposed model and do not require revision.

Table 3. Summary of Hydraulic Performance

Project Alternative	Return Frequency (Years)	Discharge (Ft ³ /S)	Stage, 40 Ft U/S (Ft, NAVD)	Contracted Velocity (Ft/S)
Existing Conditions	10	465	215.4	2.2
	25	605	217.1	2.4
	50	730	219.6	1.8
	100	865	220.1	1.7
Proposed 28-Foot Clear Waterway Single Span Bridge	10	465	214.1	2.2
	25	605	215.7	2.2
	50	730	217.0	2.3
	100	865	217.1	2.6

Scour Assessment

There is evidence of abutment scour at the upstream side of the bridge; however, the existing bridge is not only a constriction within Nonacoicus Brook, but it is also misaligned with the brook, causing flow to be directed along the southeastern wingwall rather than directly through the hydraulic opening. Additionally, the existing streambed is not armored with any form of scour countermeasure, and the embedment depth of the existing granite block substructure is relatively shallow.

The proposed bridge will improve the scour conditions at the crossing because the structure will span most of the bankfull width of the brook near the crossing, and the structure will be repositioned to better align with the brook, reducing scour attack occurring at the existing bridge caused by flow being directed at the upstream wingwall.

Scour countermeasure design calculations were prepared following the Federal Highway Administration Hydraulic Engineering Circular No. 23 (FHWA HEC-23) design procedure for the scour design flood event (50-year return period); results indicate a 1’ thick layer of material with median stone size of 6” would be necessary to resist the scour potential for the proposed 28’ span bridge. The scour countermeasure originally proposed consisted of a 2’ thick layer of special fill comprised of rock, cobble, and gravel intended to emulate the natural stream bed material while providing the required scour protection.

In accordance with the MGL Chapter 85 Section 35 requirements and MassDOT LRFD Bridge Manual Section 3.2.10 (Scour Considerations), the bridge must be scour stable and available for limited use after the design scour event without consideration of scour countermeasures. Although the original scour countermeasures were designed appropriately to resist the anticipated scour, MassDOT’s position was that the proposed design did not meet the intent of these requirements. At the request of the MassDOT Hydraulic Section, the proposed scour countermeasures have been revised to include the installation of permanent steel sheeting around the footings in lieu of special fill. Partially grouted riprap will be installed between the steel sheeting and the proposed structure to provide additional scour protection. With the installation of steel sheeting and partially grouted riprap, native material can be used to regrade the streambed and embankments outside the limits of steel sheeting.

Conclusion

The hydraulic performance of this crossing is influenced by the backwater of the Nashua River, even during lower-flow events. The USGS Regression Equation discharge values were evaluated and determined to be unreasonably high based on historic accounts of hydraulic performance of this crossing, and due to the proximity of the subject crossing to Plow Shop Pond and the potential that Nonacoicus Brook is regulated by the dam at the pond outlet. Flows calculated via the Wandle Method are similar to the published FIS flows and produce hydraulic analysis results that correlate well with local accounts of the historic performance of the bridge. Therefore, utilizing the Wandle Method is a reasonable approach for estimating the expected return period discharges for the subject crossing.

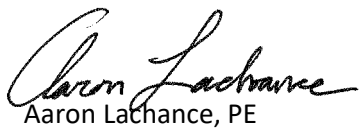
The proposed bottom of the spread footing foundation is above the calculated scour depth, and MassDOT will not accept riprap as an effective scour countermeasure in this situation, even if designed for the site-specific scour potential. Therefore, the design has been revised to incorporate permanent steel sheeting installed along the toes of both abutment footings with grouted riprap between the top of sheeting and face of abutment. This system will provide greater scour protection than the standard riprap originally proposed and will satisfy MassDOT's requirement that the replacement structure be stable and available for limited use after the design scour event. This proposed change has been presented to, and recently approved by, environmental regulators such as the Massachusetts Department of Environmental Protection, Army Corp of Engineers, Massachusetts Environmental Policy Act Office (MEPA), and the Ayer Conservation Commission.

We trust that this memorandum clearly explains Hoyle, Tanner's approach to the hydraulic and scour design for this project. With the completion of this Memorandum, and revisions to the Bridge Sketch Plans to incorporate the permanent steel sheeting and partially grouted riprap, it is Hoyle, Tanner's understanding that all outstanding MassDOT Chapter 85 review comments have been addressed. If you agree, please submit these documents to MassDOT and request their final review and approval.

Please feel free to contact me at (603) 431-2520 extension 23, or at alachance@hoyletanner.com, if you have any questions or require additional information.

Sincerely,

Hoyle, Tanner & Associates, Inc.



Aaron Lachance, PE

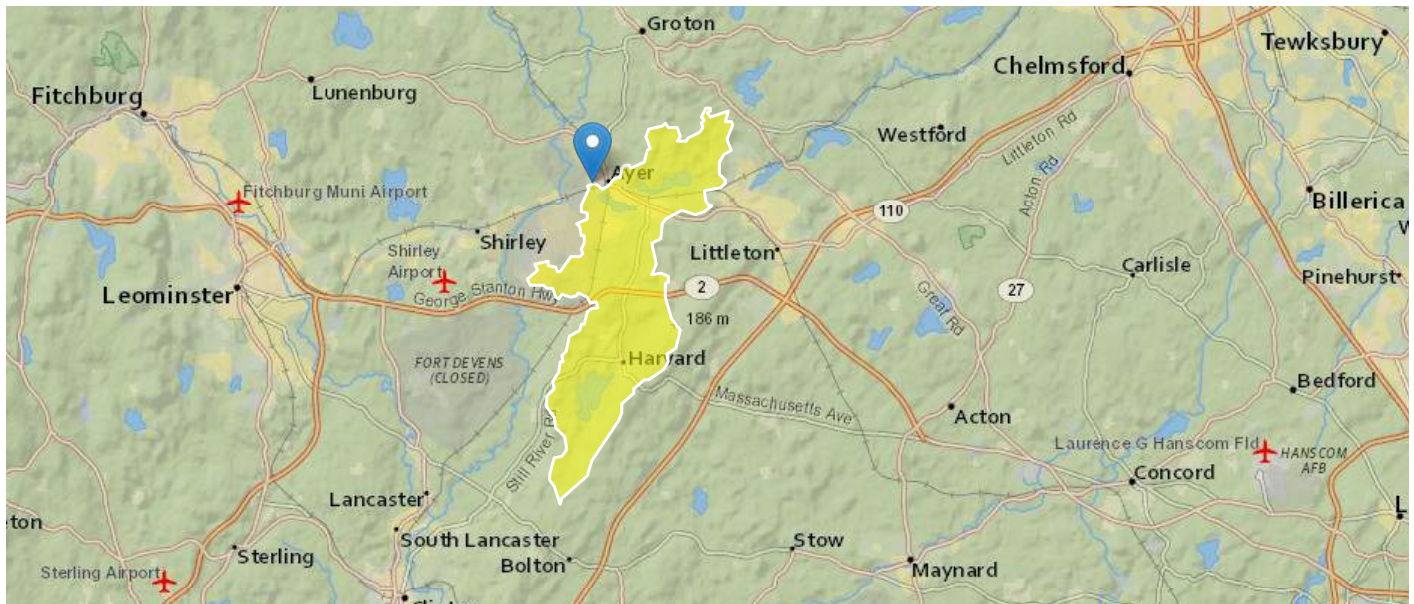
Project Manager / Associate

Enclosures

**USGS REGRESSION EQUATION (ZARRIELLO, 2017) DISCHARGES
DETERMINED USING STREAMSTATS FOR NONACOICUS BROOK
AND
THE NASHUA RIVER AT THE CONFLUENCE WITH NONACOICUS
BROOK**

StreamStats Report for West Main Street Bridge over Nonacoicus Brook

Region ID: MA
 Workspace ID: MA20190212143812546000
 Clicked Point (Latitude, Longitude): 42.56019, -71.59689
 Time: 2019-02-12 09:35:18 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	16.7	square miles
ELEV	Mean Basin Elevation	337	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	13.48	percent

Peak-Flow Statistics Parameters [Peak Statewide 2016 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	16.7	square miles	0.16	512
ELEV	Mean Basin Elevation	337	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	13.48	percent	0	32.3

Peak-Flow Statistics Flow Report [Peak Statewide 2016 5156]

Pll: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	Pll	Plu	SEp
2 Year Peak Flood	329	ft ³ /s	169	641	42.3
5 Year Peak Flood	536	ft ³ /s	272	1060	43.4
10 Year Peak Flood	697	ft ³ /s	346	1410	44.7
25 Year Peak Flood	930	ft ³ /s	446	1940	47.1
50 Year Peak Flood	1120	ft ³ /s	521	2410	49.4

Statistic	Value	Unit	PII	Plu	SEp
100 Year Peak Flood	1320	ft ³ /s	597	2940	51.8
200 Year Peak Flood	1540	ft ³ /s	675	3520	54.1
500 Year Peak Flood	1860	ft ³ /s	782	4400	57.6

Peak-Flow Statistics Citations

Zarriello, P.J., 2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (<https://dx.doi.org/10.3133/sir20165156>)

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Application Version: 4.3.0

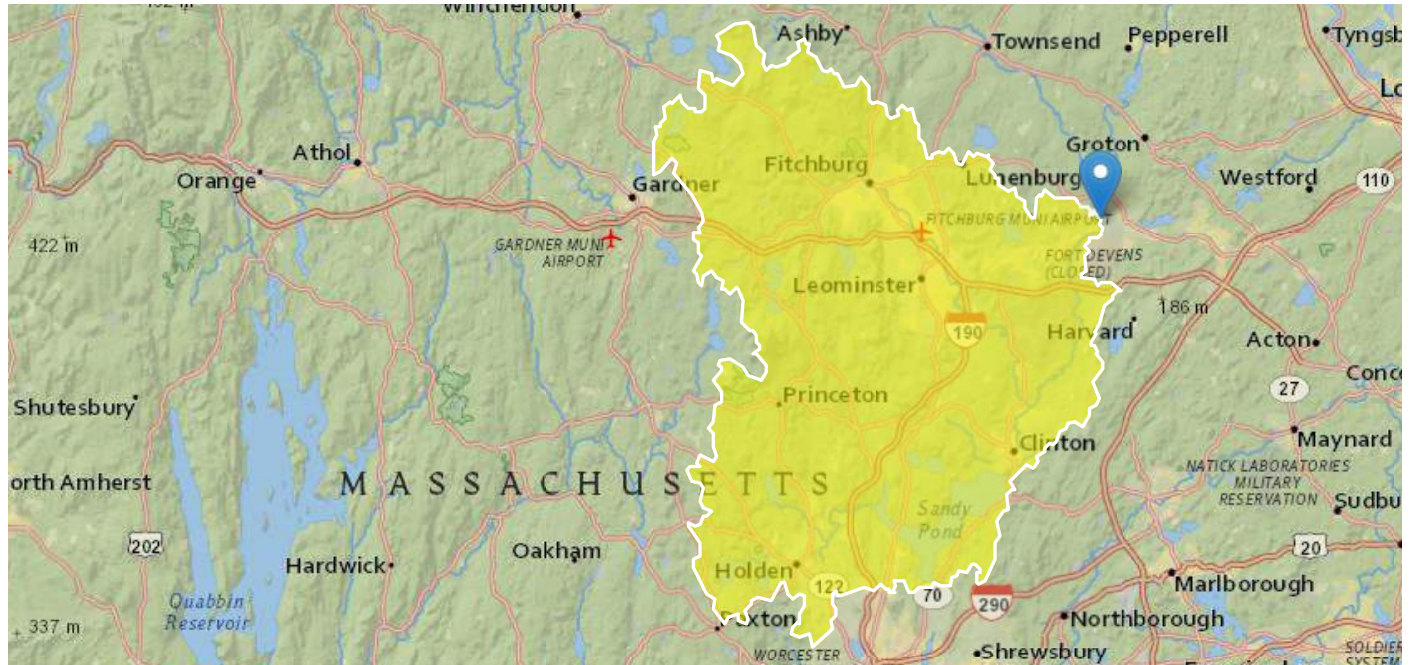
Nashua River @ Nonacoicus Brook StreamStats Report

Region ID: MA

Workspace ID: MA20200317154128261000

Clicked Point (Latitude, Longitude): 42.56209, -71.61114

Time: 2020-03-17 11:41:45 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	307	square miles
ELEV	Mean Basin Elevation	687	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	12.76	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	7.955	percent
PCTSNDGRV	Percentage of land surface underlain by sand and gravel deposits	31.39	percent
FOREST	Percentage of area covered by forest	57.11	percent
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless
BSLDEM250	Mean basin slope computed from 1:250K DEM	4.507	percent
DRFTPERSTR	Area of stratified drift per unit of stream length	0.16	square mile per mile

Peak-Flow Statistics Parameters^[Peak Statewide 2016 5156]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	307	square miles	0.16	512
ELEV	Mean Basin Elevation	687	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	12.76	percent	0	32.3

Peak-Flow Statistics Flow Report^[Peak Statewide 2016 5156]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	SEp
2 Year Peak Flood	3990	ft ³ /s	2030	7840	42.3
5 Year Peak Flood	6360	ft ³ /s	3190	12600	43.4
10 Year Peak Flood	8190	ft ³ /s	4020	16700	44.7
25 Year Peak Flood	10800	ft ³ /s	5130	22800	47.1
50 Year Peak Flood	13000	ft ³ /s	5980	28300	49.4
100 Year Peak Flood	15300	ft ³ /s	6810	34300	51.8
200 Year Peak Flood	17800	ft ³ /s	7680	41100	54.1
500 Year Peak Flood	21300	ft ³ /s	8790	51600	57.6

Peak-Flow Statistics Citations

Zarriello, P.J., 2017, Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156, 99 p. (<https://dx.doi.org/10.3133/sir20165156>)

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Application Version: 4.3.11

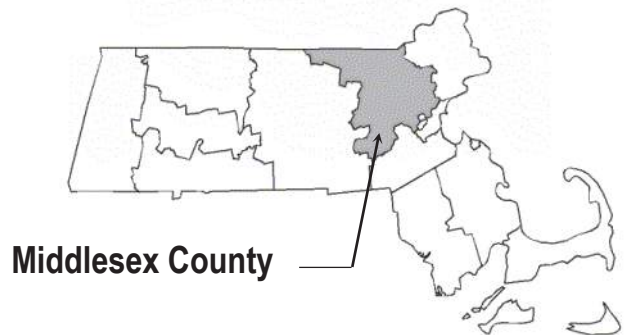
FEMA DOCUMENTS

FLOOD INSURANCE STUDY



VOLUME 1 OF 8

MIDDLESEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)



COMMUNITY NAME

ACTON, TOWN OF
ARLINGTON, TOWN OF
ASHBY, TOWN OF
ASHLAND, TOWN OF
AYER, TOWN OF
BEDFORD, TOWN OF
BELMONT, TOWN OF
BILLERICA, TOWN OF
BOXBOROUGH, TOWN OF
BURLINGTON, TOWN OF
CAMBRIDGE, CITY OF
CARLISLE, TOWN OF
CHELMSFORD, TOWN OF
CONCORD, TOWN OF
DRACUT, TOWN OF
DUNSTABLE, TOWN OF
EVERETT, CITY OF
FRAMINGHAM, TOWN OF
GROTON, TOWN OF
HOLLISTON, TOWN OF
HOPKINTON, TOWN OF
HUDSON, TOWN OF
LEXINGTON, TOWN OF
LINCOLN, TOWN OF
LITTLETON, TOWN OF
LOWELL, CITY OF
MALDEN, CITY OF
MARLBOROUGH, CITY OF
MAYNARD, TOWN OF
MEDFORD, CITY OF

COMMUNITY NUMBER

250176
250177
250178
250179
250180
255209
250182
250183
250184
250185
250186
250187
250188
250189
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250191
250192
250193
250194
250195
250196
250197
250198
250199
250200
250201
250202
250203
250204
250205

Middlesex County

COMMUNITY NAME

MELROSE, CITY OF
NATICK, TOWN OF
NEWTON, CITY OF
NORTH READING, TOWN OF
PEPPERELL, TOWN OF
READING, TOWN OF
SHERBORN, TOWN OF
SHIRLEY, TOWN OF
SOMERVILLE, CITY OF
STONEHAM, TOWN OF
STOW, TOWN OF
SUDBURY, TOWN OF
TEWKSBURY, TOWN OF
TOWNSEND, TOWN OF
TYNGSBOROUGH, TOWN OF
WAKEFIELD, TOWN OF
WALTHAM, CITY OF
WATERTOWN, TOWN OF
WAYLAND, TOWN OF
WESTFORD, TOWN OF
WESTON, TOWN OF
WILMINGTON, TOWN OF
WINCHESTER, TOWN OF
WOBURN, CITY OF

COMMUNITY NUMBER

250206
250207
250208
250209
250210
250211
250212
250213
250214
250215
250216
250217
250218
250219
250220
250221
250222
250223
250224
250225
250226
250227
250228
250229

REVISED:
July 6, 2016



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
25017CV001C

TABLE 8 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
NASHUA RIVER					
At the Massachusetts/New Hampshire State Line	396.0	8,300	14,300	17,800	28,300
At the Dunstable/Groton corporate limits	390.0	8,400	15,400	19,800	33,900
At confluence of Nissitissit River	352.0	7,055	11,945	14,651	22,829
At Fitch Bridge Road	312.6	6,950	11,700	14,400	22,600
At confluence of Squannacook River	220.5	5,850	9,900	12,500	19,200
At confluence of Mulpus Brook	204.5	5,650	9,600	12,200	18,600
At confluences of Walker Brook 1 and Nonacoicus Brook 1	183.9	5,400	9,100	11,600	18,000
At confluence of Catacoonamug Brook	161.0	5,100	8,600	11,800	17,000
NISSITISSIT RIVER					
At confluence with the Nashua River	59.8	1,497	2,642	3,642	5,000
NONACOICUS BROOK 1					
At confluence with Nashua River	18.4	840	2,120	2,370	4,160
At Main Street	160.7	400	670	720	1,070
NONACOICUS BROOK 2					
At confluence with Nonacoicus Brook 1	11.0	370	980	1,120	2,230
NORTH LEXINGTON BROOK					
At Bedford/Lexington corporate limits	4.9	396	817	1,072	1,986
At Hartwell Avenue	3.2	273	548	708	1,217
Approximately 1,260 feet downstream of Interstate 95 Interchange	1.7	168	330	421	746
At Interstate 95 Interchange	1.0	100	183	235	395
PAGES BROOK					
At confluence with Concord River	4.0	171	286	349	538
At Maple Street	1.8	95	162	199	309

Typo- DA = 16.7

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Nonacoicus Brook 1								
A	4,165 ¹	190	1,123	2.1	217.1	211.1 ³	211.8	0.7
B	4,990 ¹	290	1,737	1.4	217.1	211.3 ³	212.0	0.7
C	5,500 ¹	575	1,660	1.4	217.1	211.5 ³	212.2	0.7
D	6,130 ¹	491	1,987	1.2	217.1	211.6 ³	212.3	0.7
E	6,900 ¹	315	1,436	1.7	217.1	211.8 ³	212.5	0.7
F	7,285 ¹	40	228	3.2	217.1	214.1 ³	214.1	0.0
G	7,510 ¹	110	768	0.9	217.8	217.8	217.8	0.0
H	8,100 ¹	390	2,389	0.3	220.8	220.8	220.8	0.0
I	8,370 ¹	255	1,543	0.5	220.8	220.8	220.8	0.0
J	8,532 ¹	162	675	1.1	220.9	220.9	220.9	0.0
K	8,890 ¹	185	1,791	0.4	221.0	221.0	221.0	0.0
L	12,066 ¹	990	9,370	0.1	226.9	226.9	226.9	0.0
M	13,125 ¹	450	6,752	0.1	226.9	226.9	226.9	0.0
N	14,250 ¹	320	4,210	0.2	226.9	226.9	226.9	0.0
O	14,600 ¹	100	1,137	0.6	227.0	227.0	227.0	0.0
Nonacoicus Brook 2								
A	360 ²	240	1,187	0.9	227.2	221.2 ⁴	221.4	0.2

¹ Feet above confluence with Nashua River

² Feet above confluence with Nonacoicus Brook 1

³ Elevation computed without consideration of backwater effects from Nashua River

⁴ Elevation computed without consideration of backwater effects from Nonacoicus Brook 2

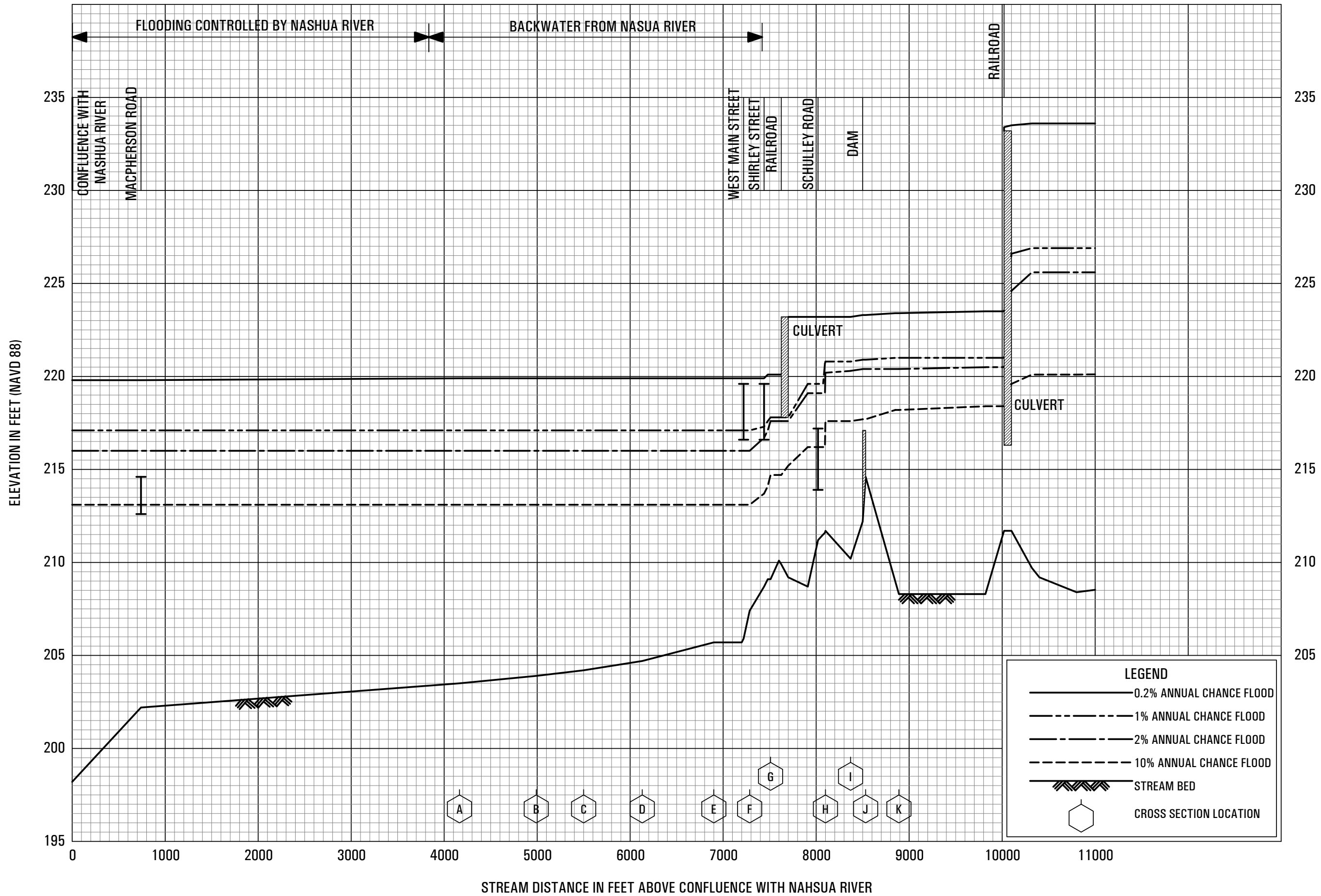
TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)**

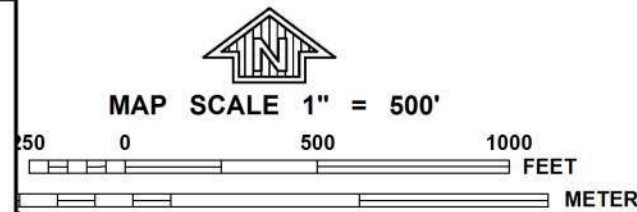
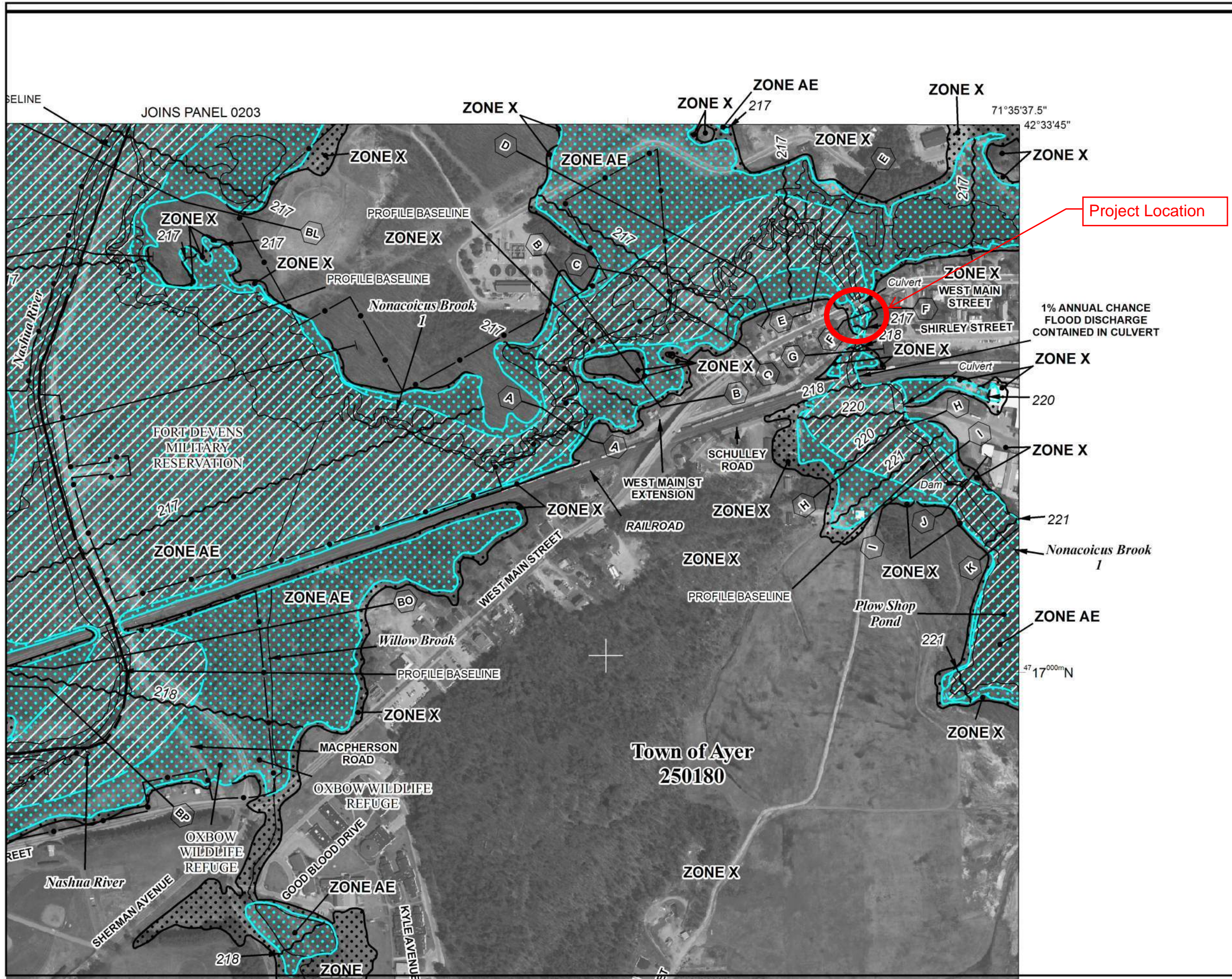
FLOODWAY DATA

NONACOICUS BROOK 1 – NONACOICUS BROOK 2



FLOOD PROFILES
NONACOICUS BROOK 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)



NFIP PANEL 0211E

FIRM
FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY,
MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 211 OF 656
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
AYER, TOWN OF	250180	0211	E
SHIRLEY, TOWN OF	250213	0211	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
25017C0211E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

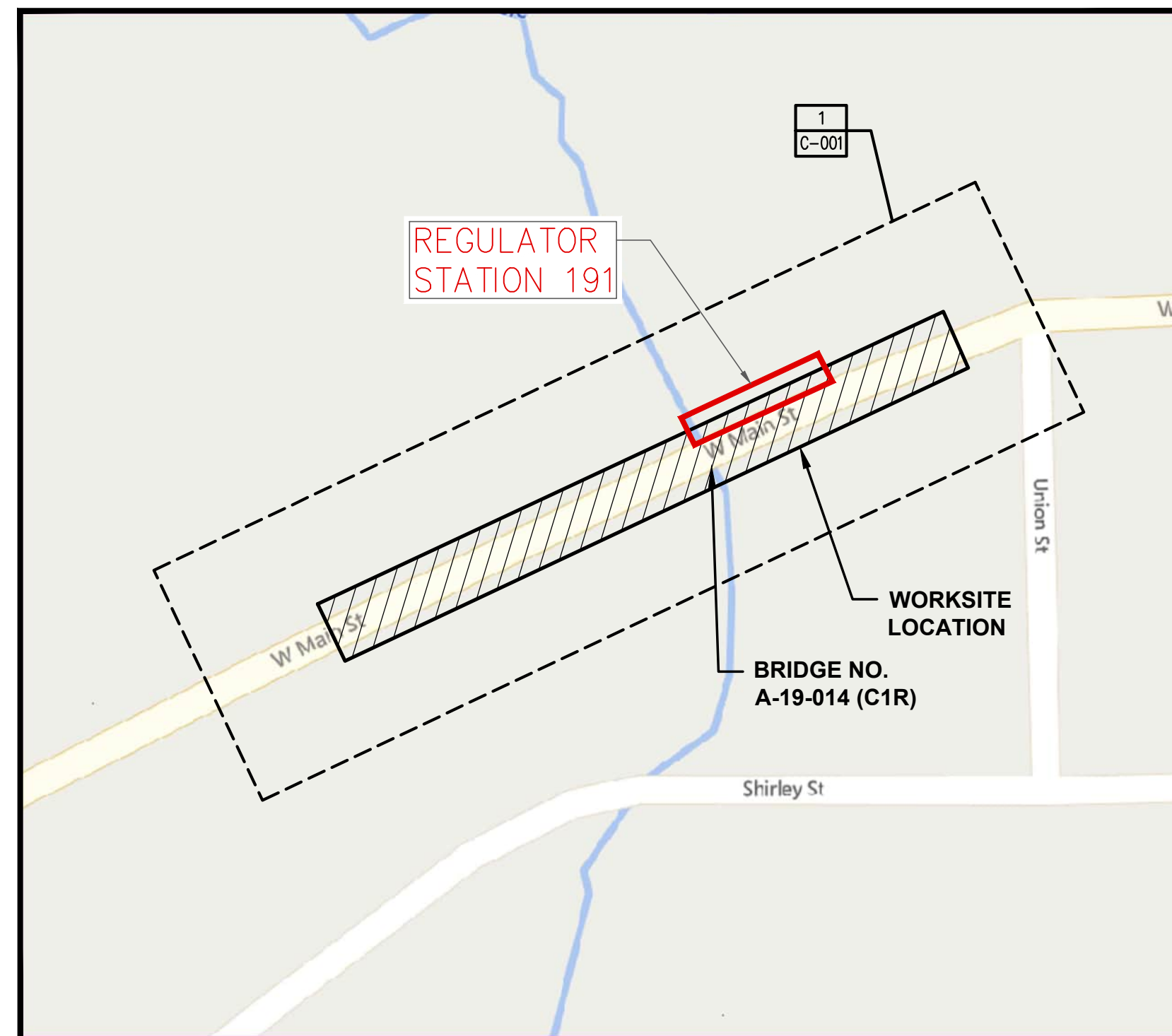
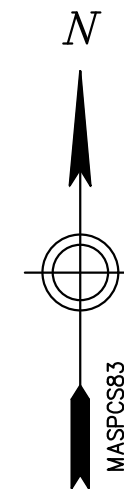
APPENDIX M

PROPOSED GAS MAIN REPLACEMENT PLANS

PROPOSED GAS MAIN REPLACEMENT APPROXIMATELY 350' OF 12" PLASTIC & 80' OF 12" COATED STEEL - 60 PSIG & UP TO 450' OF 8" COATED STEEL - 200 PSIG 92-108 WEST MAIN STREET, AYER, MA W.O. NOS. 1588874 (DISTRIBUTION) & 90000243985 (TRANSMISSION)

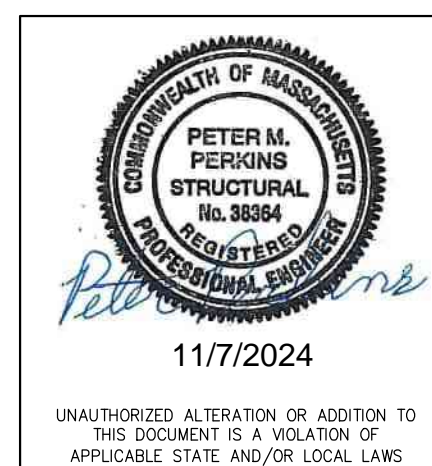
PROJECT WITHIN 200' OF REGULATOR STATION #191

CHA MAIN CONNECTION (MC) CUT AND CAP (CC) IDENTIFICATION LEGEND	
PE DESIGN	SOP
MC-A	
MC-B	
MC-C	
MC-D	
CC-A	



LOCUS
SCALE: 1" = 80'

INDEX OF SHEETS			
PAGE	DRAWING NO.	SHEET	TITLE
1	DPL-AYE-076933-1067	G-001	COVER SHEET
2	DPL-AYE-076933-1067	G-002	CONSTRUCTION NOTES
3	DPL-AYE-076933-1067	G-003	BILL OF MATERIALS
4	DPL-AYE-076933-1067	C-001	PROPOSED INSTALLATION PLAN - 60 PSIG GAS MAIN
5	DPL-AYE-076933-1067	C-002	PROPOSED INSTALLATION PLAN - 200 PSIG GAS MAIN
6	DPL-AYE-076933-1067	C-003	HYDROTEST PLAN - 200 PSIG GAS MAIN
7	DPL-AYE-076933-1067	C-101	REGULATOR FLOW DIAGRAM - REGULATOR STATION #191
8	DPL-AYE-076933-1067	C-201	PROPOSED TIE-IN DETAILS - 60 PSIG GAS MAIN
9	DPL-AYE-076933-1067	C-202	PROPOSED TIE-IN DETAILS - 200 PSIG GAS MAIN
10	DPL-AYE-076933-1067	S-001	BRIDGE PLAN AND ELEVATION
11	DPL-AYE-076933-1067	S-002	BRACKET DETAILS
12	DPL-AYE-076933-1067	S-003	WALL PENETRATION DETAILS
13	DPL-AYE-076933-1067	C-301	NATIONAL GRID STANDARD CONSTRUCTION DETAILS
14	DPL-AYE-076933-1067	C-302	NATIONAL GRID STANDARD CONSTRUCTION DETAILS
15	DPL-AYE-076933-1067	C-303	NATIONAL GRID STANDARD CONSTRUCTION DETAILS
16	DPL-AYE-076933-1067	C-304	NATIONAL GRID STANDARD CONSTRUCTION DETAILS
17	DPL-AYE-076933-1067	C-305	NATIONAL GRID STANDARD CONSTRUCTION DETAILS



NO.	DESCRIPTION	DATE	DR. BY	CK. BY	APP. BY
1	INCORPORATED CLIENT COMMENTS (DATED 10/25/2024)	11/07/2024	ACR	MLT	FMP
0	ISSUED FOR CONSTRUCTION	10/09/2024	ACR	MLT	FMP

BOSTON GAS COMPANY
d/b/a
nationalgrid
170 DATA DRIVE
WALTHAM, MA 02451

FINAL

PROPOSED GAS MAIN REPLACEMENT 92-108 WEST MAIN STREET AYER, MA					
COVER SHEET					
DWG SIZE	DESIGNER	ENGINEER	DATE	ASSET I.D.	W.O. NO.:
22"X34"	A.ROSA	M.THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

PAGE 1 OF 17	
DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	G-001

CONSTRUCTION NOTES

SCOPE OF WORK

NATIONAL GRID WORK ORDER NUMBERS 1588874 & 90000243985: (92-108 WEST MAIN STREET, AYER, MA)

NATIONAL GRID WORK ORDER NUMBER 1588874: DUE TO THE REPLACEMENT OF THE NONACOICUS BROOK BRIDGE BY THE TOWN OF AYER, PWNONREIM RECOMMENDS THE REPLACEMENT OF APPROXIMATELY: - 330 FEET OF 4 INCH CS 60 PSIG (1930)(NAYE0000) AND 20 FEET OF 4, 6 AND 8 INCH PL 60 PSIG (2002) GAS MAIN IN WEST MAIN ST FROM #92 TO #108 WEST MAIN ST WITH 12 INCH CS AND PL

NATIONAL GRID WORK ORDER NUMBER 90000243985: UP TO 450 FEET OF 8 INCH CS 200 PSIG WITH 8 INCH CS INCLUDING AN ABOVE GRADE BRIDGE CROSSING OF APPROXIMATELY 30 FT

GENERAL

- 1. NO FIELD CHANGES SHALL BE MADE TO THIS DESIGN WITHOUT APPROVAL FROM THE ASSIGNED NATIONAL GRID ENGINEER... A. NATIONAL GRID ENGINEER - DISTRIBUTION ENGINEER: ANTHONY DELLACAMERA... B. NATIONAL GRID ENGINEER - TRANSMISSION ENGINEER: DANIEL CHOROSER... C. NATIONAL GRID ENGINEER - I&R ENGINEER: ROBERT KILGUS... 2. NEW MAINS SHALL BE INSTALLED IN ACCORDANCE WITH THE TYPICAL TRENCH DETAIL INCLUDED IN THESE DRAWINGS... 3. SERVICES SHALL BE INSTALLED WITH 24 INCHES OF COVER... 4. REFER TO CNST04017 FOR SHALLOW MAIN REQUIREMENTS... 5. ALL MAINS SHOULD BE INSTALLED WITH CLEARANCE OF 12 INCHES FROM OTHER FACILITIES... 6. THE PIPE ALIGNMENT IS SHOWN FOR REFERENCE ONLY AS APPROXIMATELY 3 FEET FROM THE EXISTING MAIN... 7. VALVES DEPICTED IN THE DESIGN ARE THE MINIMUM REQUIRED FOR SECTIONALIZING, ISOLATION, CRITICAL VALVES, AND/OR TO ACCOMMODATE TIE-INS... 8. ELECTROFUSION COUPLINGS MAY BE INTERCHANGED WITH BUTT FUSION WHERE APPLICABLE... 9. TIE-IN LOCATIONS MAY VARY UP TO 100 FEET OF THE PROPOSED LOCATION TO ACCOMMODATE CONSTRUCTION... 10. NOT ALL BYPASSES, GAUGES, PURGES AND OTHER MISCELLANEOUS FITTINGS ARE SHOWN... 11. WHEN CONNECTING NEW "DEAD" MAIN TO NEW "DEAD" MAIN, ALL CONNECTIONS SHALL BE MADE USING AN INLINE TEE... 12. THE LIVE MAIN CONNECTION DETAIL SHOWN IN THE DRAWINGS SHALL BE FOLLOWED... 13. PRIOR TO MAIN ABANDONMENT, THE CONTRACTOR SHALL CONFIRM THAT ALL IMPACTED CUSTOMER SERVICES ARE INSTALLED... 14. BUTT FUSE PLASTIC CAPS, WITH OR WITHOUT ELECTROFUSION COUPLINGS, MAY BE USED IN LIEU OF ELECTROFUSION CAPS AS NEEDED... 15. CONTRACTOR SHALL CALL DIGSAFE (DIAL 811 OR 888-344-7233) AT LEAST 72 HOURS PRIOR TO CONSTRUCTION... 16. CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UTILITIES AND STRUCTURES DEPICTED OR NOT DEPICTED ON THIS DESIGN PRIOR TO CONSTRUCTION... 17. NOTIFY NATIONAL GRID I&R IF THE PROJECT IS WITHIN 200 FEET OF A REGULATOR STATION.

DESIGN CRITERIA

- 1. DESIGN IN ACCORDANCE WITH THE FOLLOWING: A. ENGO2001: DESIGN OF GAS SERVICES B. ENGO4001: DESIGN OF DISTRIBUTION MAINS C. ENGO3001: DESIGN OF GAS TRANSMISSION LINES D. ENGO4020: DESIGN REQUIREMENTS FOR INSTALLATION OF GAS MAIN ON BRIDGES, CULVERTS AND SUSPENDED CROSSINGS 2. PROPOSED PIPING: A. DESIGN CLASS LOCATION - 4 B. NOMINAL SIZE - 12 INCH (60 PSIG) & 8 INCH (200 PSIG) C. MATERIAL - MDPE & COATED STEEL D. SYSTEM MAOP - 60 PSIG & 200 PSIG E. % SVCS @ 200 PSIG PRESSURE - 7.65% (6") F. DESIGN FLOOD ELEVATION - 215.7' (25-YR), 217.1' (100-YR), FLOW GENERALLY SOUTH TO NORTH PER HOYLE, TANNER & ASSOCIATES 3. PIPE SIZING DETERMINED BY NATIONAL GRID STRATEGIC ASSET AND SYSTEM PLANNING AND REFERENCED IN THE DESIGN PARAMETERS ON SHEET C-001. 4. WHERE REQUIRED, THE CONTRACTOR SHALL INSTALL A TEMPORARY BYPASS TO MAINTAIN CONTINUOUS SERVICE TO CUSTOMERS IN ACCORDANCE WITH CS-LIVE002 (60 PSIG ONLY). ALL TEMPORARY BYPASS REQUIREMENTS SHALL BE DESIGNED BY OPERATIONS ENGINEERING AND INCLUDED AS PART OF THE SOP.

PROJECT CONSTRUCTION REQUIREMENTS

- 1. PER NATIONAL GRID GAS POLICY DOC# ENGO5004, ALL COMPLEX PROJECTS ARE REQUIRED TO PREPARE AN SOP IN ACCORDANCE WITH THE STAMPED PLANS, WHICH MUST BE APPROVED BY A PROFESSIONAL ENGINEER... 2. IN ACCORDANCE WITH MASSACHUSETTS 220 CMR 105.00, THE STAMPED SOP IS CONSIDERED PART OF A REQUIRED PROJECT SPECIFIC PACKAGE TO PERFORM ANY COMPLEX PROJECT CONSTRUCTION... 3. COORDINATE WITH BRIDGE CONSTRUCTION PROJECT

CODES & STANDARDS

- 1. WORK SHALL CONFORM TO ALL LOCAL, STATE, AND FEDERAL CODES IN ADDITION TO NATIONAL GRID GAS POLICIES AND WORK METHODS... 2. ALL REFERENCES SHALL BE IN ACCORDANCE WITH THE MOST CURRENT REVISION AVAILABLE AT THE TIME OF CONSTRUCTION... 3. FEDERAL & STATE A. TITLE 49: PART 192 TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE... B. 220 CMR: DEPARTMENT OF PUBLIC UTILITIES... C. AMERICAN SOCIETY OF MECHANICAL ENGINEERS... 4. CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH NATIONAL GRID GAS POLICIES AND WORK METHODS... 5. SERVICE SPECIFIC CONSTRUCTION STANDARDS, GAS POLICIES AND WORK METHODS: A. CMS03002: CUSTOMER METER AND SERVICE REGULATOR DESIGN... B. CMS04002: PURGING PROCEDURES FOR CUSTOMER METER SERVICES... C. CNST03011: NO-INTERRUPT SERVICE TRANSFER... D. CNST06002: INSTALLING DISTRIBUTION SERVICES... E. CNST06003: INSTALLATION & MAINTENANCE POLICY FOR CURB VALVES ON SERVICE LINES... F. CNST06009: METER/SERVICE RELOCATION GUIDELINE... G. CNST06020: COMPLETION AND PROCESSING OF GAS SERVICE RECORD CARDS... H. CNST06030: NOTIFICATION OF CUSTOMERS INVOLVED IN THE INTERRUPTION OF GAS SERVICE... I. CS-SERV001: TYPICAL 1/2" SERVICE OUTSIDE SETS... J. CS-SERV002: TYPICAL 1" SERVICE OUTSIDE SETS... K. CS-SERV003: TYPICAL 1-1/4" SERVICE OUTSIDE SETS... L. CS-SERV004: TYPICAL 2" SERVICE... M. CS-SERV005: EXCESS FLOW VALVE REQUIREMENTS ON HP SERVICES... N. CS-SERV009: TYPICAL 1/2" SERVICE INSIDE SETS... O. CS-SERV010: TYPICAL 1" SERVICE INSIDE SETS... P. HTAP-6010: NO-INTERRUPT 1 INCH CTS AND 1-1/4 INCH CTS SERVICE TRANSFER (NIST) LP TO 60 PSIG MAINS... Q. SERV-5075: RELOCATION OF METER SET ASSEMBLIES INSIDE TO OUTSIDE... R. SERV-6185: HOT TAPPING MD BRANCH SADDLES OFF 4"-12" 60 PSIG MAOP LIVE PLASTIC GAS MAIN USING MCELROY HOT TAPPING TOOL... S. SERV-6186: HOT TAPPING BRANCH SADDLES OFF 4"-12" LIVE PLASTIC GAS MAIN USING HDPE SUPRAFLOW TEES... T. VALV6110: 1/2 INCH - 3 INCH POLYETHYLENE GAS SERVICE VALVE INSTALLATION 6. SEE BILL OF MATERIAL FOR MATERIAL SPECIFICATION, STANDARD AND/OR APPLICABLE NATIONAL GRID "FITS" REFERENCE

PRESSURE TESTING

- 1. PRESSURE TEST MAIN IN ACCORDANCE WITH: A. CNST04003: PRESSURE TESTING MAINS OPERATING BELOW 125 PSIG B. CNST04002: PIPELINE HYDROSTATIC TESTING C. CNST04004: PRESSURE TESTING PIPELINES OPERATION AT 125 PSIG OR GREATER D. TEST PRESSURE (MINIMUM) - 90 PSIG (60 PSIG MAIN) - 315 PSIG (200 PSIG MAIN) E. TEST DURATION BASED ON LENGTH AND DIAMETER IN ACCORDANCE WITH TABLE 1. F. TEST MEDIUM: - AIR AND/OR NITROGEN (60 PSIG MAIN) - WATER (200 PSIG MAIN) 2. PRESSURE TEST SERVICES IN ACCORDANCE WITH: A. CNST06008: PRESSURE TESTING SERVICE LINES

WELDING

- 1. NATIONAL GRID WELDING GAS POLICIES AND WORK METHODS INCLUDE: A. CNST05002: WELDING POLICY B. CNST05003: PIPE WELDING SAFETY C. CNST05005: WELDING PROCEDURE SPECIFICATIONS D. MS-030: WELDING FILLER MATERIALS 2. PRIOR TO THE START OF ANY WORK THE CONTRACTOR SHALL SUBMIT WELDER CERTIFICATION DOCUMENTS FOR EACH OF THE WELDERS EMPLOYED ON THIS PROJECT. 3. WELDING PROCEDURE SPECIFICATIONS REQUIRED: A. BUTT WELDS (GROOVE): WPS-SMAW-E6010/7010 (LATEST REVISION) B. FILLET WELDS (BRANCH): WPS-SMAW-E6010/7010 (LATEST REVISION) C. IN-SERVICE WELDS: WPS-SMAW-E7016/E7018 (LATEST REVISION) 4. 10% (AT LEAST 1) OF WELDS IN EACH CATEGORY BELOW SHALL BE SUBJECT TO NON-DESTRUCTIVE EXAMINATION (NDE). A. BUTT WELDS 2-INCH AND GREATER: 10% RADIOGRAPH B. BUTT WELDS < 2-INCHES: 10% MAGNETIC PARTICLE C. FILLET WELDS: 10% MAGNETIC PARTICLE 5. FOR EXPOSED MAIN INSTALLED ON A BRIDGE, BURIED MAIN UNDER BRIDGE APPROACH, OR MAIN OPERATING AT 125 PSIG OR GREATER, 100% OF THE WELDS SHALL BE SUBJECTED TO NDE. A. 100% OF BUTT WELDS > 2" SHALL BE RADIOGRAPHED B. 100% OF WELDS <= 2" SHALL RECEIVE MAGNETIC PARTICLE TESTING C. 100% OF FILLET WELDS SHALL BE MAGNETIC PARTICLE TESTED 6. NDE AND WELD MAP SHALL BE PROVIDED BY THIRD PARTY. 7. NDE SCHEDULING CONTACT: ALEX DEVINE CELL: (603) 440-5239 EMAIL: ALEXANDER.DEVINE@NATIONALGRID.COM

CATHODIC PROTECTION

- 1. IF EXISTING TEST STATIONS, WIRES, AND/OR MAGNESIUM ANODES ARE DISTURBED OR DAMAGED, NOTIFY THE NATIONAL GRID CORROSION DEPARTMENT: A. (CONSTRUCTION) DAVE HALDEN: (781) 379-7831 B. (DESIGN REVIEW) ALANNA GRONDINE: (339) 225-5378 C. (ATMOSPHERIC) ALISSIA APINIAN-MARGIOS: (781) 296-7569 2. 24 HOUR NOTICE IS REQUIRED PRIOR TO INSTALLATION OF INSULATED FITTINGS TO ALLOW FOR ACCEPTANCE TESTING. 3. NATIONAL GRID CORROSION GAS POLICIES AND WORK METHODS INCLUDE: A. COR01100: CORROSION DESIGN CRITERIA B. COR02001: APPLICATION OF COATING SYSTEMS C. COR02020: INSPECTING EXPOSED STEEL PIPE FOR CORROSION D. COR02021: INSPECTING EXPOSED CAST OR DUCTILE PIPING FOR GRAPHITIZATION E. COR03001: TESTING OF PIPE COATING (JEEP TESTING) F. COR04001: INSTALLATION OF MAGNESIUM ANODES G. COR04003: INSTALLATION OF TEST STATIONS FOR CATHODIC PROTECTION H. COR04004: INSTALLATION OF WIRE CONNECTIONS I. COR04005: INSTALLATION OF INSULATING JOINTS FOR CATHODIC PROTECTION J. 030031- CS: FACILITY COATING GUIDE 4. CORROSION DESIGN: SEE CONTENTS OF THIS DESIGN FOR CATHODIC PROTECTION REQUIREMENTS.

ENVIRONMENTAL

- 1. WORK SHALL CONFORM TO THE NATIONAL GRID ENVIRONMENTAL POLICY. 2. ENVIRONMENTAL ENGINEERING CONTACT: PATRICK HUTCHINSON PHONE: (774) 291-9348 EMAIL: PATRICK.HUTCHINSON@NATIONALGRID.COM 3. CONTRACTOR SHALL REVIEW THE PROJECT WORK ORDER PACKAGE FOR THE ENVIRONMENTAL GUIDANCE FORMS, FOR EXAMPLE EG-301, FOR THE RESPECTIVE STATE. 4. WHEN SOLS OR LIQUIDS ARE ENCOUNTERED THAT ARE BELIEVED TO BE CONTAMINATED WITH OIL AND/OR HAZARDOUS MATERIAL, EXCAVATION WORK SHALL BE HALTED AND FIELD PERSONNEL SHALL NOTIFY THEIR IMMEDIATE SUPERVISOR. 5. NO EXCAVATED SOIL SHALL LEAVE THE WORK SITE UNTIL ENVIRONMENTAL HAS MADE A DETERMINATION FOR ITS PROPER DISPOSAL. 6. NATIONAL GRID ENVIRONMENTAL POLICIES AND PROCEDURES INCLUDE: A. SHE02001: HANDLING CONTAMINATED MATERIALS AND PIPING B. SHE02002: REMOVING MERCURY REGULATORS AND DEVICES C. SHE02003: ENCOUNTERING CONTAMINATION WHILE EXCAVATING D. EG303-NE: BEST MANAGEMENT PRACTICES E. EG140: USED GAS PIPE MANAGEMENT 7. ENVIRONMENTAL REQUIREMENTS: PROPOSED WORK IS LOCATED WITHIN 100 FEET OF WETLANDS AND/OR BODIES OF WATER / WITHIN 200 FEET OF A RIVER OR A STREAM (*25 FEET IN BOSTON, BROCKTON, CAMBRIDGE, CHELSEA, EVERETT, FALL RIVER, LAWRENCE, LOWELL, MALDEN, NEW BEDFORD, SOMERVILLE, SPRINGFIELD, WINTHROP OR WORCESTER/) WITHIN A FLOODPLAIN. ENVIRONMENTAL PERMIT AND/OR THE USE OF ENVIRONMENTAL BMPs MAY BE REQUIRED. SEE ENVIRONMENTAL MEMO FOR DETAILS

SAFETY

- 1. WORK SHALL CONFORM TO THE NATIONAL GRID EMPLOYEE SAFETY HANDBOOK AND OSHA REQUIREMENTS. 2. REQUIRED PPE SHALL BE WORN AND UTILIZED IN ACCORDANCE WITH THE CURRENT NATIONAL GRID SAFETY POLICY. 3. A NATIONAL GRID APPROVED CONTRACTOR HEALTH AND SAFETY PLAN (HASP) IS REQUIRED PRIOR TO CONSTRUCTION. 4. CONSTRUCTION SIGNING, DRUMS, BARRICADES, AND OTHER DEVICES SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.) PART VI AND SHALL BE MAINTAINED BY THE CONTRACTOR. 5. NATIONAL GRID SAFETY POLICIES AND PROCEDURES INCLUDE: A. ADMINISTRATIVE B. INSPECTIONS C. WALKING WORKING SURFACES D. MEANS OF EGRESS E. MATERIAL HANDLING AND STORAGE F. TOXIC AND HAZARDOUS SUBSTANCES G. HAZARDOUS MATERIALS H. PERSONAL PROTECTIVE EQUIPMENT I. GENERAL ENVIRONMENTAL CONTROLS J. ACCIDENT INVESTIGATION K. MACHINERY AND GUARDING L. WELDING/CUTTING/BRAZING M. EXCAVATIONS N. CONTRACTORS O. EXCAVATIONS Q. FLEET AND ROADWAY SAFETY 6. GAS WORK METHODS SAFETY PROCEDURES INCLUDE: A. SHE01001: GENERAL SAFETY REQUIREMENTS B. SHE01002: SUPPLIED-AIR RESPIRATORS C. SHE01003: USING AND MAINTAINING PORTABLE GAS MONITORS D. SHE01004: USING AND MAINTAINING FLAME IONIZATION UNITS E. SHE01005: DISSIPATING STATIC ELECTRICAL CHARGES ON PLASTIC PIPE F. SHE01006: ENTERING GAS UTILITY VAULTS G. SHE01007: INTERNAL PIPE SEALING H. SHE01008: USING AND MAINTAINING THE GAS-EXPLORER I. SHE01009: DISSIPATING STATIC ELECTRICAL CHARGES ON PLASTIC PIPE J. SHE01010: THE APPLICATION OF FORMAL PROCESS SAFETY ASSESSMENTS TO HIGHER-RISK GAS ACTIVITIES PERFORMED IN THE FIELD 7. ANY AND ALL WORKERS THAT HAVE ANY POTENTIAL TO COME INTO CONTACT WITH SOIL AND/OR ANY AND ALL WORKERS THAT HAVE ANY POTENTIAL TO COME INTO CONTACT WITH SOIL AND/OR GROUNDWATER MUST HAVE UP-TO-DATE OSHA 40-HOUR HAZWOPER TRAINING. COPIES OF OSHA CERTIFICATES/TRAINING REFRESHERS SHALL BE PROVIDED TO NATIONAL GRID FOR REVIEW PRIOR TO THE START OF WORK.

OTHER PERMITTING REQUIREMENTS

TOWN OF AYER STREET OPENING PERMIT.

UTILITY OWNER INFORMATION

ELECTRIC: NATIONAL GRID ELECTRIC 548 HAYDENVILLE ROAD LEEDS, MA 01053 413-582-7424 CROWN CASTLE 80 CENTRAL STREET BOXBOROUGH, MA 01719 508-616-7818 DW: AYER DPW 25 BROOK STREET AYER, MA 01432 978-772-8240 LOCAL LINX 30 ELMVIEW CIRCLE DOVER, NH 03820 403-538-4545 VERIZON 385 MYLES STANDISH BLVD. TAUNTON, MA 02780 774-409-3160

COMCAST CABLE CORPORATION PO BOX 6505, 5 OMNI WAY CHELMSFORD, MA 01824 978-848-5163

REFERENCE DRAWINGS

LOCATION OF UNDERGROUND UTILITIES IF SHOWN, ARE WITHOUT ANY DIMENSIONS AND ARE FOR REPRESENTATION ONLY. ADDITIONAL UTILITIES MAY EXIST WHICH ARE NOT IDENTIFIED ON THESE PLANS. ALL EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR FOR SERVICE, SIZE, INVERT ELEVATIONS, LOCATIONS, ETC.

THE TOPOGRAPHIC AND ELEVATION DATA IF SHOWN HEREON WAS OBTAINED FROM MASS GIS AND MAIN NOTES AND IS NOT CERTIFIED AS CORRECT AND/OR ACCURATE BY THIS ENGINEER. USERS RELY ON SAID DATA AT THEIR OWN RISK.

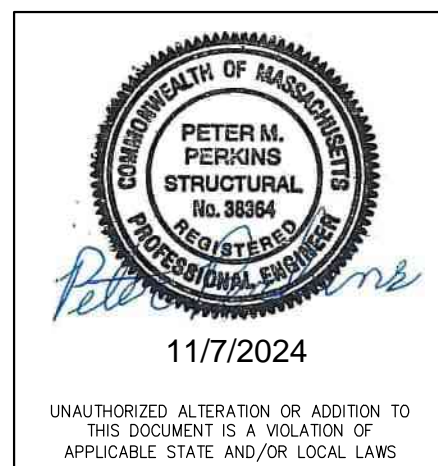
"WEST MAIN STREET OVER NONACOICUS BROOK" CONTRACT PLANS OF PROPOSED BRIDGE AYER DATED: AUG 14, 2024

CONSULTANT CONTACT INFORMATION

CHA CONSULTING, INC.: JEFFREY O'DONNELL, P.E. BUSINESS PRACTICE LEADER - GAS ENGINEERING (781) 982-5456 JODONNELL@CHACOMPANIES.COM

CONSULTANT BILLING INFORMATION

BILLING: 4 MAIN CONNECTIONS, 1 CUT & CAPS



Revision table with columns: NO., DESCRIPTION, DATE, DR.BY, CK.BY, APP.BY. Includes entries for incorporated client comments and issued for construction.

Logos for Boston Gas Company and National Grid. Includes address: 170 DATA DRIVE, WALTHAM, MA 02451.

Project information table including DWG SIZE (22"x34"), DESIGNER (A.ROSA), ENGINEER (M.THOMPSON), DATE (10/09/2024), ASSET I.D. (BG-025.0.0), and W.O. NO. (1588874 & 90000243985).

CONSTRUCTION NOTES section containing drawing title (DPL-AYE-076933-1067), sheet number (G-002), and page number (PAGE 2 OF 17).

File: V:\PROJECTS\NAYV\6076933\000\09_DESIGN\DRAWINGS\01_SHEETS\076933-1067\076933-1067.DWG Saved: 11/7/2024 4:33:34 PM Plotted: 11/7/2024 8:18:35 AM Current User: Perkins, Peter Last Saved By: 6236

BILL OF MATERIALS

ITEM	QTY	UOM	DESCRIPTION	SIZE (IN.)	NATIONAL GRID REFERENCE	SAP ID NUMBER	PROVIDED BY:
60 PSIG GAS MAIN							
1	350	FT	PIPE, PLASTIC, MDPE	12	120026-MS	9340863	NATIONAL GRID
2	6	EA	COUPLING, PLASTIC ELECTROFUSION	12	CS-FIT015	9314939	NATIONAL GRID
3	8	EA	ELBOW, PLASTIC, MDPE, 90 DEGREE	12	CS-FIT011	9341404	NATIONAL GRID
4	2	EA	FITTING, TRANSITION, MDPE	12	HTAP6020	9339397	NATIONAL GRID
5	3	EA	VALVE, PLASTIC, FULL BORE/PORT, MDPE	12	VALV6020	9341704	NATIONAL GRID
6	1	EA	REDUCER, PLASTIC, MDPE PUP	12 X 8	CS-FIT013	9342617	NATIONAL GRID
7	1	EA	CAP, PLASTIC, HDPE, ELECTRO FUSE	8	CS-FIT015	93393633	NATIONAL GRID
8	1	EA	CAP, PLASTIC, MDPE, BUTT FUSE	8	CS-FIT010	9339559	NATIONAL GRID
9	2	EA	COUPLING, PLASTIC ELECTROFUSION	8	CS-FIT015	9314591	NATIONAL GRID
10	2	FT	PIPE, PLASTIC, MDPE	8	120026-MS	9340862	NATIONAL GRID
11	1	EA	CAP, STEEL, DRESSER, SELF-RESTRAINING	6	FITS6024	9314880	NATIONAL GRID
12	1	EA	CAP, STEEL, WELD END	6	FITS6100	9312094	NATIONAL GRID
13	1	EA	CAP, PLASTIC, MDPE, BUTT FUSE	12	CS-FIT010	9339560	NATIONAL GRID
14	-	-	ITEM REMOVED	-	-	-	-
15	1	EA	CAP, STEEL, DRESSER, SELF-RESTRAINING	4	FITS6024	9315211	NATIONAL GRID
16	80	FT	PIPE, STEEL, 0.375" WALL, PRITEC 15/50 COATED	12	120020-MS	NON-STOCK	NATIONAL GRID
17	4	EA	ELBOW, STEEL, 45 DEGREE	12	MATL3100	9308373	NATIONAL GRID
18	1	EA	FITTING, LINE STOPPER, WILLIAMSON, CONTOURED	6	HTAP5010	9312587	NATIONAL GRID

200 PSIG GAS MAIN							
30	210	FT	PIPE, STEEL, APL 5L X52 PSL-2, 0.322" WALL, PRITEC 15/50 COATED	8	MS-500/504	NON-STOCK	NATIONAL GRID
31	4	EA	ELBOW, STEEL, 90 DEGREE	8	MATL3110/MS-504	NON-STOCK	NATIONAL GRID
32	-	-	ITEM REMOVED	-	-	-	-
33	2	EA	CAP, STEEL, WELD END	8	MATL3110/MS-504	NON-STOCK	NATIONAL GRID
34	2	EA	CAP, STEEL, DRESSER, SELF-RESTRAINING	8	FITS6024	9315210	NATIONAL GRID
35	2	EA	FITTING, STOPPER, MUELLER H-17256, NO. 3SW	8	-	NON-STOCK	NATIONAL GRID
36	2	EA	FITTING, MUELLER SAVE-A-VALVE H-17491, 3/4" X 2"	3/4	-	NON-STOCK	NATIONAL GRID
37	2	EA	VALVE, ANSI 300, FULL BORE, WEXWE, .322 WALL	8	MATL-3150	NON-STOCK	NATIONAL GRID
38	2	EA	INSULATING JOINT, COUPLING, WELD END, STANDARD WALL	8	MS-035	NON-STOCK	NATIONAL GRID

PIPE SUPPORT ON BRIDGE							
B1	2	EA	LB&A DOUBLE ROLLER SUPPORT 3B, BLUECOAT	12	-	NON-STOCK	NATIONAL GRID
B2	4	EA	240 FRP SHIELD, 12 IN LONG	12	-	NON-STOCK	NATIONAL GRID
B3	2	EA	SLEEVE, 2'-6" LONG, GALVANIZED OR SCH. 80-120 PVC (PRITEC COATING AT FIELD/ENGINEER DISCRETION)	16	-	NON-STOCK	NATIONAL GRID
B4	4	EA	END SEAL, MODEL C, FULL ON W/ SS PIPE CLAMPS	12X16	-	NON-STOCK	NATIONAL GRID
B5	4	EA	LINK SEAL LS-425-12	12X16	-	NON-STOCK	NATIONAL GRID
B6	2	EA	LB&A DOUBLE ROLLER SUPPORT 3B, BLUECOAT	8	-	NON-STOCK	NATIONAL GRID
B7	4	EA	240 FRP SHIELD, 12 IN LONG	8	MAIN-6330	NON-STOCK	NATIONAL GRID
B8	2	EA	SLEEVE, 2'-6" LONG, GALVANIZED OR SCH. 80-120 PVC (PRITEC COATING AT FIELD/ENGINEER DISCRETION)	12	-	NON-STOCK	NATIONAL GRID
B9	4	EA	END SEAL, MODEL C, FULL ON W/ SS PIPE CLAMPS	8X12	-	NON-STOCK	NATIONAL GRID
B10	4	EA	LINK SEAL LS-475-12	8X12	-	NON-STOCK	NATIONAL GRID
B11	2	EA	SUPPORT BRACKET ASSY	2	-	NON-STOCK	NATIONAL GRID

CATHODIC PROTECTION							
C1	16	EA	17# ANODE	N/A	030024-CS	9311183	NATIONAL GRID
C2	4	EA	TEST STATION BOX - 9" SQUARE HEAVY DUTY	N/A	030026-CS	9339391	NATIONAL GRID
C3	4	EA	TEST STATION COVER, MARKED "GAS TEST" FOR 9" SQUARE BOX	N/A	030026-CS	9339797	NATIONAL GRID
C4	80	FT	#8 AWG STRANDED COPPER WIRE FOR TEST STATIONS (SOFT JACKETED INSULATION)	N/A	030026-CS	9307539	NATIONAL GRID
C5	12	EA	EXOTHERMIC SHOT FOR STEEL PIPE - FOR NEW ERICO TECHNOLOGY	N/A	030036-CS	9381574	NATIONAL GRID
C6	16	EA	SPLIT BOLT (#6 CABLE)	N/A	030026-CS	9331578	NATIONAL GRID
C7	A/R	EA	ABOVE GRADE CANUSA SHRINK SLEEVES	N/A	-	NON-STOCK	NATIONAL GRID

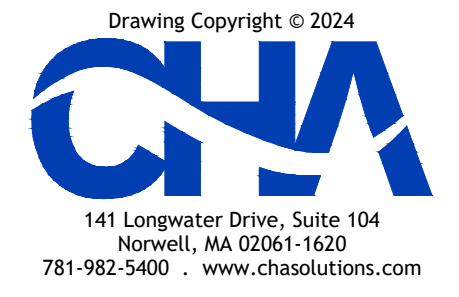
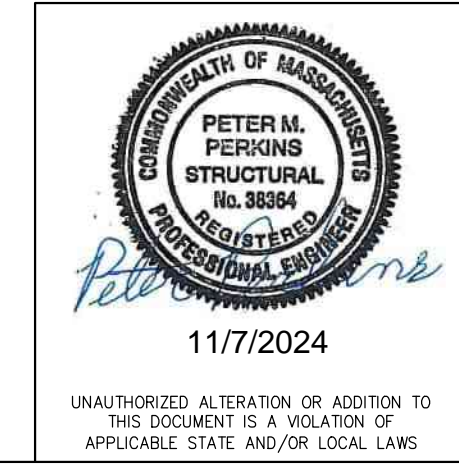
GENERAL							
G1	350	FT	TRACER WIRE	-	CNST6061	9315005	NATIONAL GRID
G2	350	FT	YELLOW CAUTION TAPE - GAS MAIN - 6" WIDE	6	CNST6060	9341904	NATIONAL GRID
G3	3	EA	VALVE BOX ASSEMBLY	12	FITS6360	(SEE STD)	NATIONAL GRID
G4	2	EA	VALVE BOX ASSEMBLY	8	FITS6370	(SEE STD)	NATIONAL GRID
G5	A/R	LF	H35 GRAY TAPE/WAX TAPE #2	-	-	NON-STOCK	NATIONAL GRID
G6	2	EA	STEEL PLATE, A36, 5/8 THK, 8 FT X 4 FT	-	-	NON-STOCK	NATIONAL GRID

NOTE: ALL MATERIAL QUANTITIES ARE ESTIMATED BASED ON PROPOSED DESIGN. ADDITIONAL QUANTITIES AND/OR OTHER MATERIALS MAY BE REQUIRED TO CONSTRUCT VERTICAL OFFSETS OR DUE TO OTHER UNKNOWN AS-FOUND CONDITIONS/DESIGN CONFLICTS AND FOR TESTING AND ARE THE RESPONSIBILITY OF THE CONTRACTOR.

ITEM	QTY	UOM	DESCRIPTION	SIZE (IN.)	NATIONAL GRID REFERENCE	SAP ID NUMBER	PROVIDED BY:
200 PSIG GAS MAIN BYPASSES							
D1	4	EA	FITTING, MUELLER BOTTOM-OUT STOPPER, CL 300# (H-17261)	8	-	NON-STOCK	NATIONAL GRID
D2	A/R	EA	ELBOW, 90 DEGREE, STEEL, MSS SP-75 GR, WPHY-52, XH WALL, BEVELED ENDS	8	MATL3110/MS-504	NON-STOCK	NATIONAL GRID
D3	4	EA	REDUCER, STEEL, MSS SP-75 GR, WPHY-52, XH WALL, BEVELED ENDS	8 X 4	MATL3110/MS-504	NON-STOCK	NATIONAL GRID
D4	A/R	FT	PIPE, STEEL, API 5L X52 PSL-2, XH WALL, PRITEC 15/50 COATED	4	MS-500/504	NON-STOCK	NATIONAL GRID
D5	2	EA	VALVE, BALL, STEEL, CLASS 300, FULL BORE	4	MATL-3150	NON-STOCK	NATIONAL GRID
D6	A/R	FT	PIPE, STEEL, API 5L X52 PSL-2, XH WALL, UNCOATED, 10 FT LONG	2	MS-500/504	NON-STOCK	NATIONAL GRID
D7	2	EA	WELD-O-LET, SCH 80, XS, CL 3000#, (FOR 8-INCH MAIN)	2	MS-034	NON-STOCK	NATIONAL GRID
D8	2	EA	VALVE, 2" BALL SOCKET WELD X THREADED END - KF VALVES MODEL 2 C7453-02-Y96	2	-	NON-STOCK	NATIONAL GRID
D9	2	EA	PLUG, 2" SOLID STEEL WITH SQUARE HEAD, 3000#	2	-	NON-STOCK	NATIONAL GRID

NOTE: ALL MATERIAL QUANTITIES ARE ESTIMATED BASED ON PROPOSED DESIGN. ADDITIONAL QUANTITIES AND/OR OTHER MATERIALS MAY BE REQUIRED TO CONSTRUCT VERTICAL OFFSETS OR DUE TO OTHER UNKNOWN AS-FOUND CONDITIONS/DESIGN CONFLICTS AND FOR TESTING AND ARE THE RESPONSIBILITY OF THE CONTRACTOR.

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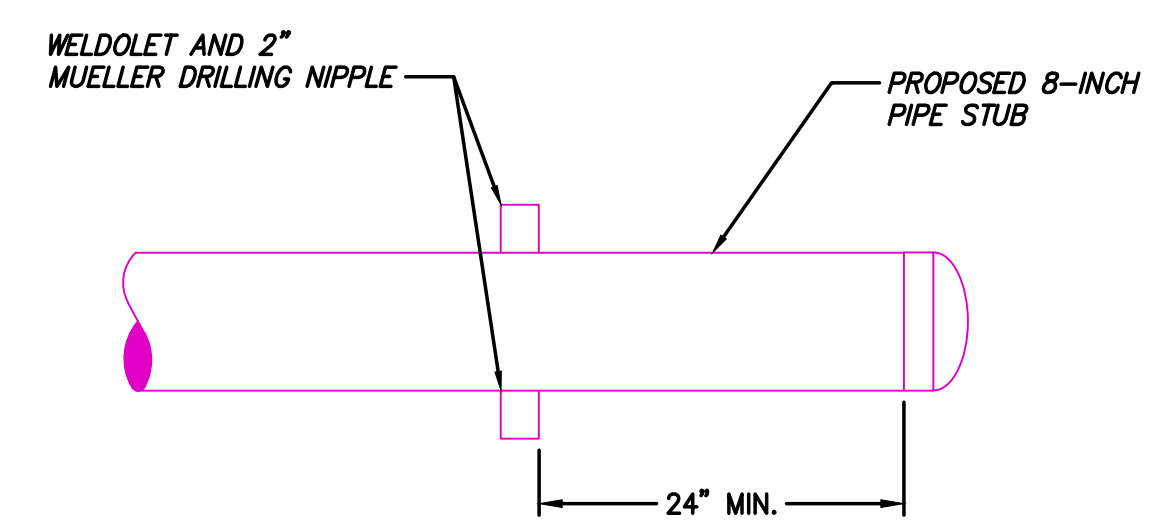
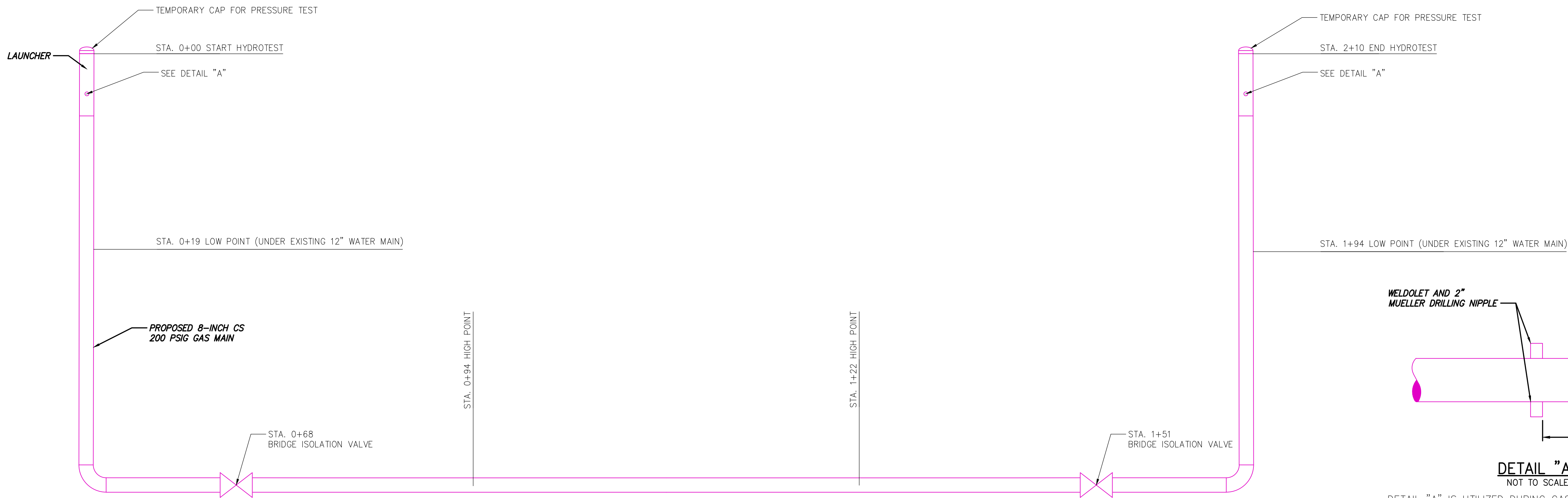
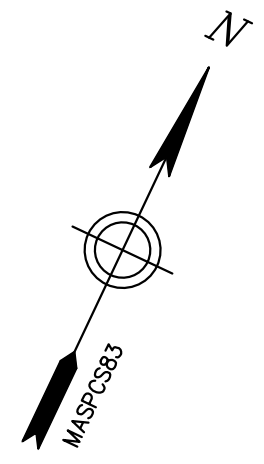
NO.	DESCRIPTION	DATE	DR.BY	CK.BY	APP.BY
1	INCORPORATED CLIENT COMMENTS (DATED 10/25/2024)	11/07/2024	ACR	MLT	FMP
0	ISSUED FOR CONSTRUCTION	10/09/2024	ACR	MLT	FMP



FINAL

BOSTON GAS COMPANY d/b/a nationalgrid 170 DATA DRIVE WALTHAM, MA 02451						PROPOSED GAS MAIN REPLACEMENT 92-108 WEST MAIN STREET AYER, MA									
BILL OF MATERIALS						PAGE 3 OF 17									
DWG SIZE: 22"x34"						DESIGNER: A.ROSA		ENGINEER: M.THOMPSON		DATE: 10/09/2024		ASSET I.D.: BG-025.0.0		W.O. NO.: 1588874 & 90000243985	

DRAWING NO.		SHEET NO.	
DPL-AYE-076933-1067		G-003	



DETAIL "A"
NOT TO SCALE

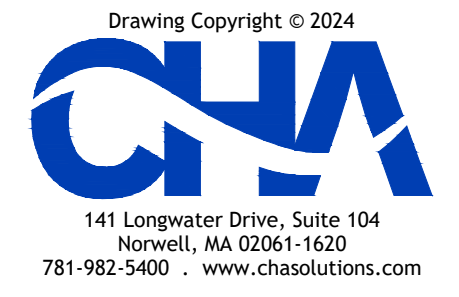
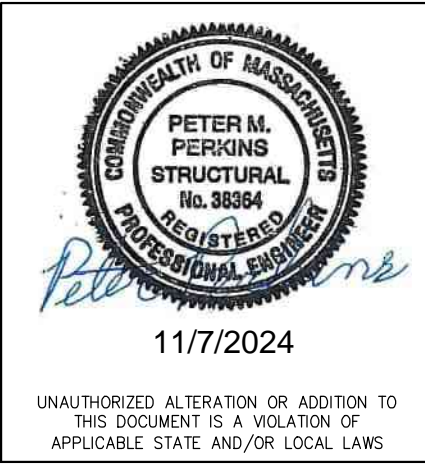
DETAIL "A" IS UTILIZED DURING GAS MAIN PRESSURE TEST. A 8" PIPE STUB WITH 2" VENT AND DRAIN CONNECTION IS INSTALLED DURING GAS MAIN CONSTRUCTION. POST TEST AND DRYING THE 8" STUB IS CUT OFF TO REMOVE THE VENT AND DRAIN CONNECTION. THE CONNECTION TO THE MAIN IS THEN MADE (REF. TIE-IN DETAILS MC-C & MC-D IN C-202)

PRESSURE TEST PLAN
NOT TO SCALE

PRESSURE TEST DATA	
PIPE DIAMETER =	8"
MATERIAL GRADE =	X52
MAOP =	200 PSIG
REQ. TEST PRESSURE (1.5X MAOP) =	315 PSIG
8" PIPE LENGTH =	210 FT
ESTIMATED PIPE VOLUME =	73 CU.FT
FRAC TANKS REQUIRED/CAPACITY =	TBD
HIGH ELEVATION, APPROX. =	219 FT
LOW ELEVATION, APPROX. =	212 FT
TEST MANIFOLD ELEVATION, APPROX. =	218 FT

HYDROTEST TEST SUMMARY					
DESCRIPTION	APPROX. STATION	APPROX. ELEVATION	MIN. PRESSURE	MAX. PRESSURE	% SMYS @ MAX. PRESSURE
BEGINNING STATION	0+00	217.70	300 PSIG	400 PSIG	15.31
LOW POINT	0+19 & 1+94	212.00	300 PSIG	400 PSIG	15.31
HIGH POINT	0+94 TO 1+22	218.91	300 PSIG	400 PSIG	15.31
ENDING POINT	2+10	216.74	300 PSIG	400 PSIG	15.31

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BOSTON GAS COMPANY
a/b/a
nationalgrid
170 DATA DRIVE
WALTHAM, MA 02451

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PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

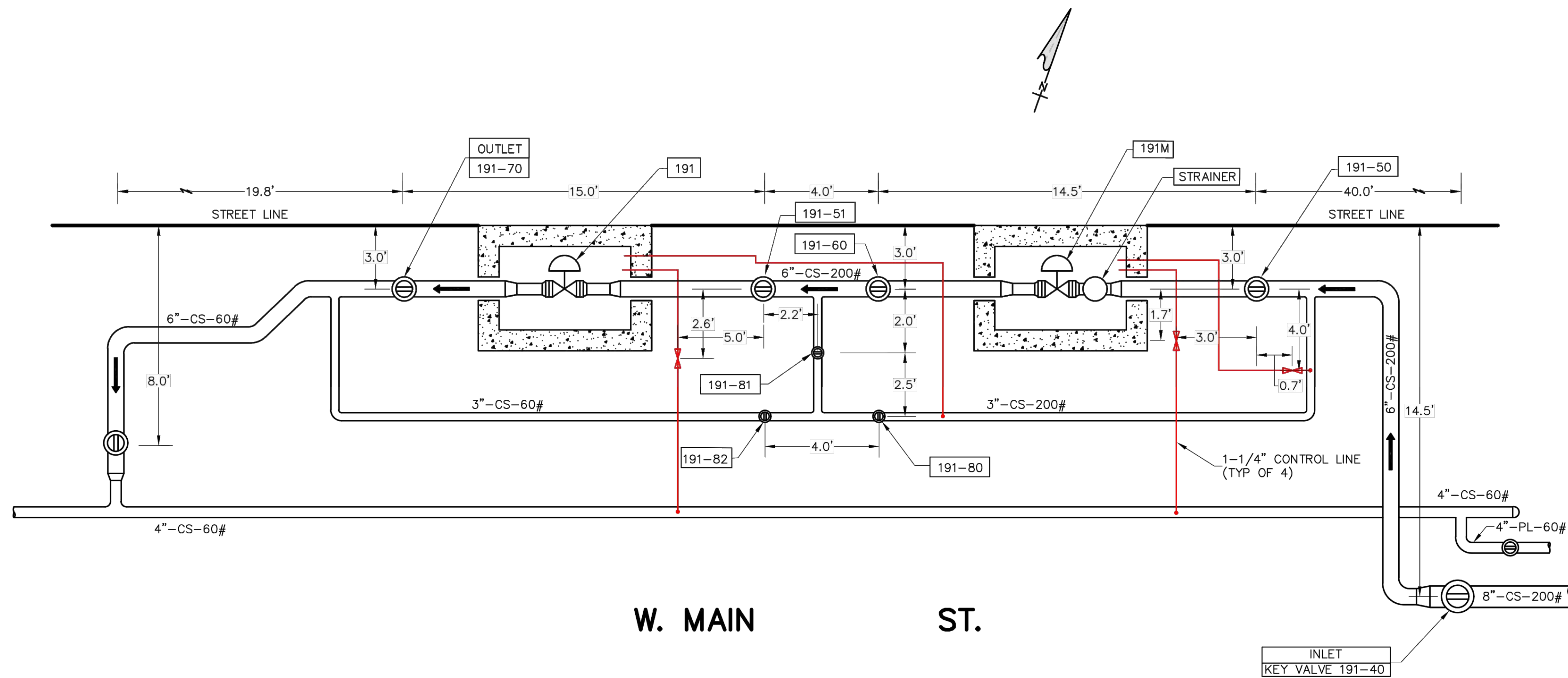
HYDROTEST PLAN - 200 PSIG GAS MAIN

DWG SIZE	DESIGNER	ENGINEER	DATE	ASSET I.D.	W.O. NO.:
22"X34"	A.ROSA	M.THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

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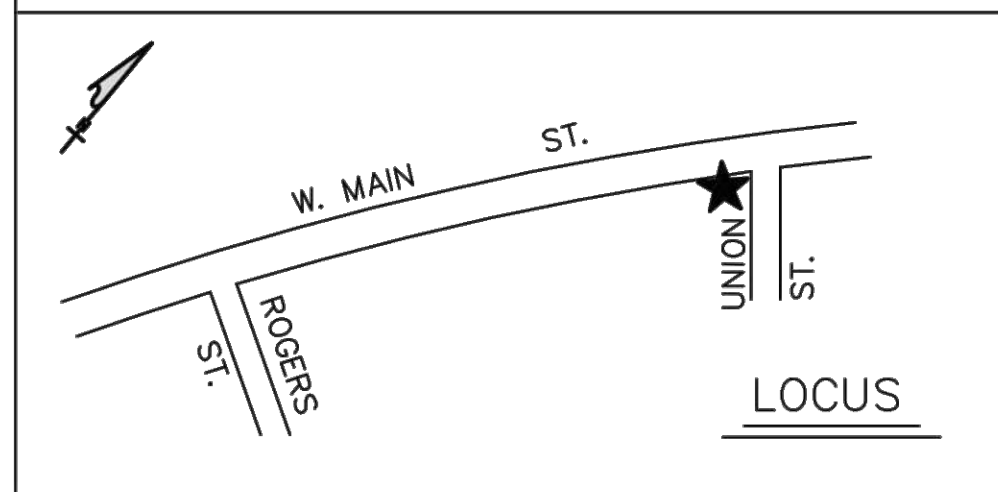
DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	C-003

STATION #191 REGULATOR INFORMATION			
ID	TYPE	MAKE & MODEL	SET PRESSURE
191	PRIMARY CONTROL	3" MOONEY FLOWGRID	REMOTE
191M	PRIMARY MONITOR	3" FISHER 1098EGR	55-60 PSIG



W. MAIN ST.

INSTALLATION DATE: 1991



REGULATOR STATION FLOW DIAGRAM
W. MAIN ST. @ UNION ST., AYER, MASSACHUSETTS
INLET MAOP: 200 PSIG, OUTLET MAOP: 60 PSIG
NOT TO SCALE

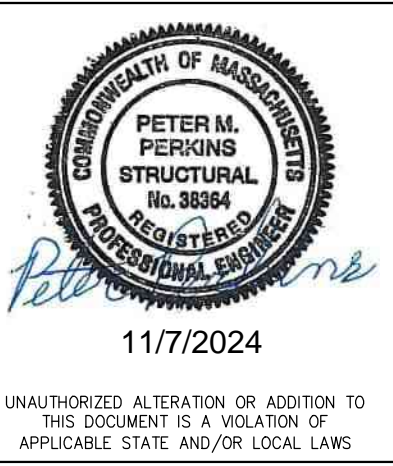
BOSTON GAS COMPANY
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WALTHAM, MA 02451

NO	DESCRIPTION	DATE	DFT	APP
6	UPDATED ADDRESS	01/04/2024	LZ	
5	ADDED REGULATOR TABLE	03/01/2022	TRB	
3	ALL CHANGES TO DATE	12/3/2016	V.P.	A.D.

DWG. NO.	FD-191
ASSET ID:	191

ENTIRE PAGE
REVISED ON
11/07/2024

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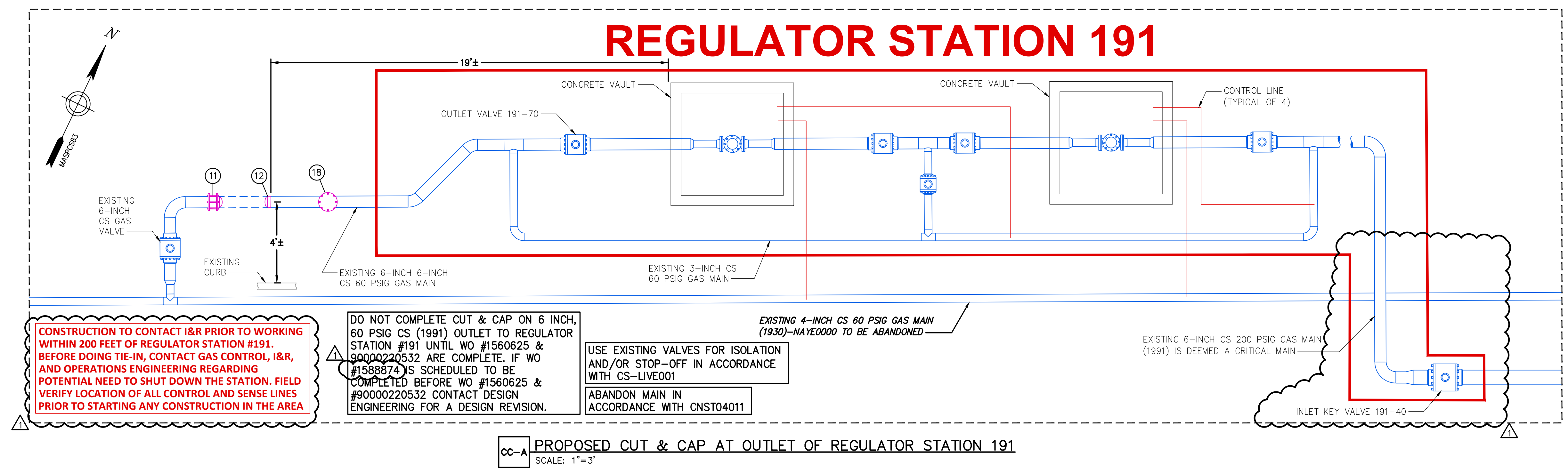
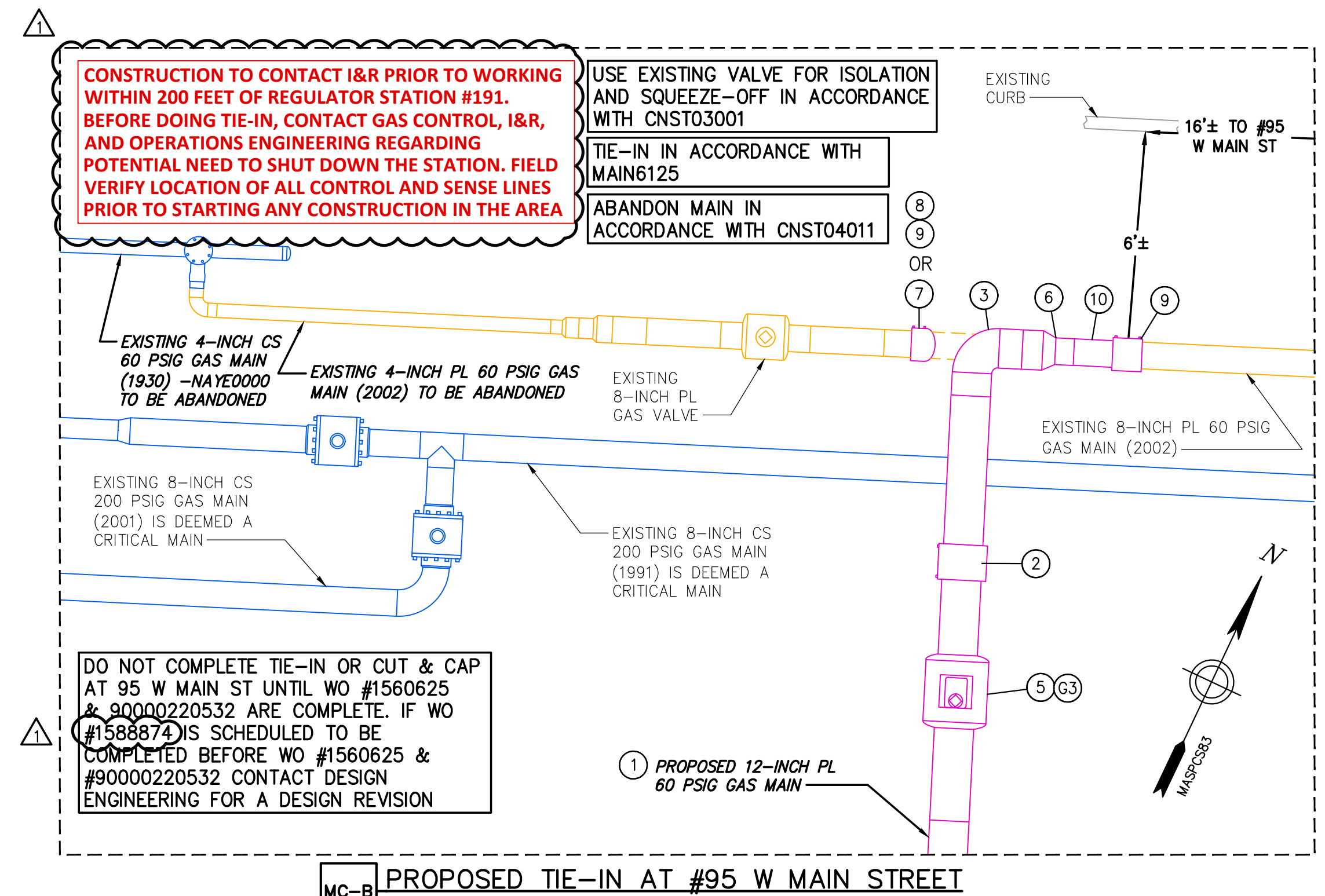
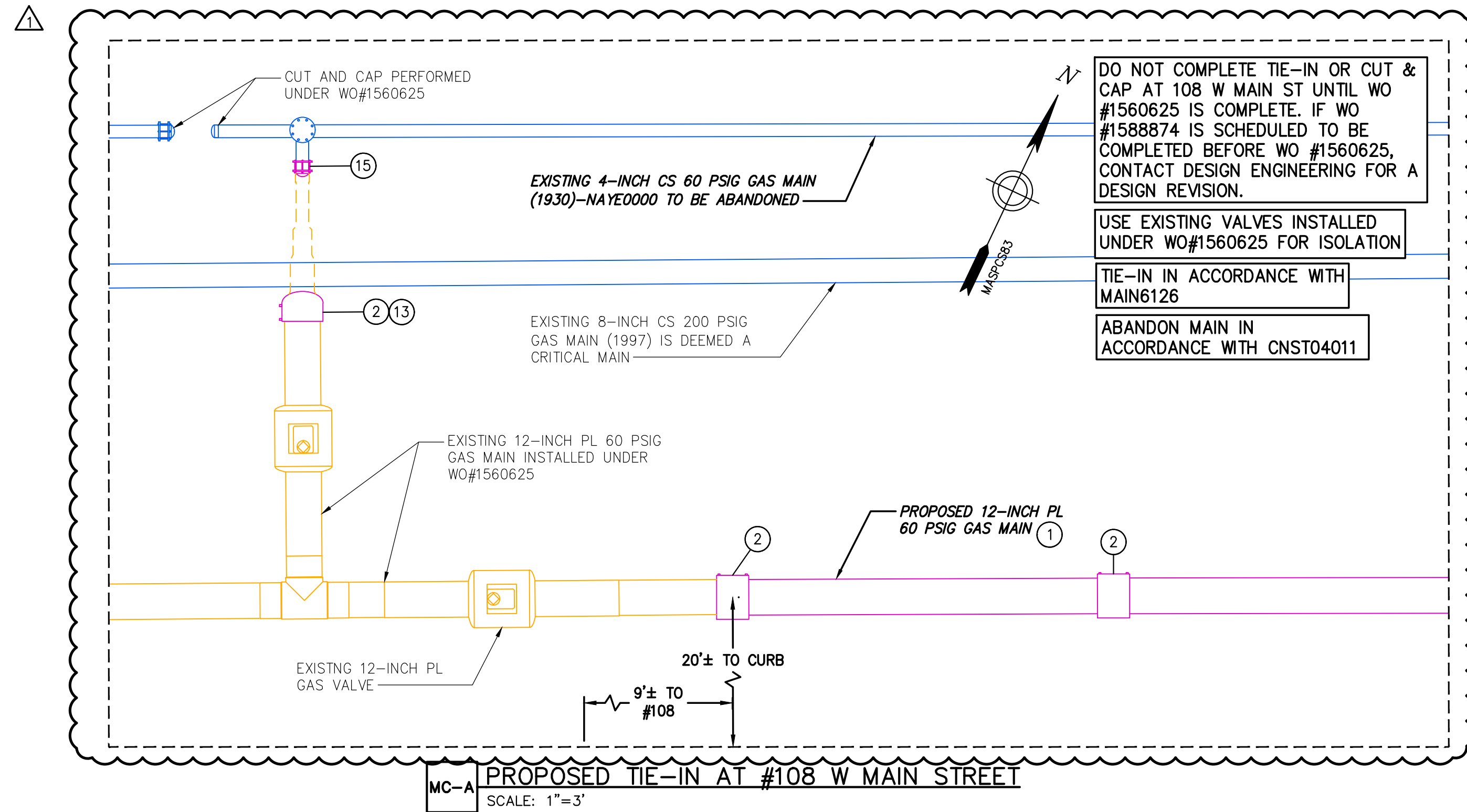
PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

**REGULATOR FLOW DIAGRAM -
REGULATOR STATION #191**

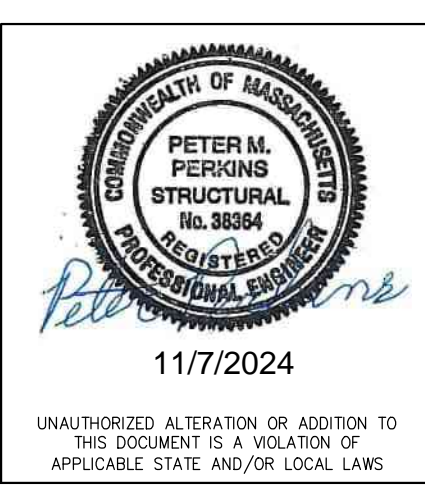
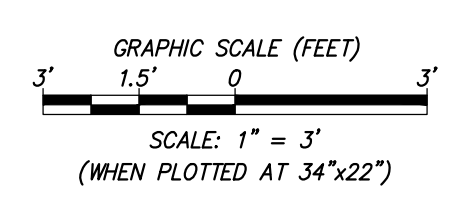
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22"x34"	A. ROSA	M. THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

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DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	C-101



GENERAL NOTES:
1) REFER TO SHEET G-003 FOR BILL OF MATERIALS, ITEM NUMBER PART DESCRIPTIONS



NO.	DESCRIPTION	DATE	DR.BY	CK.BY	APP.BY
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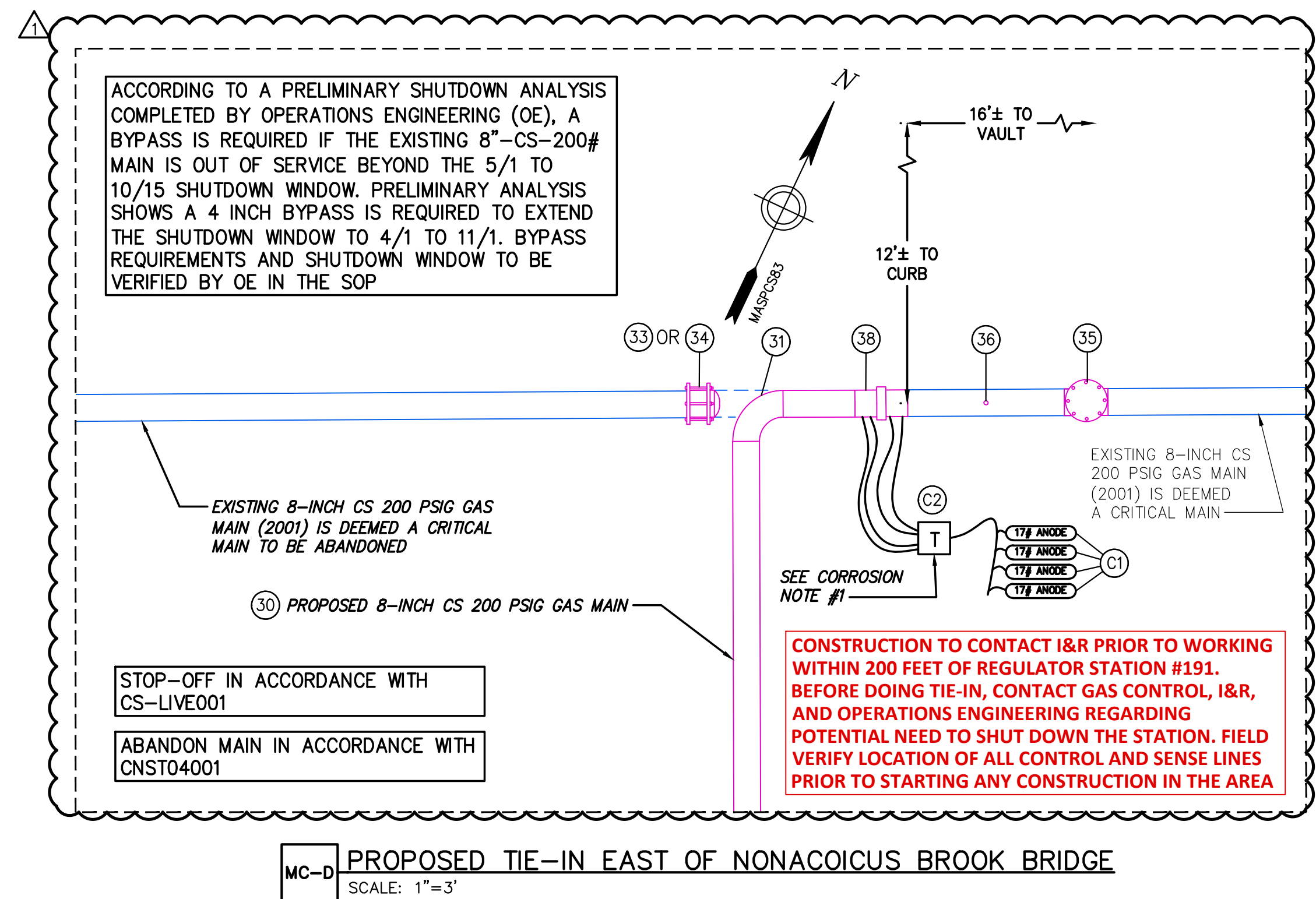
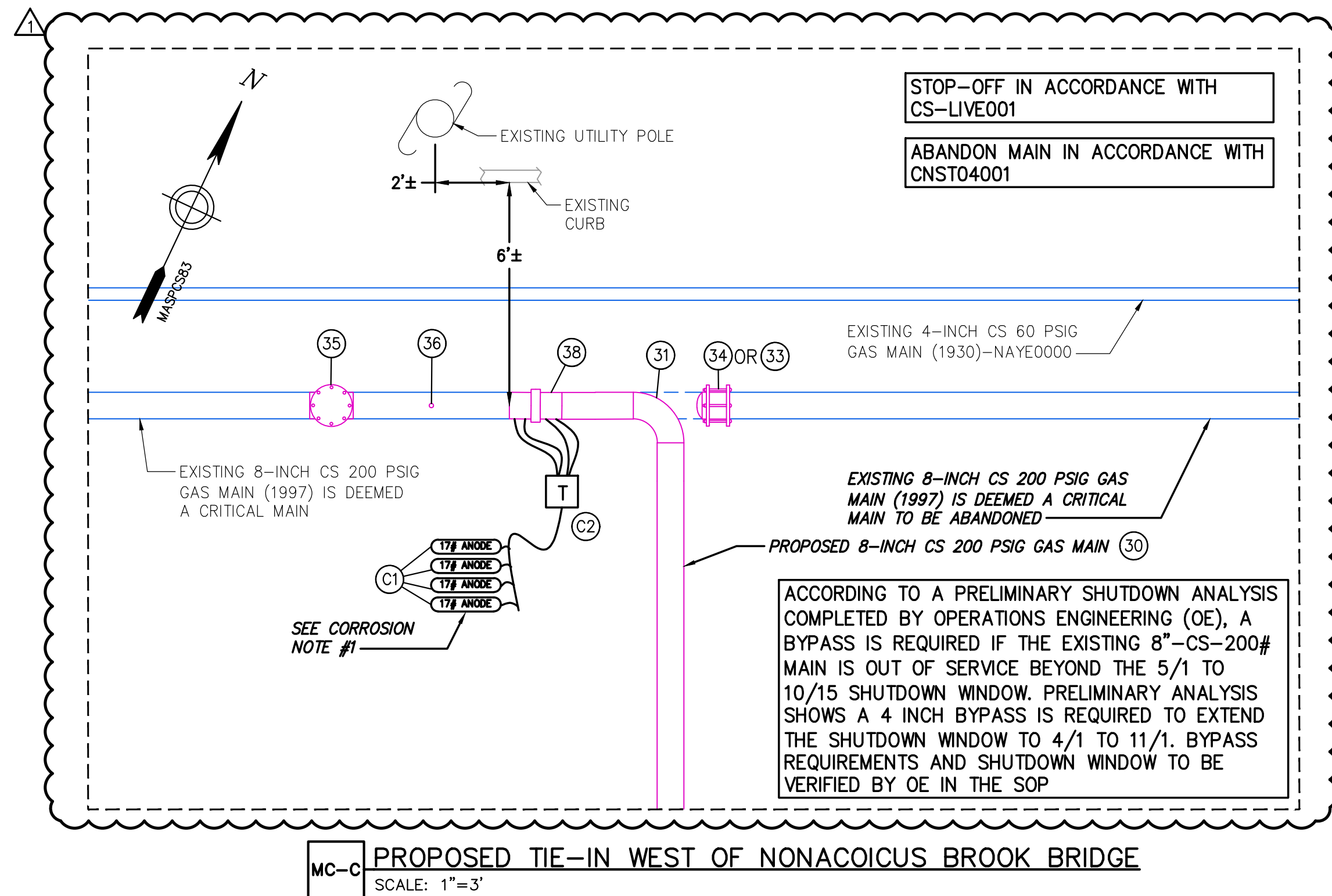
PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

**PROPOSED TIE-IN DETAILS -
60 PSIG GAS MAIN**

DWG SIZE	DESIGNER	ENGINEER	DATE:	ASSET I.D.	W.O. NO.:
22"x34"	A.ROSA	M.THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

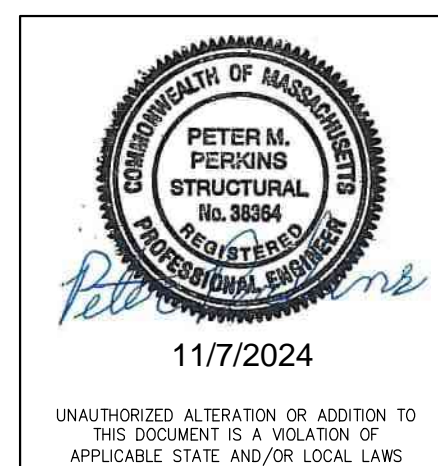
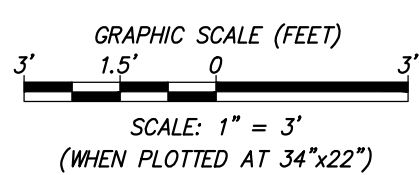
PAGE 8 OF 17

DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	C-201



GENERAL NOTES:

- CORROSION NOTE #1: INSTALL A WELD-END INSULATOR BETWEEN THE EXISTING COATED STEEL MAIN AND THE PROPOSED COATED STEEL MAIN. INSTALL A 4-WIRE TEST STATION ACROSS THE INSULATOR. INCLUDE 4-17 LB ANODES SPACED AT LEAST 8 FT APART AND 1 FT BELOW THE MAIN USING A SINGLE HEADER CABLE. INSTALL THE 9X9 TEST STATION IN AN ACCESSIBLE LOCATION. MAYE0035
- REFER TO SHEET G-003 FOR BILL OF MATERIALS, ITEM NUMBER PART DESCRIPTIONS



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BOSTON GAS COMPANY
d/b/a
nationalgrid
170 DATA DRIVE
WALTHAM, MA 02451

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PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

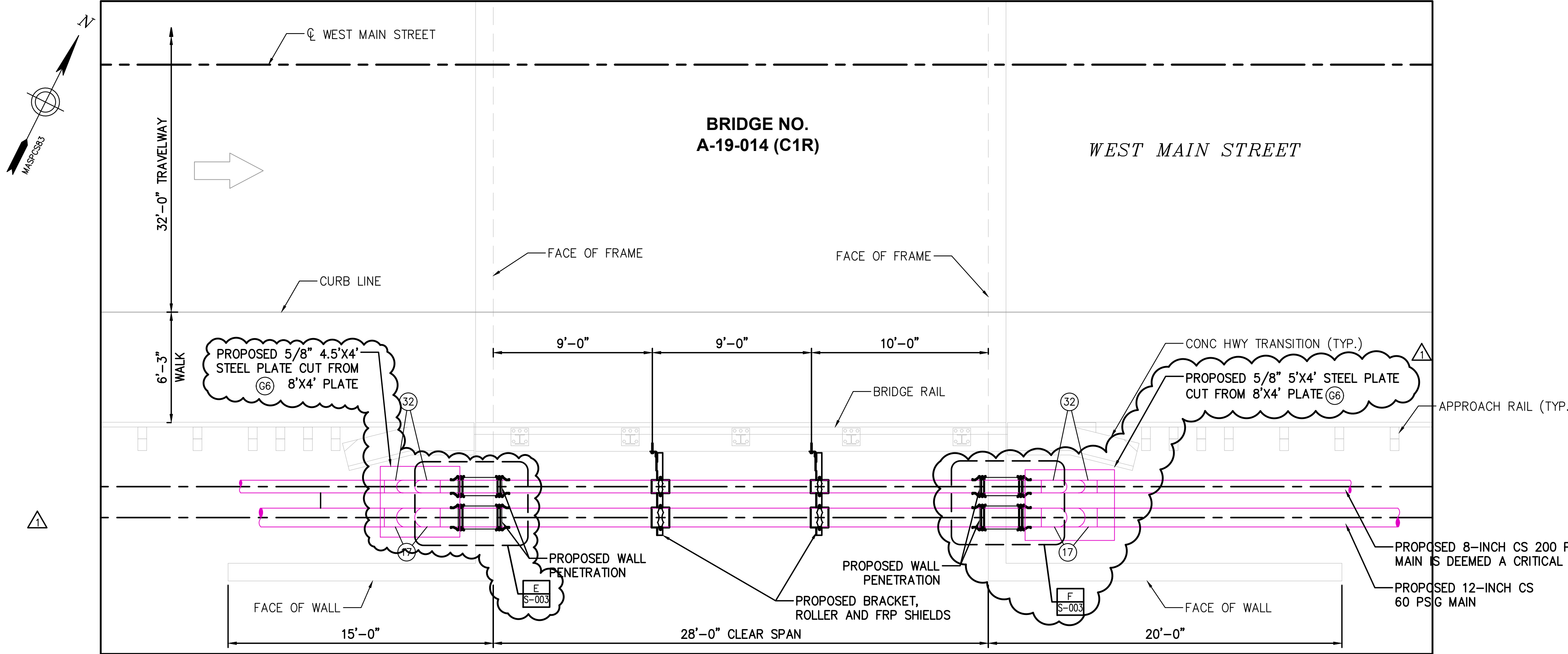
**PROPOSED TIE-IN DETAILS -
200 PSIG GAS MAIN**

DWG SIZE	DESIGNER	ENGINEER	DATE:	ASSET I.D.	W.O. NO.:
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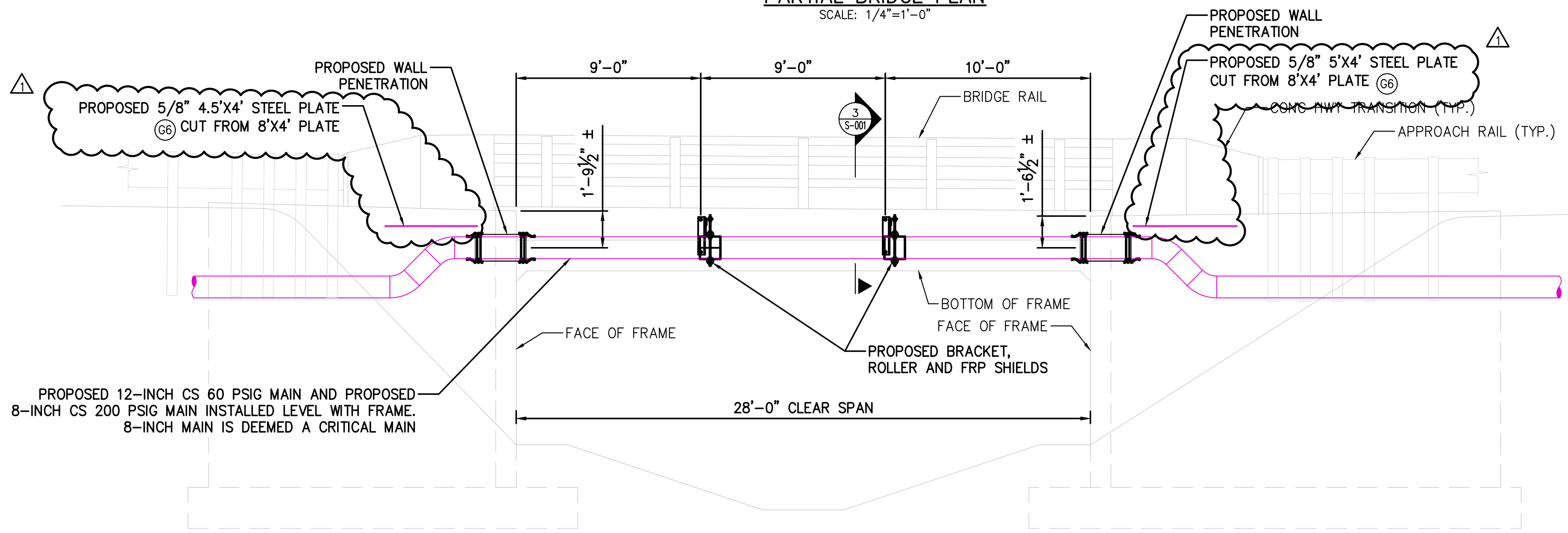
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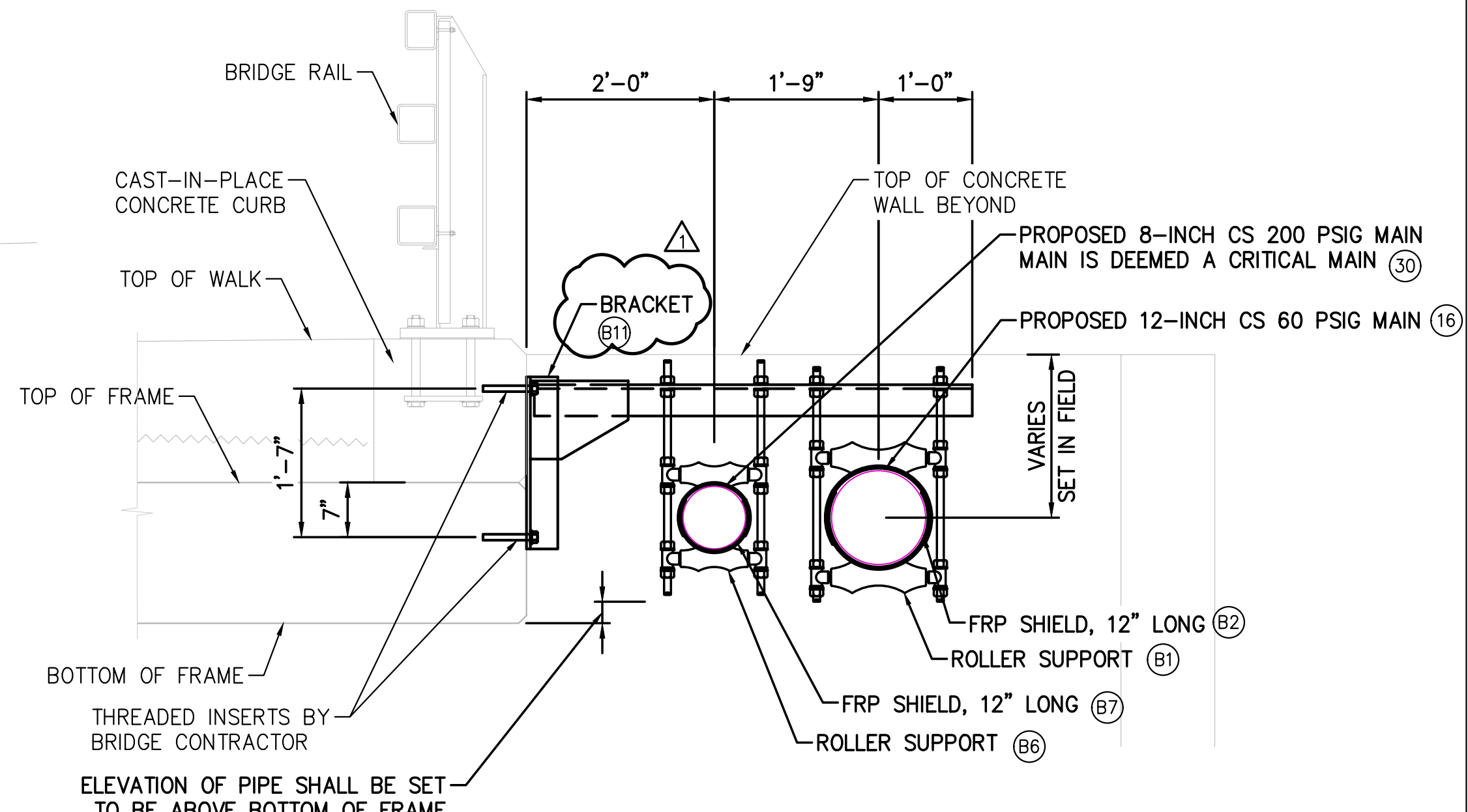
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PARTIAL BRIDGE PLAN
SCALE: 1/4"=1'-0"



SOUTH ELEVATION
SCALE: 1/4"=1'-0"



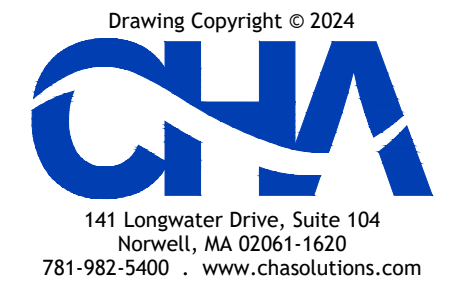
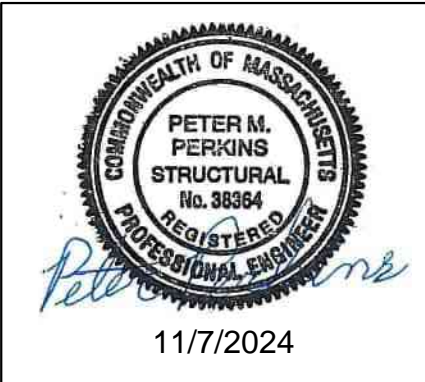
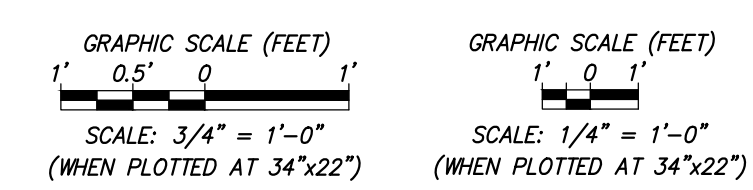
3 PARTIAL BRIDGE SECTION
SCALE: 3/4"=1'-0"

GENERAL NOTES:

1. REFER TO SHEET NO. G-003 FOR BILL OF MATERIALS.
2. SEE SHEET NO. S-002 FOR MATERIAL NOTES.
3. THE EXISTING 8-INCH CS 200 PSIG MAIN IS DEEMED A CRITICAL MAIN.
4. THE CONTRACTOR IS RESPONSIBLE TO COORDINATE WALL OPENINGS WITH THE BRIDGE CONTRACTOR PRIOR TO ABUTMENT CONSTRUCTION.
5. ALL DIMENSIONS TO BE FIELD VERIFIED AND CONFIRMED PRIOR TO MATERIAL FABRICATION AND INSTALLATION.
6. ALL WORK SHALL BE PERFORMED DURING THE WORK HOURS IN THE APPROVED PERMITS.
7. FRP SHIELDS SHALL BE SECURED TO THE GAS MAIN. SECURING MECHANISM SHALL BE FROM THE SAME MANUFACTURER AS THE FRP SHIELDS. CONSULT MANUFACTURER FOR MATERIALS AND INSTALLATION. PREPARE PIPE AND FRP SHIELD PER MANUFACTURER. WAX TAPE SHOULD BE REMOVED PRIOR TO SECURING SHIELDS.
8. CONTRACTOR IS RESPONSIBLE FOR REPAIRING AND DAMAGE TO BRIDGE.
9. ANY PIPE SUPPORT LOCATION AND CONFIGURATION CHANGES FROM THE DRAWINGS SHALL BE REVIEWED BY THE PROJECT'S STRUCTURAL ENGINEER AND APPROVED BY NATIONAL GRID.
10. INSTALL A36 STEEL PLATE TO PROTECT TRANSMISSION & DISTRIBUTION MAINS IN SHALLOW CONDITION. DETERMINE PLACEMENT IN ACCORDANCE WITH NATIONAL GRID SPECIFICATION CNST-6030.

COATING NOTES:

11. ALL COATED STEEL PIPE EXPOSED TO THE ATMOSPHERE SHALL INCLUDE PRITEC COATING, MINIMUM 15/50 THICKNESS.
12. COAT ALL PIPE IN ACCORDANCE WITH 030031-CS.
13. H35 GRAY TAPE/WAX TAPE #2 CAN BE APPROPRIATELY USED ON FITTINGS, WELDS, OR COATING DEFECTS AS NEEDED.
14. BLUECOAT COATING FROM LB&A, INC. OR APPROVED EQUAL SHALL BE APPLIED TO ALL APPLICABLE MATERIALS. IF BLUECOAT COATING IS UNAVAILABLE FOR MATERIALS, ALL MATERIALS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153/A123. CONTRACTOR SELECTED MATERIALS MUST BE EITHER ALL BLUECOAT OR ALL GALVANIZED. MIXING OF CONTRACTOR SELECTED MATERIALS IS NOT ALLOWED.
15. PARTS WITH DAMAGED BLUECOAT SHALL BE REPLACED. DAMAGED GALVANIZING SHALL BE REPAIRED IN ACCORDANCE WITH ASTM A780.
16. ABOVE GRADE CANUSA SHRINK SLEEVES MAY BE USED ON ALL WELDS.



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BOSTON GAS COMPANY
a/b/a
nationalgrid
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WALTHAM, MA 02451

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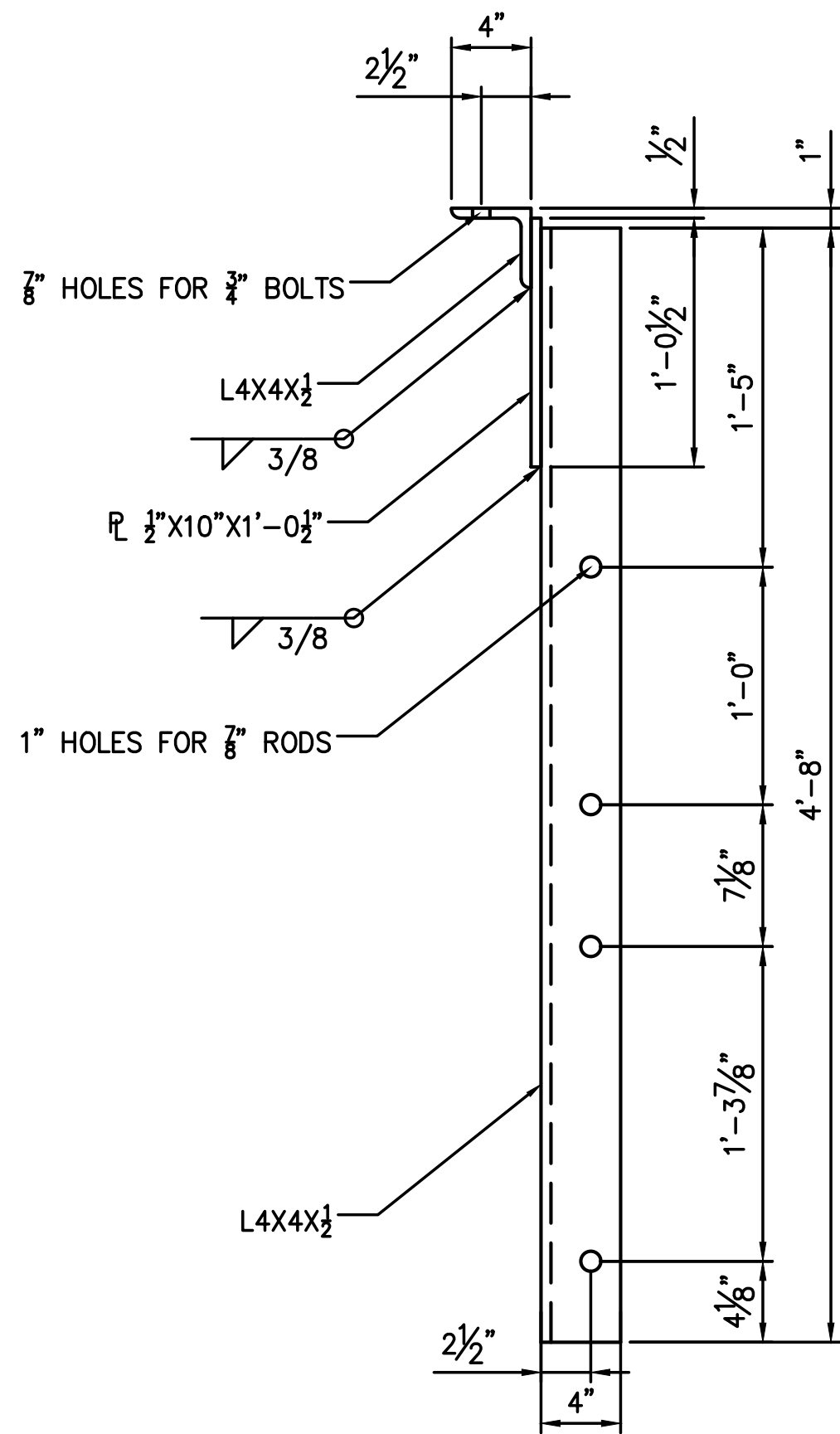
PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

BRIDGE PLAN AND ELEVATION

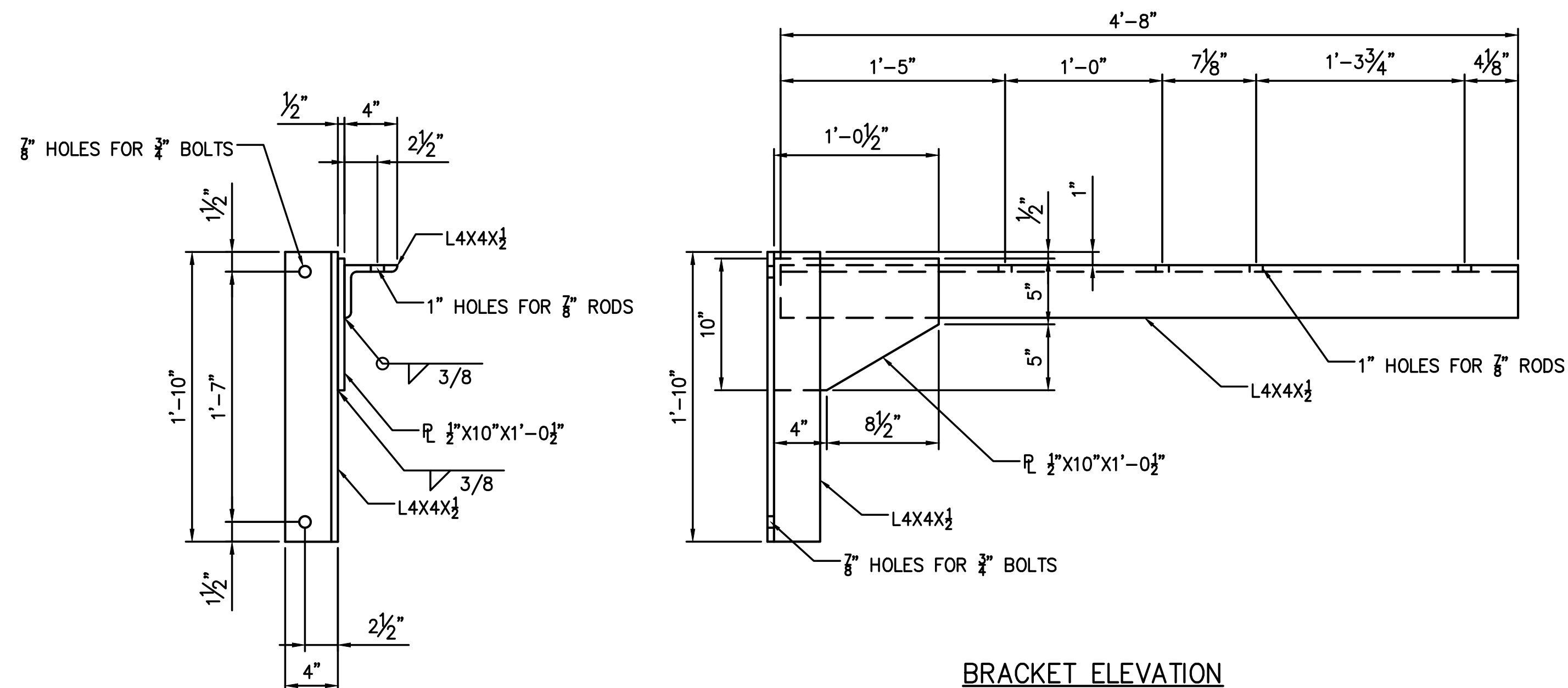
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22"x34"	A. JAJIARDO	P. PERKINS	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

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DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	S-001

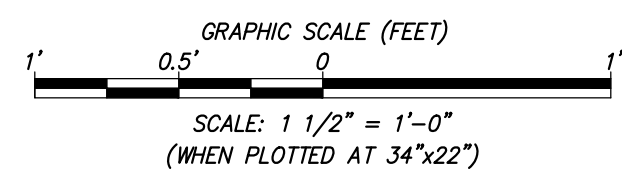


BRACKET PLAN
SCALE: 1 1/2"=1'-0"



BRACKET ELEVATION
SCALE: 1 1/2"=1'-0"

BRACKET END VIEW
SCALE: 1 1/2"=1'-0"



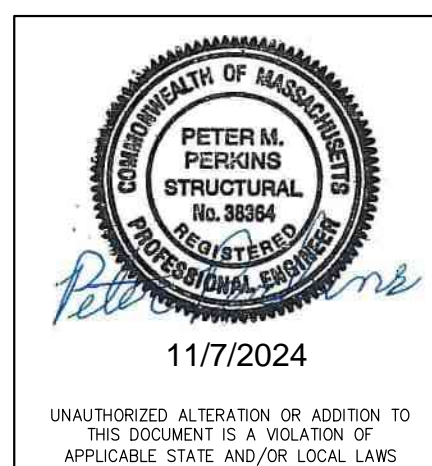
MATERIAL NOTES:

1. REFER TO SHEET NO. G-003 FOR BILL OF MATERIALS.
2. SEE SHEET NO. S-001 FOR GENERAL NOTES AND COATING NOTES.
3. ALL STEEL PLATE AND ANGLES SHALL BE ASTM A36.
4. BOLTS SHALL BE ASTM F3125, GR 325, HEAVY HEX.
5. ALL NUTS SHALL BE HEAVY HEX ASTM A563, GRADE A. ALL WASHERS SHALL BE ASTM A436, TYPE 1.
6. ALL WELDING SHALL USE E60 ELECTRODES.
7. ALL WELDING SHALL BE IN ACCORDANCE WITH AASHTO/AWS D1.1

BILL OF MATERIALS – SUPPORT BRACKET ASSEMBLY

ITEM	QTY	UOM	DESCRIPTION	SIZE (IN)	PROVIDED BY
1	13	FT	STEEL ANGLE, ASTM A36, L4X4X1/2	-	CONTRACTOR
2	2	EA	STEEL PLATE, ASTM A36, 1/2"X10"X1'-0 1/2"	-	CONTRACTOR
3	4	EA	BOLT, ASTM F3125, GR 325, HH	3/4	CONTRACTOR
4	4	EA	WASHER, ASTM436, TYPE 1	3/4	CONTRACTOR

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BOSTON GAS COMPANY
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nationalgrid
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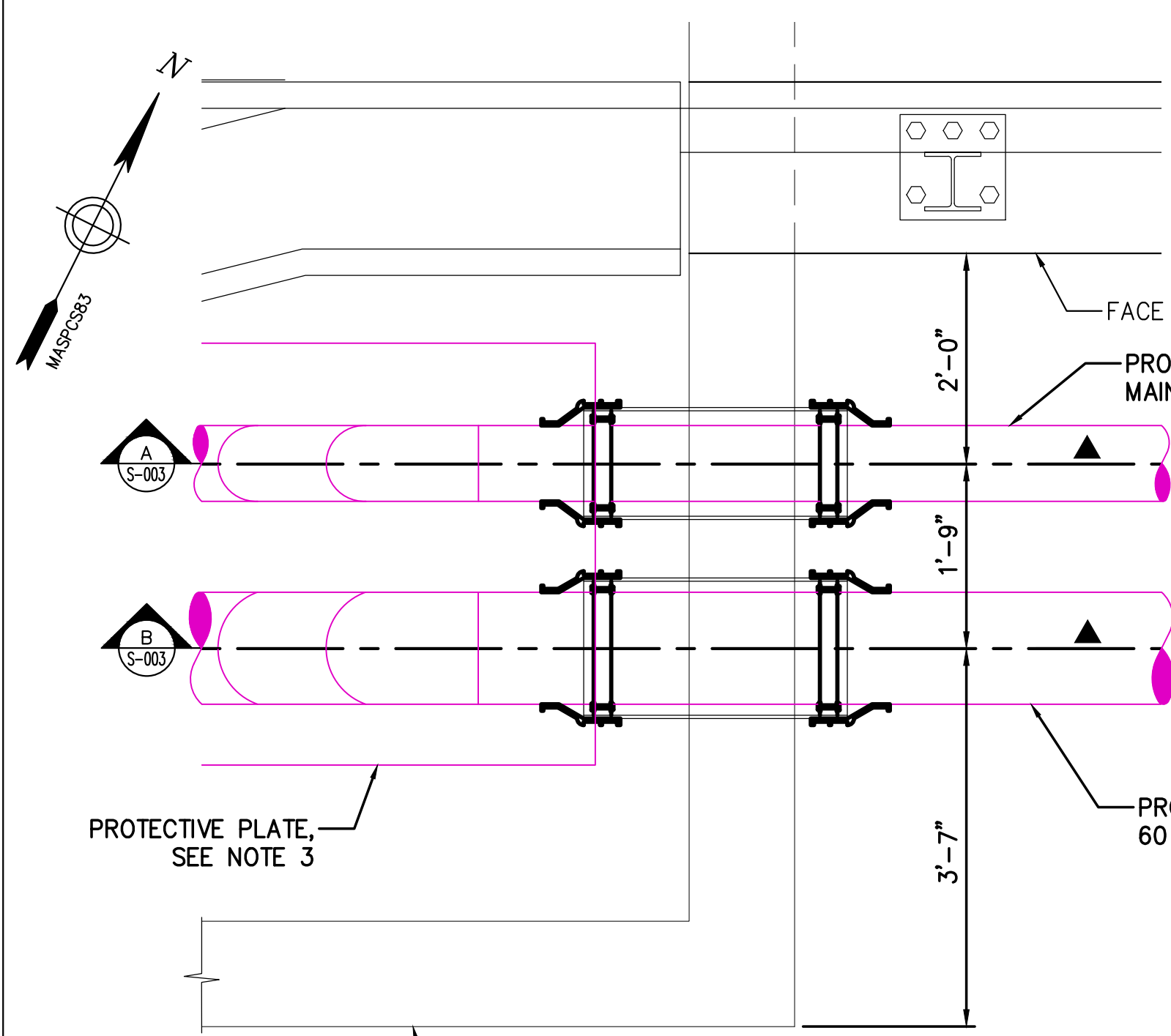
PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

BRACKET DETAILS

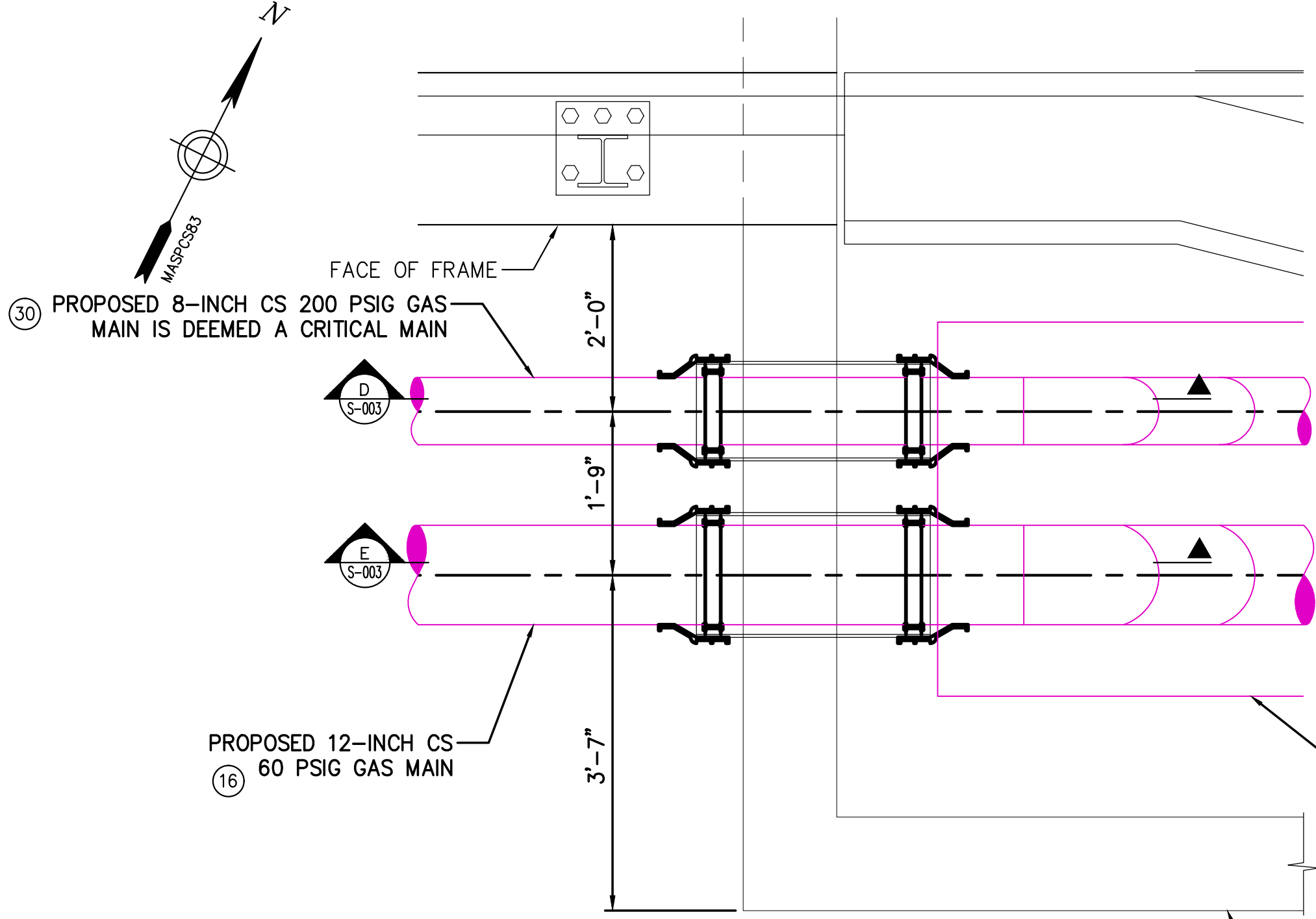
DWG SIZE	DESIGNER	ENGINEER	DATE	ASSET I.D.	W.O. NO.:
22"X34"	A. JAJIARDO	P. PERKINS	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

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DPL-AYE-076933-1067	S-002

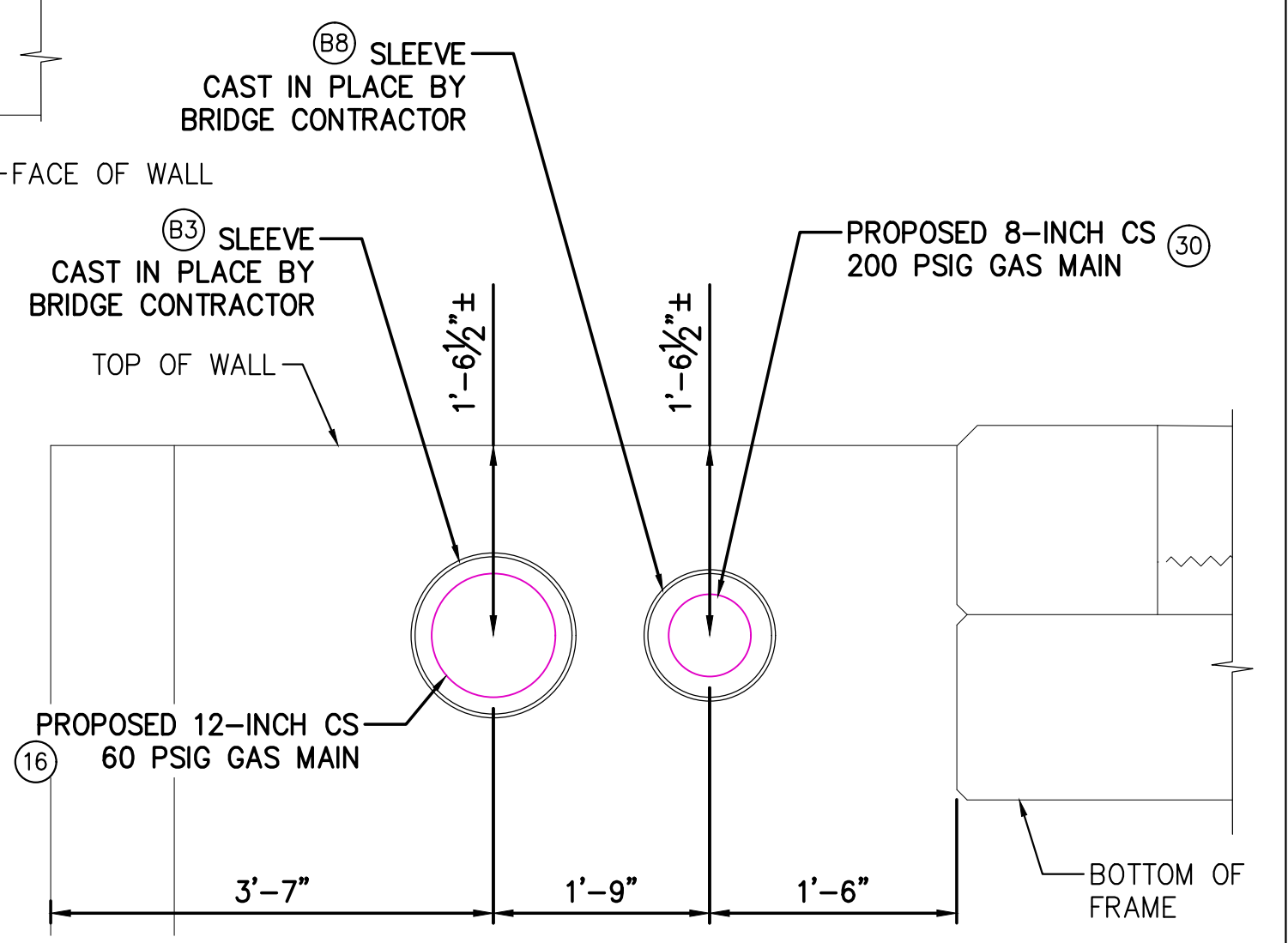
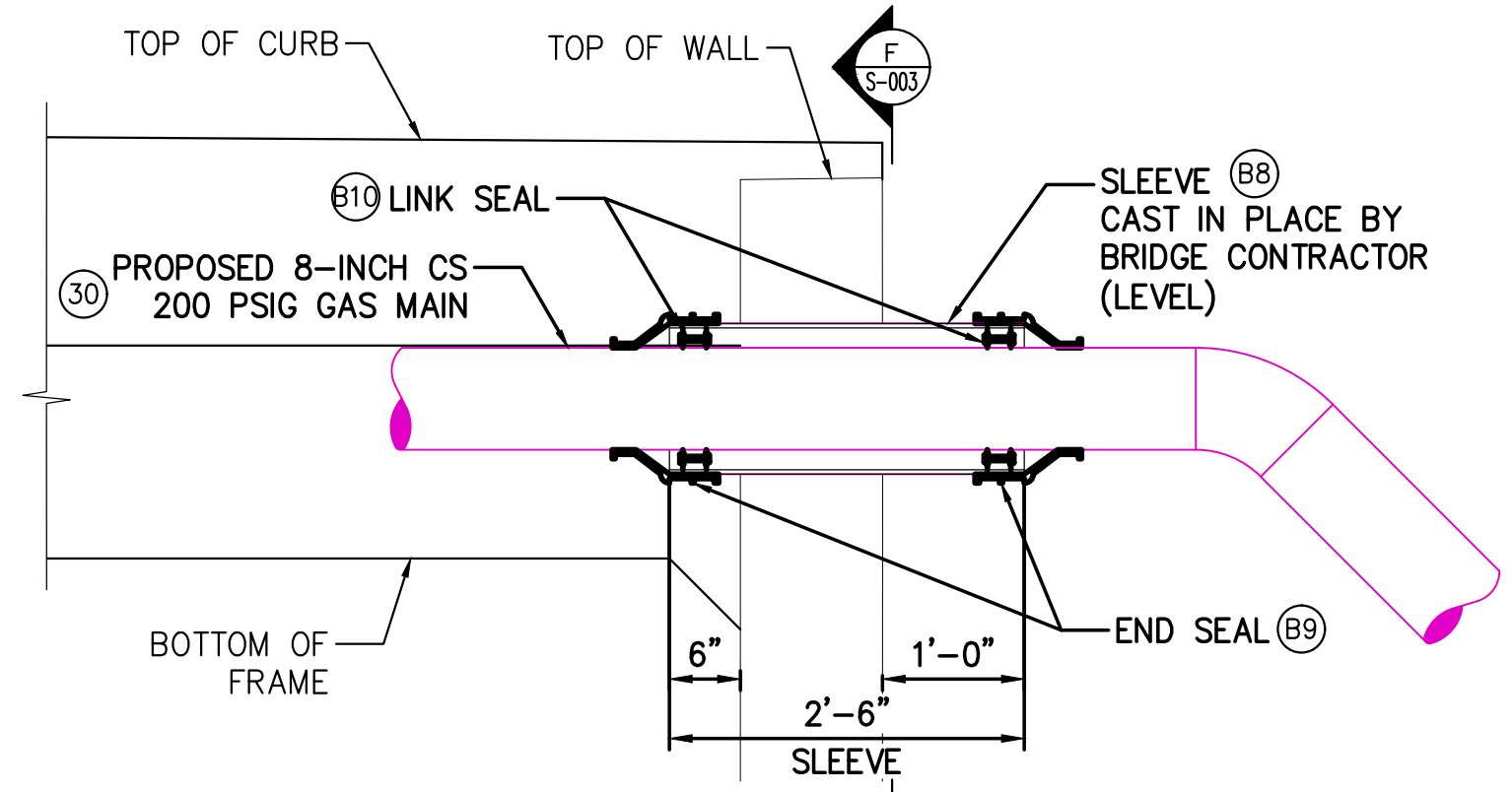
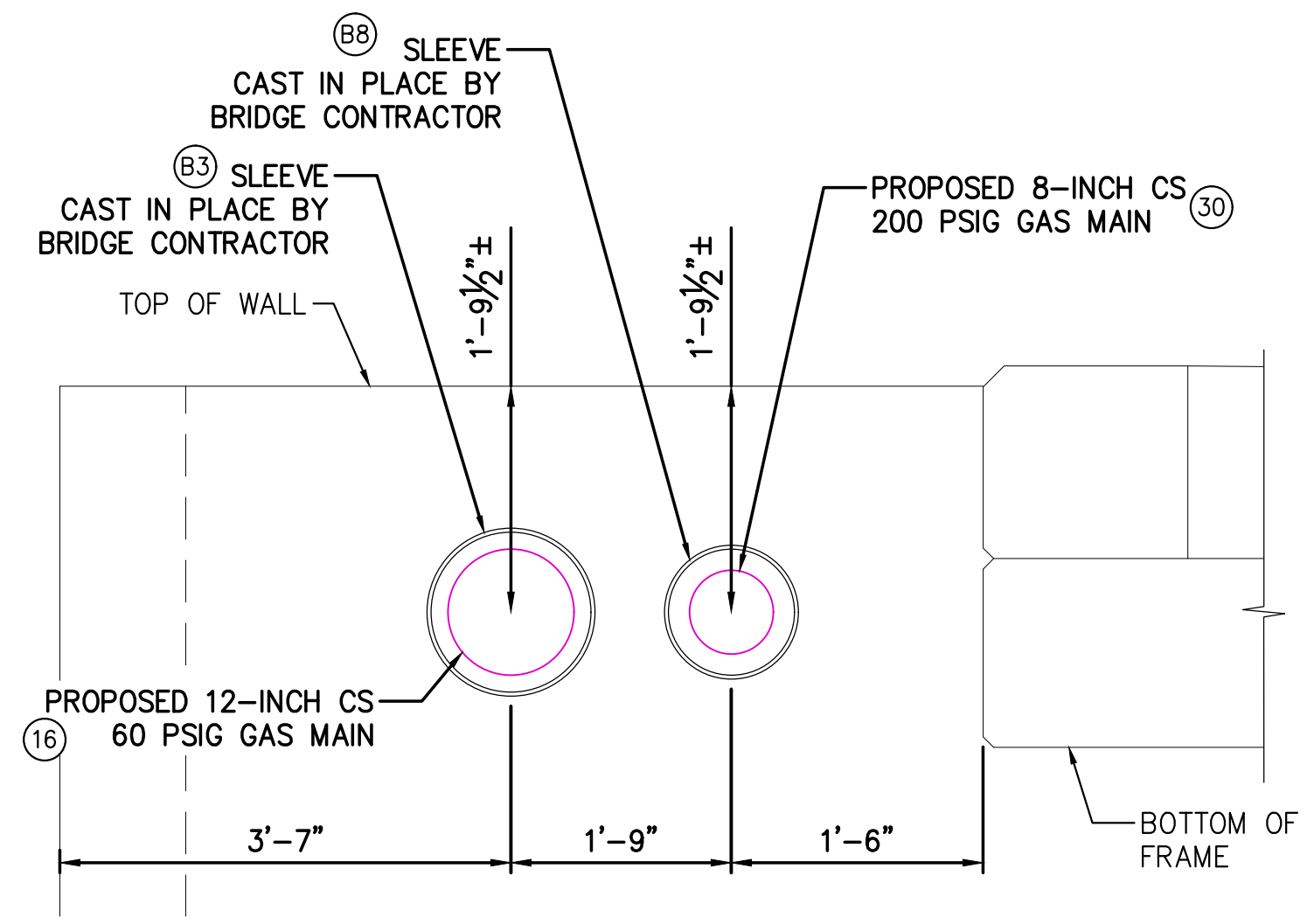
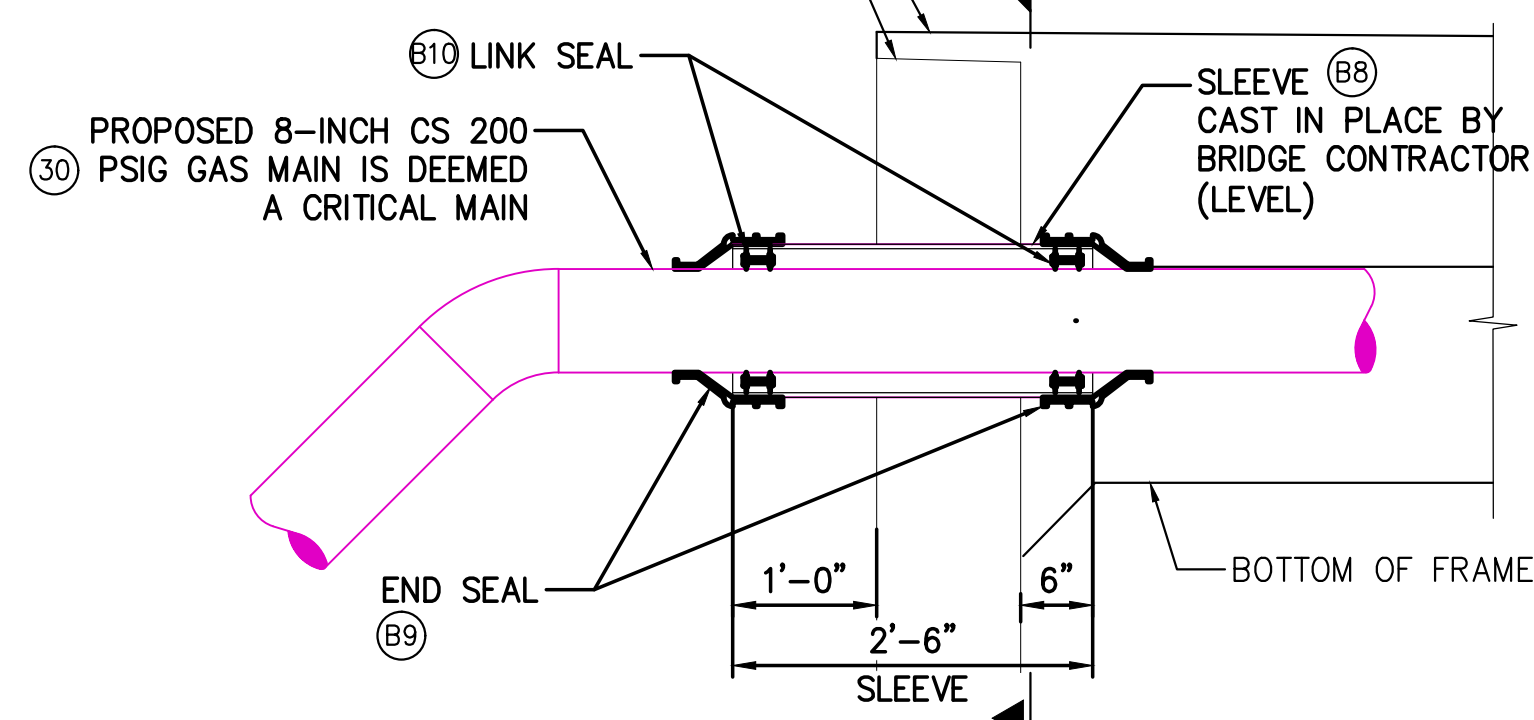


- MATERIAL NOTES:**
- REFER TO SHEET NO. G-003 FOR BILL OF MATERIALS.
 - SEE SHEET NO. S-001 FOR GENERAL NOTES AND COATING NOTES.
 - SEE SHEET NO. S-001 FOR STEEL PLATE PROTECTION FOR TRANSMISSION AND DISTRIBUTION MAINS AS THEY EXIT THE WALL SLEEVE TO 3' OF COVER



E WESTERN WALL PENETRATION DETAIL
S-001 SCALE: 3/4" = 1'-0"

F EASTERN WALL PENETRATION DETAIL
S-001 SCALE: 3/4" = 1'-0"

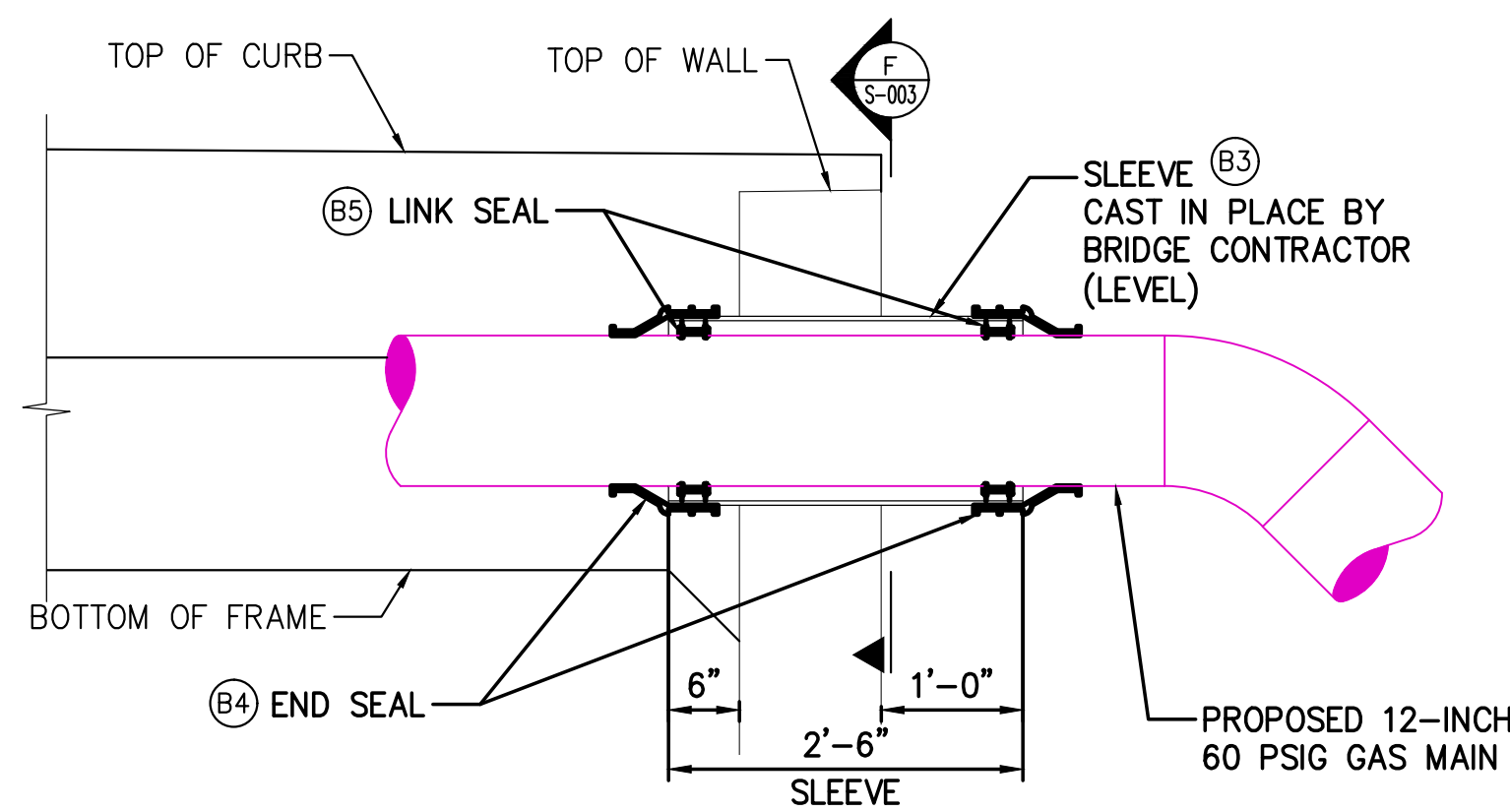
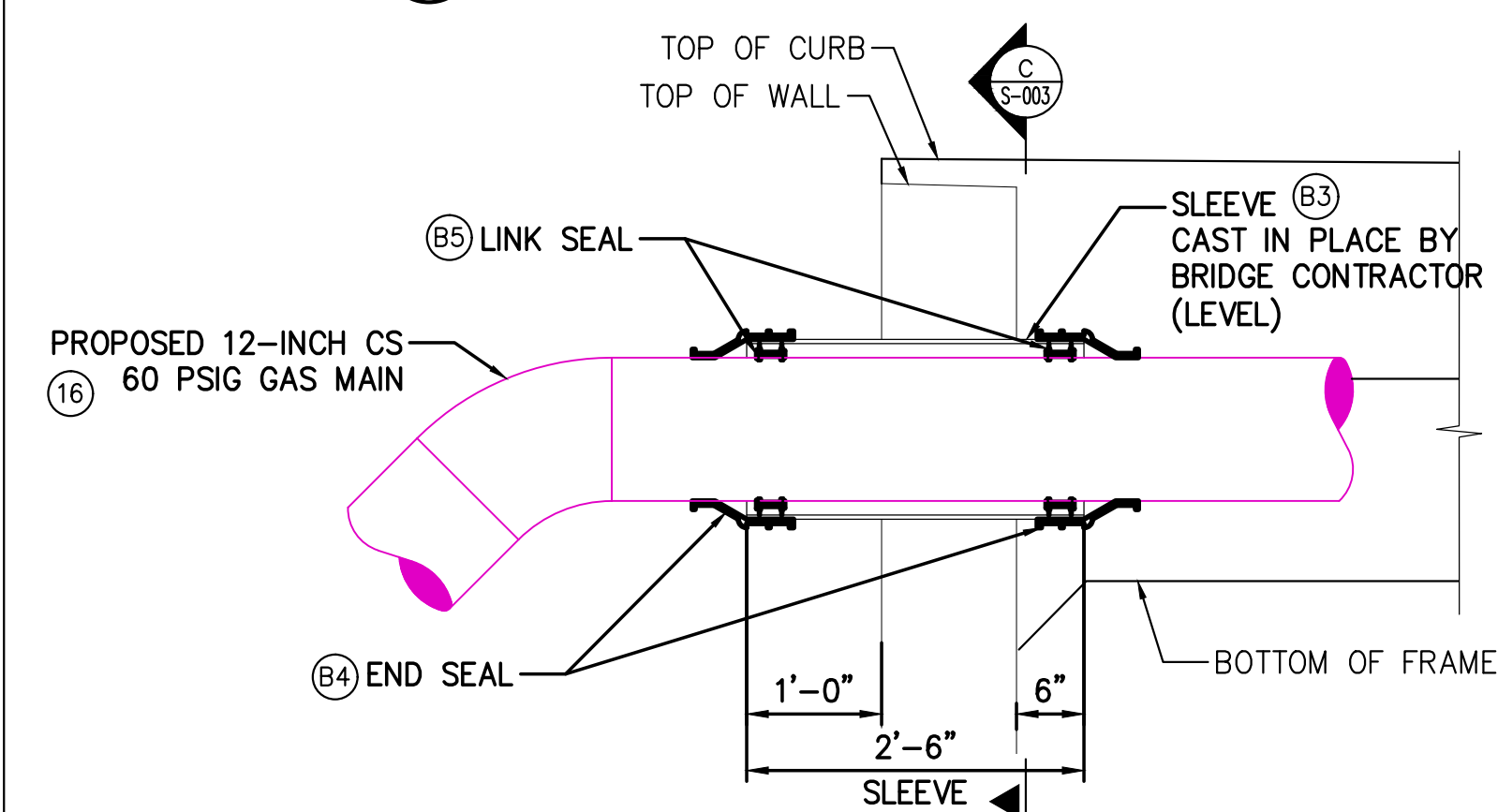


A WESTERN WALL PENETRATION SECTION
SCALE: 3/4" = 1'-0"

C WESTERN WALL PENETRATION SECTION
SCALE: 3/4" = 1'-0"

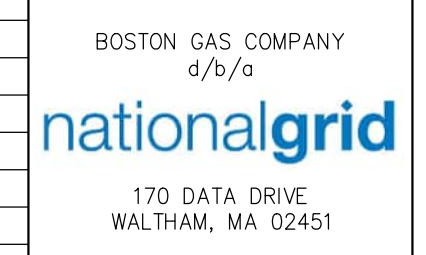
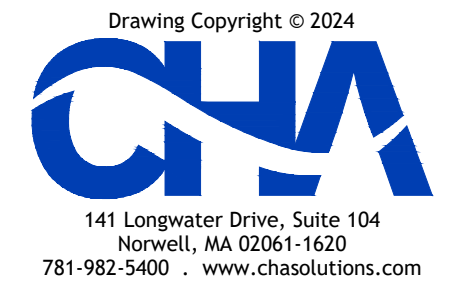
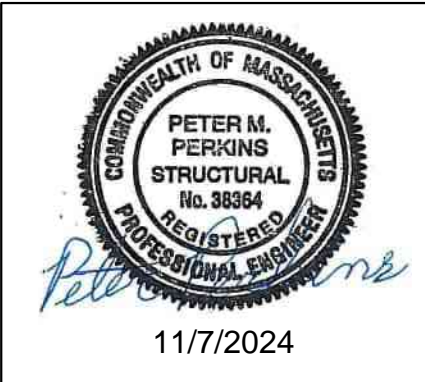
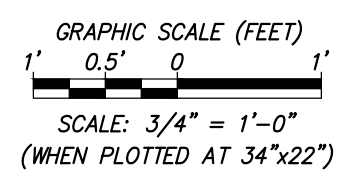
D EASTERN WALL PENETRATION SECTION
SCALE: 3/4" = 1'-0"

F EASTERN WALL PENETRATION SECTION
SCALE: 3/4" = 1'-0"



B WESTERN WALL PENETRATION SECTION
SCALE: 3/4" = 1'-0"

E EASTERN WALL PENETRATION SECTION
SCALE: 3/4" = 1'-0"



PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

WALL PENETRATIONS

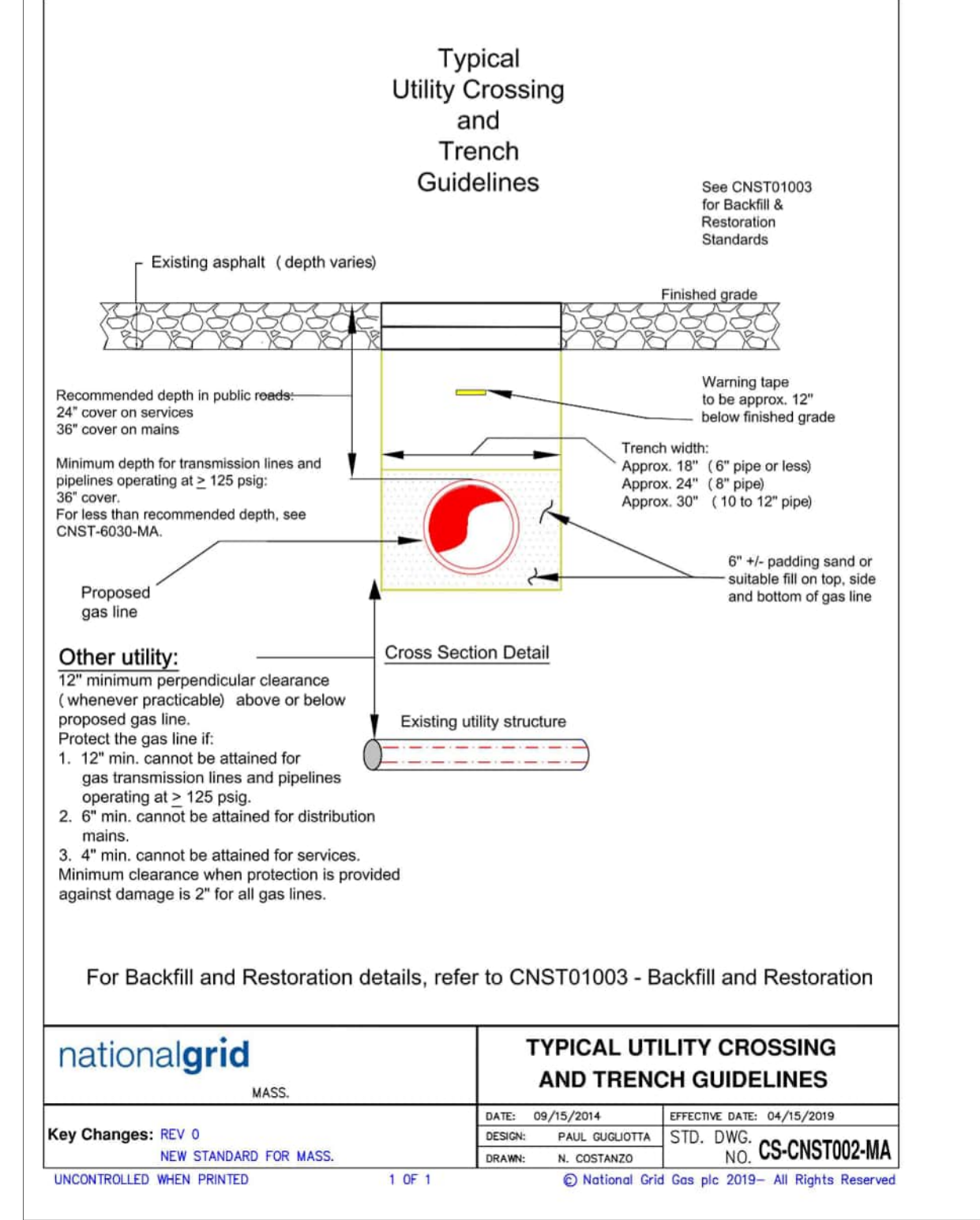
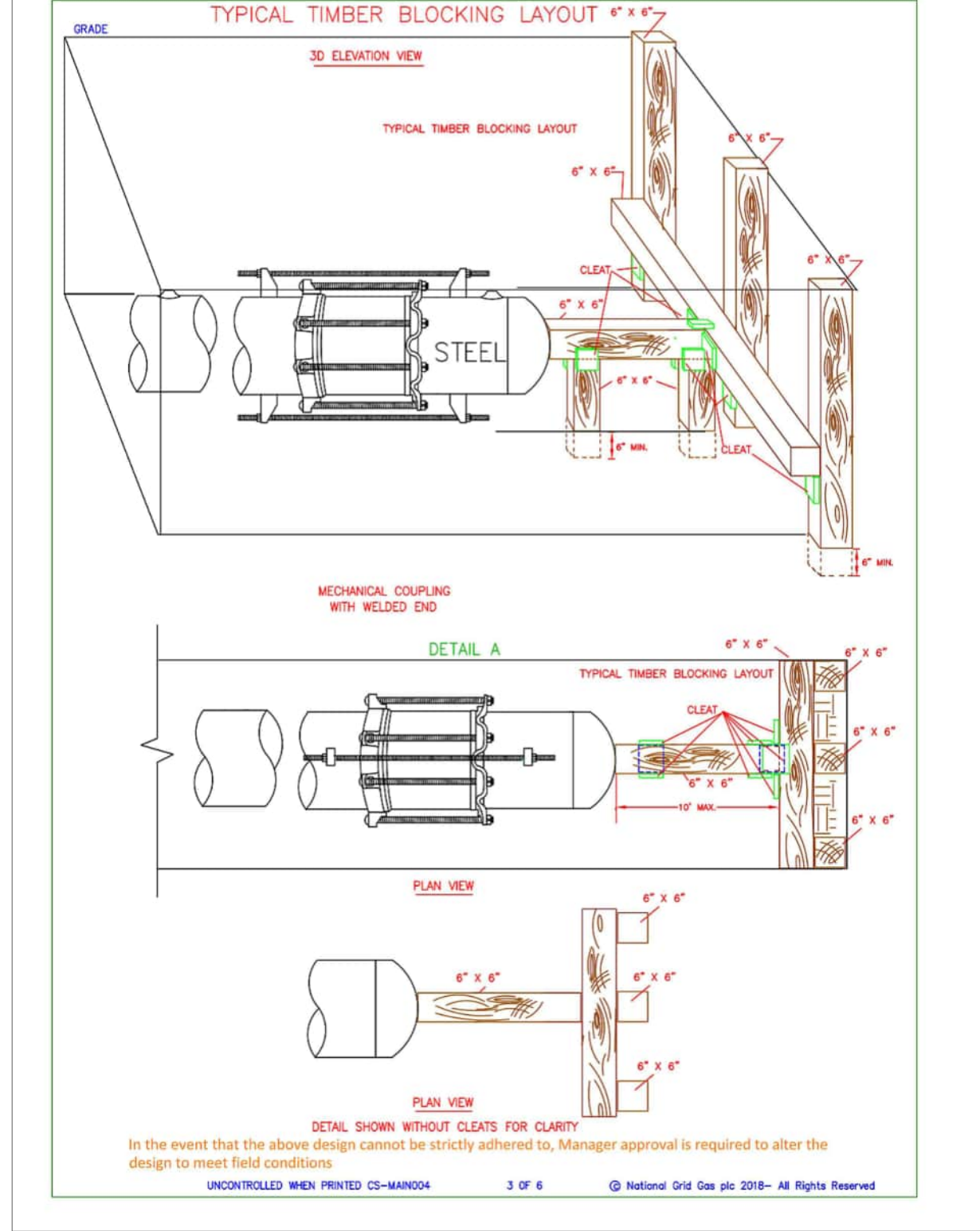
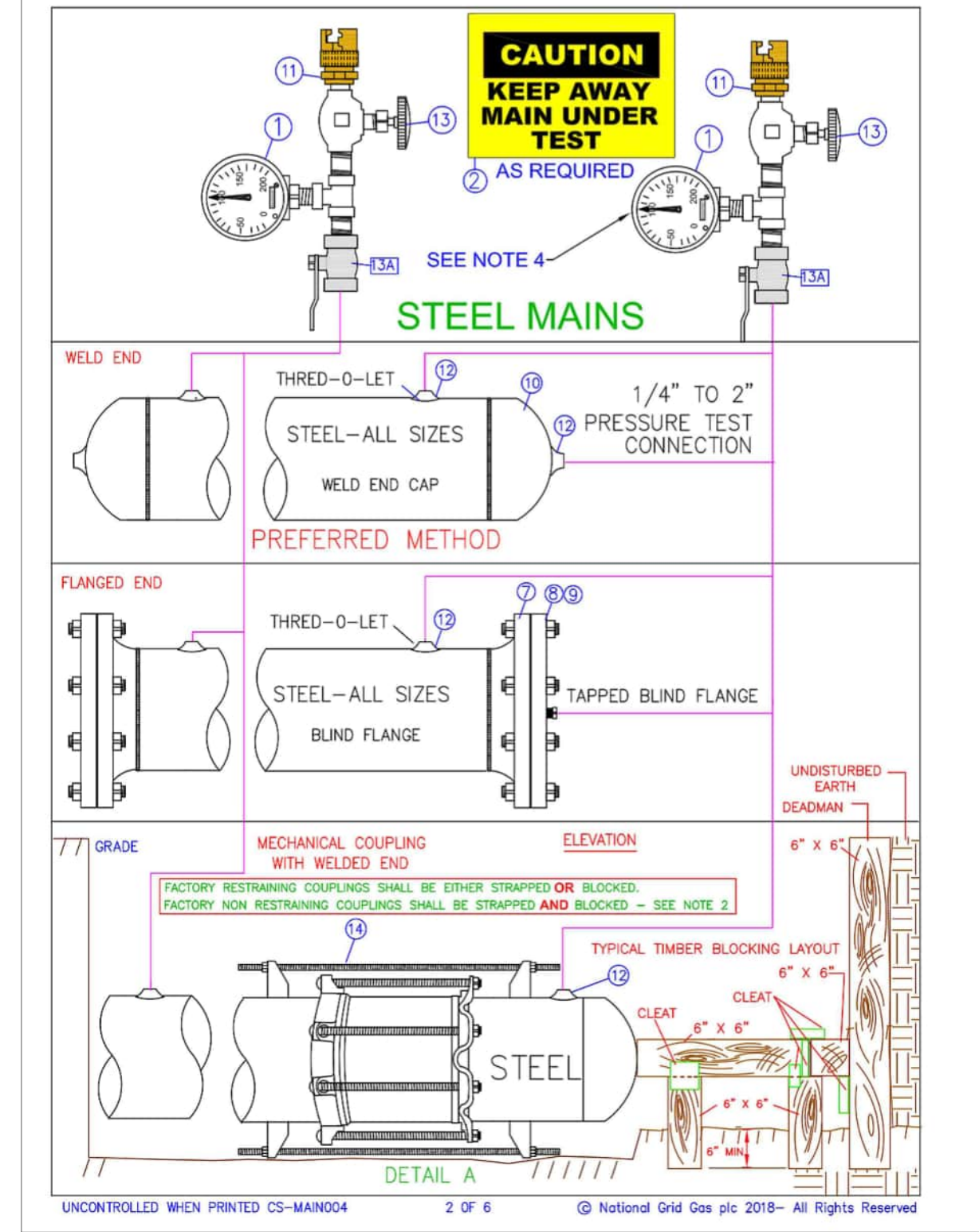
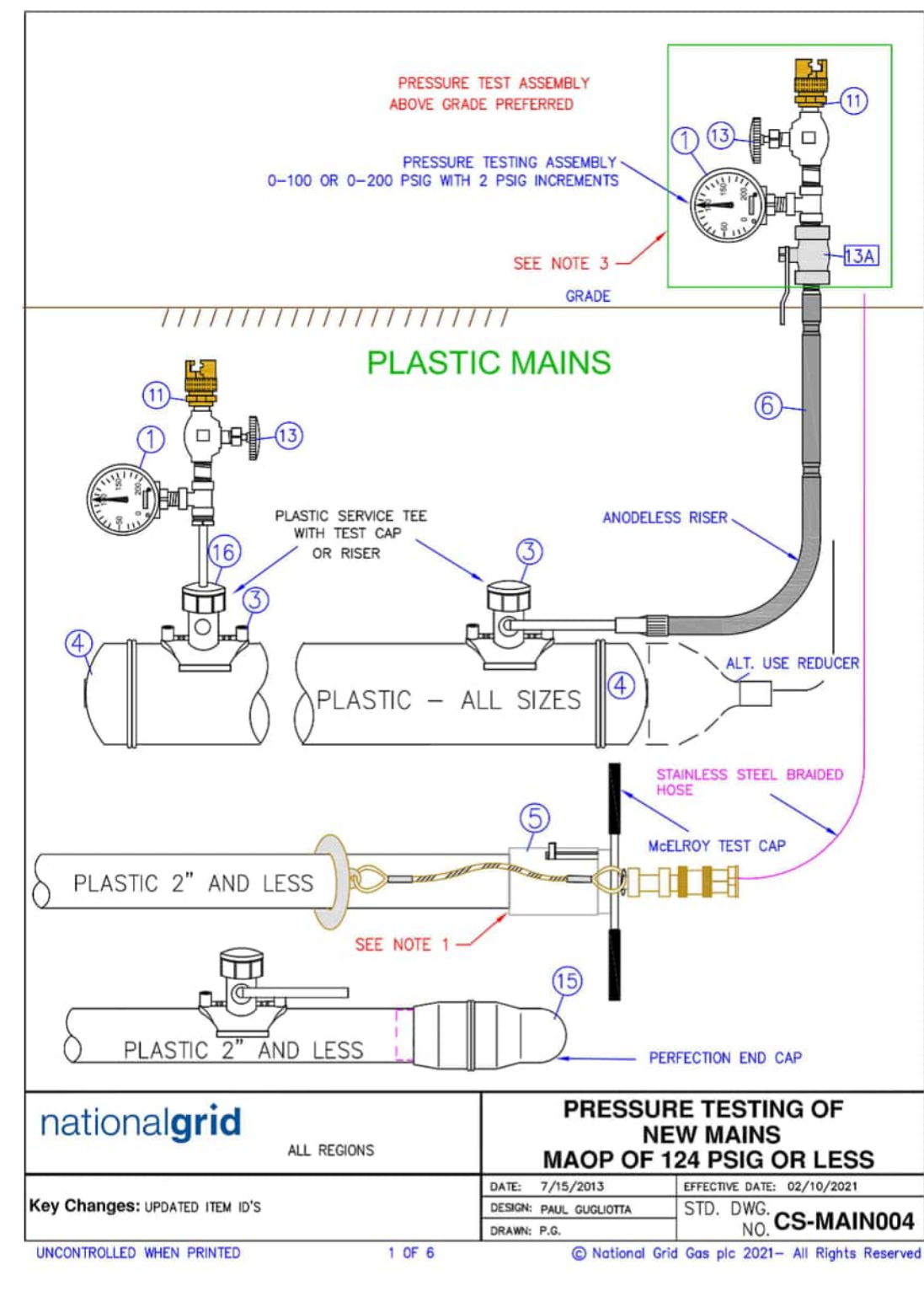
DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	S-003

NO.	DESCRIPTION	DATE	DR. BY	CK. BY	APP. BY
1	ADDRESSED NGRID COMMENTS (DATED 10/25/2024)	11/6/2024	ACR	PMP	PMP

FINAL

DWG SIZE	DESIGNER	ENGINEER	DATE	ASSET I.D.	W.O. NO.:
22"X34"	A. JAJIARDO	P. PERKINS	01/18/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

▲ PAGE ADDED ON 11/06/2024



NOTES:

- INSTALL PER MCELROY MANUFACTURER'S INSTRUCTIONS.
- WHEN USING MECHANICAL COUPLINGS (AS SHOWN IN DETAIL A), NON-RESTRAINING COUPLING SHALL BE STRAPPED AND THE ENDS SHALL BE BLOCKED PER APPROVED STANDARD DRAWINGS. RESTRAINING COUPLINGS NEED TO BE EITHER STRAPPED OR BLOCKED. WHEN USING RESTRAINING COUPLINGS, STRAPPING NUTS SHOULD BE HAND TIGHT.
- ON EXISTING STEEL, REFER TO THE TABLE BELOW FOR THE MINIMUM SAFE EMBEDMENT DISTANCE FROM THE WALL. WHEN BLOCKING IS REQUIRED FOR THE PRESSURE TEST, IF AN ALL WELDED SYSTEM CAN NOT BE CONFIRMED, THE WELDED OR FLANGED ENDS SHALL BE BLOCKED.

PIPE SIZE (INCHES)	MINIMUM SAFE EMBEDMENT FROM THE EXCAVATION WALL (FEET)
2	8
3	8
4	12
6	24
8	41
12	70

REFER TO CONSTRUCTION STANDARD FITS 6025 AND FITS 6015 FOR LIST OF COUPLINGS.

- IT IS RECOMMENDED THAT THE GAUGE ASSEMBLY BE ABOVE GRADE TO PREVENT PERSONNEL FROM ENTERING THE TRENCH WHILE THE PRESSURE TEST IS UNDERWAY.
- ONE PRESSURE TEST GAUGE AT EACH PIPE END IS RECOMMENDED TO VERIFY THE PRESSURE. ALL GAUGES SHALL BE 0-100 OR 0-200 PSIG RANGE (2 PSIG INCREMENTS RECOMMENDED BY STATE ONLY).
- REFER TO CNST04003 'PRESSURE TESTING OF MAINS OPERATING BELOW 125 PSIG' FOR TESTING AND DESIGN REQUIREMENTS.

ITEM	DESCRIPTION	SAP ITEM ID LI/MA/INVC	SAP ITEMS RI AND UNY
1	PRESSURE GAUGE 0-100 OR 0-200 PSIG - 2 PSI INCREMENTS 0-200 PSIG STAINLESS STEEL 1/2" NPT 3/16" DIA. 0-200 PSIG STAINLESS STEEL 1/2" NPT 2-1/2" DIA. 0-200 PSIG STAINLESS STEEL 1/2" NPT	9354865 9358390 NON STOCK	TOOL ITEM TOOL ITEM NON STOCK
2	SIGN - WARNING PRESSURE TEST (AS REQUIRED IN FIELD)	9332340	NON STOCK
3	TEE SERVICE - ELECTROFUSION YELLOW MD 1/2" CTS BUTT FUSE OUTLET 2" MAIN X 1/2" BUTT FUSE OUTLET L/M/ANY/INVC 4" MAIN X 1/2" BUTT FUSE OUTLET L/M/ANY/INVC 6" MAIN X 1/2" BUTT FUSE OUTLET L/M/ANY/INVC 8" MAIN X 1/2" BUTT FUSE OUTLET L/M/ANY/INVC	9342517 2X12 9342518 4X12 9342516 6X12 9342371 8X12	NON STOCK NON STOCK NON STOCK NON STOCK
3	TEE SERVICE - ELECTROFUSION YELLOW MD 1" CTS BUTT FUSE OUTLET 2" MAIN X 1" BUTT FUSE OUTLET L/M/ANY/INVC 4" MAIN X 1" BUTT FUSE OUTLET L/M/ANY/INVC 6" MAIN X 1" BUTT FUSE OUTLET L/M/ANY/INVC 8" MAIN X 1" BUTT FUSE OUTLET L/M/ANY/INVC	9342332 1-1/4 X 1 9342519 2X1 9342521 4X1 9342328 6X1 9342372 8X1	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
3	TEE SERVICE - ELECTROFUSION BLACK HD 1" IPS BUTT FUSE OUTLET 2" MAIN X 1" IPS BUTT FUSE OUTLET MASS 4" MAIN X 1" IPS BUTT FUSE OUTLET MASS 6" MAIN X 1" IPS BUTT FUSE OUTLET MASS 8" MAIN X 1" IPS BUTT FUSE OUTLET MASS 12" MAIN X 1" IPS BUTT FUSE OUTLET MASS	9322653 2X1 9322628 3X1 9322620 4X1 9322626 6X1 9322607 8X1 9318311 12X1	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
3	TEE SERVICE - SADDLE FUSION HIGH DENSITY BLACK 1/2" CTS BUTT FUSE 2" MAIN X 1/2" OUTLET LI 4" MAIN X 1/2" OUTLET LI 6" MAIN X 1/2" OUTLET LI 8" MAIN X 1/2" OUTLET LI	9342405 2X12 9342406 4X12 9342407 6X12 9342408 8X12	NON STOCK NON STOCK NON STOCK NON STOCK
3	TEE SERVICE - SADDLE FUSION HIGH DENSITY BLACK 1" CTS BUTT FUSE 2" MAIN X 1" OUTLET LI 4" MAIN X 1" OUTLET LI 6" MAIN X 1" OUTLET LI 8" MAIN X 1" OUTLET LI 12" MAIN X 1" OUTLET LI	9342409 2X1 SDR 9 9342409 4X1 SDR 9 9342409 6X1 SDR 9 9342409 8X1 SDR 9 9314629 12X1	9315907 2X1 9315904 4X1 9315903 6X1 9315902 8X1 NON STOCK
3	TEE SERVICE MECHANICAL X PERFECTION OUTLET 2" MAIN X 1/2" OUTLET 4" MAIN X 1/2" OUTLET 6" MAIN X 1/2" OUTLET 8" MAIN X 1/2" OUTLET 12" MAIN X 1/2" OUTLET	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK	9306584 2X12 9306584 4X12 9306472 6X12 9306471 8X12 9315492 2X1 9306123 3X1 9315490 4X1 9306473 6X1 9306178 8X1

ITEM	DESCRIPTION	GRACLE ITEM ID LI/MA/INVC	PEOPLESOFT ITEM RI AND UNY
4	CAP END PLASTIC MEDIUM DENSITY YELLOW BUTT FUSE 2" SDR 11 4" SDR 11 6" SDR 11 8" SDR 11.5 12" SDR 11.5	9336540 9336541 9336542 9336543 9336560	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
4	CAP END PLASTIC HIGH DENSITY BLACK BUTT FUSION 2" SDR 9 4" SDR 9 6" SDR 9 8" SDR 9	9336538 9336539 9336536 9336537	NON STOCK NON STOCK NON STOCK NON STOCK
4	2" SDR 11 MASS RI & UNY 3" SDR 11 MASS RI & UNY 4" SDR 11 MASS RI & UNY 6" SDR 11 MASS RI & UNY 8" SDR 11 MASS RI & UNY 12" SDR 11 RI UNY	9312986 9310276 9312985 9312984 9310272 9310879	2" 9312986 3" 9310276 4" 9312985 6" 9312984 8" 9310272 12" 9310879
5	MECROY TEST CAPS (165 PSIG MAX) 1-1/4" MODEL TP 2" MODEL TP-310	NON STOCK NON STOCK TP-308 TP-310	NON STOCK NON STOCK NON STOCK NON STOCK
6	RISER 1" CTS MEDIUM DENSITY X 1/2" NPT OUTLET 1" CTS MEDIUM DENSITY X 1-1/4" IPS OUTLET 1" HIGH DENSITY X 1-1/4" OUTLET 1" CTS SERVICE X 1" OUTLET 1" CTS HIGH DENSITY .689" WALL X 1" IPS STEEL OUTLET 1/2" CTS .689" WALL PERFECTION END X 1-1/4" NPT STEEL 1-1/4" CTS .689" WALL PERFECTION END X 1-1/4" NPT STEEL	9344996 9346874 9340683 9320927 9316495 9312095 9306180	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
7	OR TEST CAPS WITH STEEL OR PLASTIC PIPE TO TEST TEE TEST CAP FOR CENTRAL PLASTIC ELECTROFUSION TAPPING TEE	9301110 OR TOOL ROOM ITEM	TOOL ROOM ITEM
8	BLIND FLANGE CLASS 150W ASTM A-106 2" FLAT FACE WITH 5/8" CENTER NPT TAP 3" FLAT FACE WITH 5/8" CENTER NPT TAP 4" FLAT FACE WITH 5/8" CENTER NPT TAP 6" FLAT FACE WITH 5/8" CENTER NPT TAP 8" FLAT FACE 12" FLAT FACE	9341434 9341414 9341415 9340462 9306674 9307751 9306675 9306574 9307750 9307750	2" NON STOCK 3" NON STOCK 4" NON STOCK 6" NON STOCK 8" NON STOCK 12" NON STOCK
9	GASKETS 3" FULL FACE 150W 4" FULL FACE 150W 6" FULL FACE 150W 8" FULL FACE 150W 12" BRIG TYPE 150W	9333167 2" 9341158 3" 9341159 4" 9332599 6" 9341168 8" 9341165 12"	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK

ITEM	DESCRIPTION	GRACLE ITEM ID LI/MA/INVC	PEOPLESOFT ITEM RI AND UNY
10	END CAPS - STEEL WELD END STANDARD WALL - GRADE B 2" 3" 4" 6" 8" 10" 12" 16" 20"	9312095 9308719 9312096 4" 9312096 4" 9312094 6" 9312093 8" 9315182 10" 9312092 12" 9314824 16" 9336697 20"	2" 9312095 3" 9308719 4" 9312096 4" 9312096 6" 9312094 8" 9312093 10" 9315182 12" 9312092 16" 9314824 20" 9336697
11	THOR FITTING 1/2" MALE NPT X HOSE CONNECTION 1/2" FEMALE X HOSE CONNECTION	0550489 05504301	NON STOCK NON STOCK
12	THRED-O-LET 12" - 6" X 1/2" 3000W PER ASTM A-105 GRADE B 10" - 6" X 1" 3000W PER ASTM A-105 GRADE B 8" - 12" X 1" 3000W PER ASTM A-105 GRADE B 6" - 12" X 1" 3000W PER ASTM A-105 GRADE B 10" - 6" X 1" 3000W PER ASTM A-105 GRADE B 8" - 12" X 1" 3000W PER ASTM A-105 GRADE B	9341652 12-6X3/4 9341656 10-8X1 9342552 36-12X1 9307695 2X1 9307695 10-6X1 9307677 36-MA	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
13	VALVE		TOOL ROOM ITEM
13A	VALVE (OPTIONAL - TO SHUT OFF TEST ASSEMBLY)		TOOL ROOM ITEM
14	LUG ASSEMBLY 7/8" X 24" LONG (LI ONLY - SEE MAIN-4210) 7/8" X 44" LONG (LI ONLY - SEE MAIN-4210) LUG GREEN 3" - 2" MAIN 7/8" DIAM. (INVC ONLY - SEE MAIN-4230 & MAIN-4230) LUG YELLOW 10" - 30" MAIN 1-1/8" DIAM. (INVC ONLY - SEE MAIN-4230 & MAIN-4230) ROD 1/2" X 12" LONG (INVC ONLY) ROD 1" X 12" LONG (INVC ONLY) LUG ASSEMBLY 1/2" X 30" LONG	9342211 9342212 9342212 9337904 9337904 9338152 9320150 9315741 9303661	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
15	TEST CAP FOR SADDLE FUSION TEE - CENTRAL PLASTICS FOR SADDLE FUSION TEE - IM EAGLE / POLY U/POHOR FOR SADDLE FUSION TEE - PERFORMANCE PIPE TEES FOR HVT (HIGH VOLUME TAPPING) TEE SADDLE FUSION CENTRAL PLASTICS FOR HVT (HIGH VOLUME TAPPING) TEE SADDLE FUSION - IM EAGLE / POLY U/POHOR FOR HVT (HIGH VOLUME TAPPING) TEE SADDLE FUSION PERFORMANCE PIPE TEES FOR HVT (HIGH VOLUME TAPPING) TEE SADDLE FUSION PERFORMANCE PIPE TEES FOR ELECTROFUSION TEE FOR PERFECTION HVT MECHANICAL TEE (CAP FITS ALL MAIN SIZE & OUTLET SIZES OF PMITS)	9325109 9325017 9341368 9306298 9304174 9322175 9306944 9301846 9303661	NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK NON STOCK
16	COUPLING - END 2" PERFECTION	9306180	NON STOCK

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Effective Date: 7/15/2013

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4/12/2023

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BOSTON GAS COMPANY
d/b/a

nationalgrid

170 DATA DRIVE
WALTHAM, MA 02451

FINAL

NO. DESCRIPTION DATE DR.BY CK.BY APP.BY

PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

PAGE 13 OF 17

NATIONAL GRID STANDARD
CONSTRUCTION DETAILS

DWG SIZE: 22"x34"
DESIGNER: A.ROSA
ENGINEER: M.THOMPSON
DATE: 10/09/2024
ASSET I.D.: BG-025.0.0
W.O. NO.: 1588874 & 90000243965

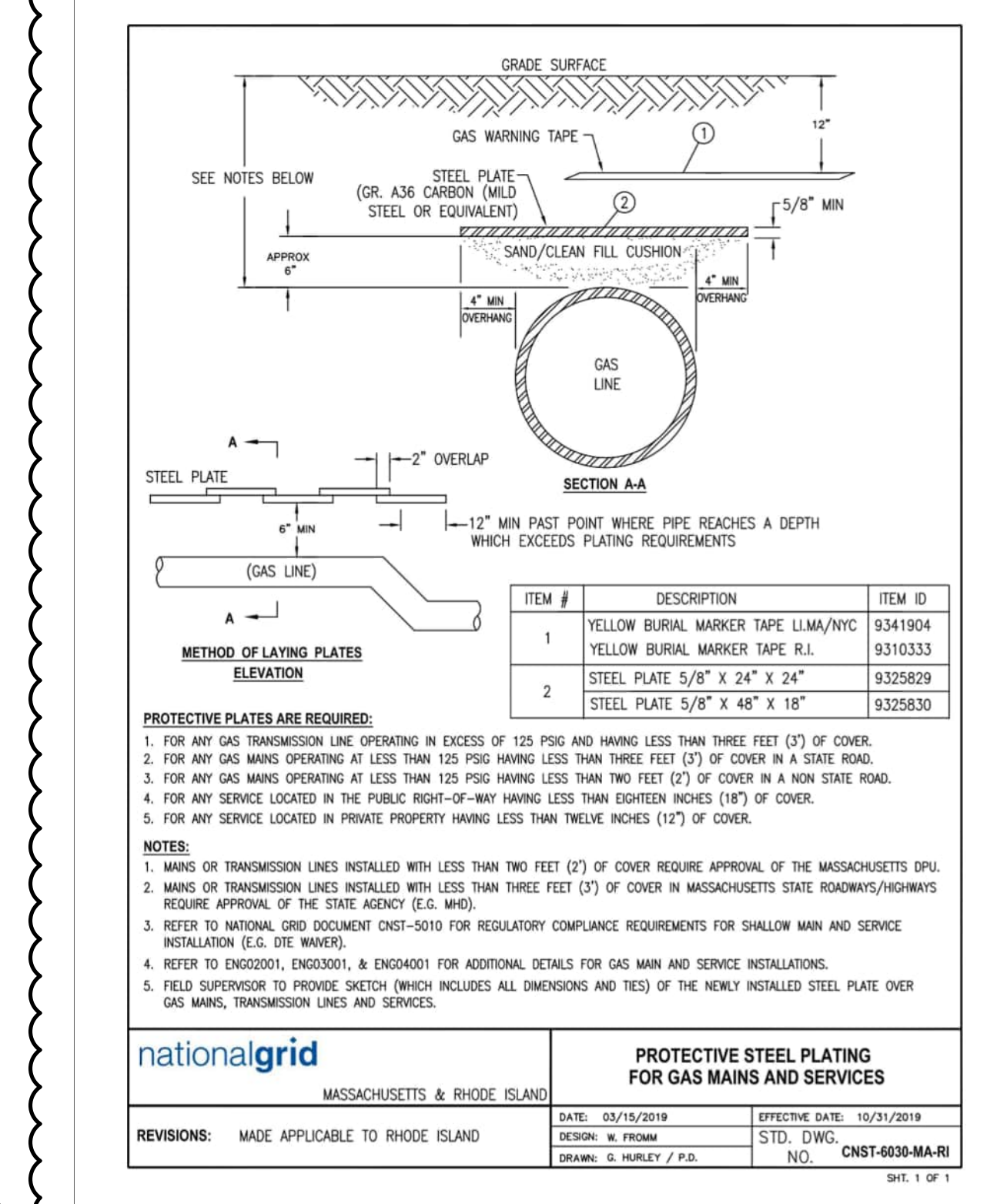
DRAWING NO. SHEET NO.
DPL-AYE-076933-1067 C-301

MADE APPLICABLE TO RHODE ISLAND

DATE: 03/15/2019
DESIGN: H. FROMM
DRAWING: G. HARLEY / P.D.

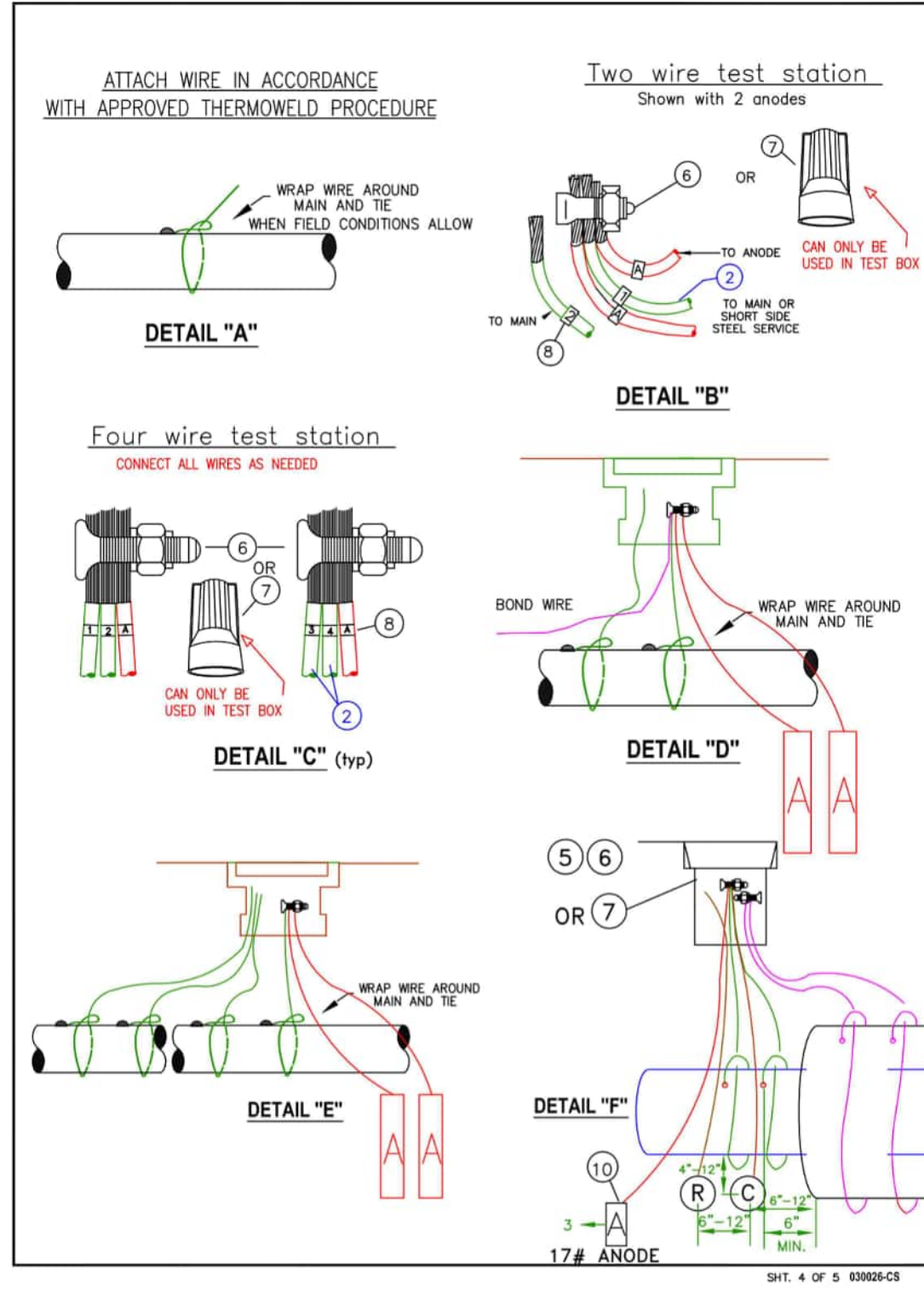
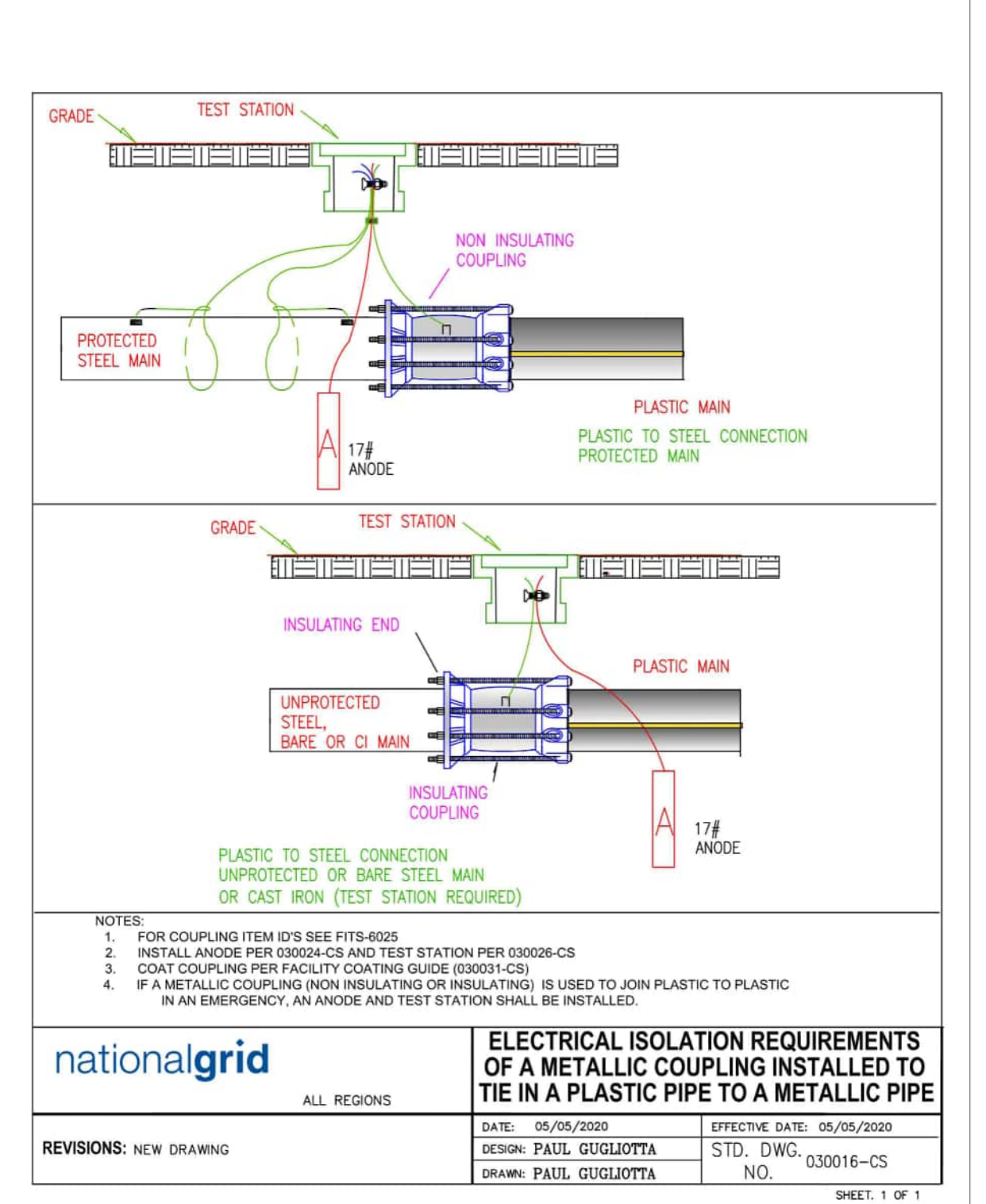
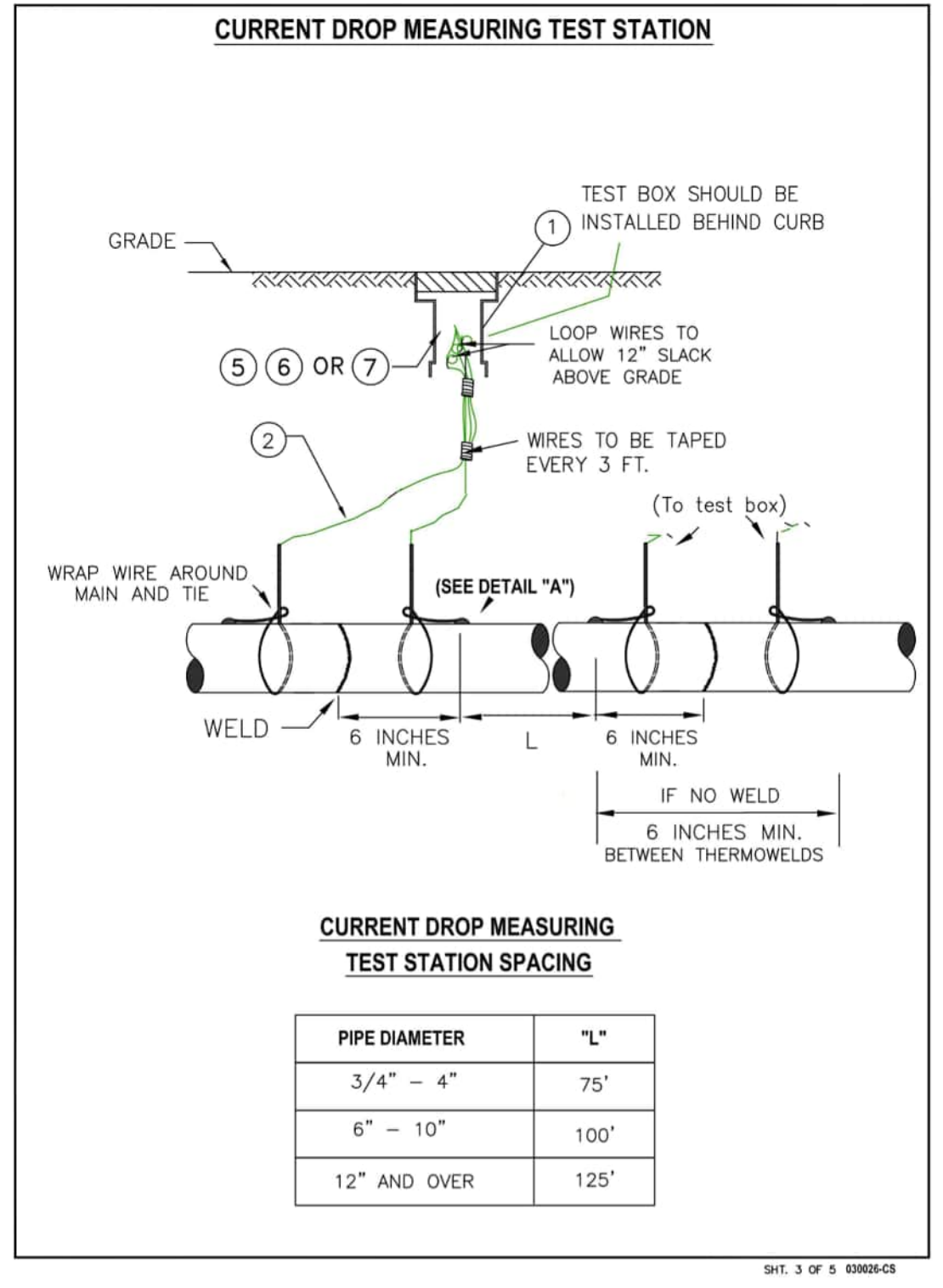
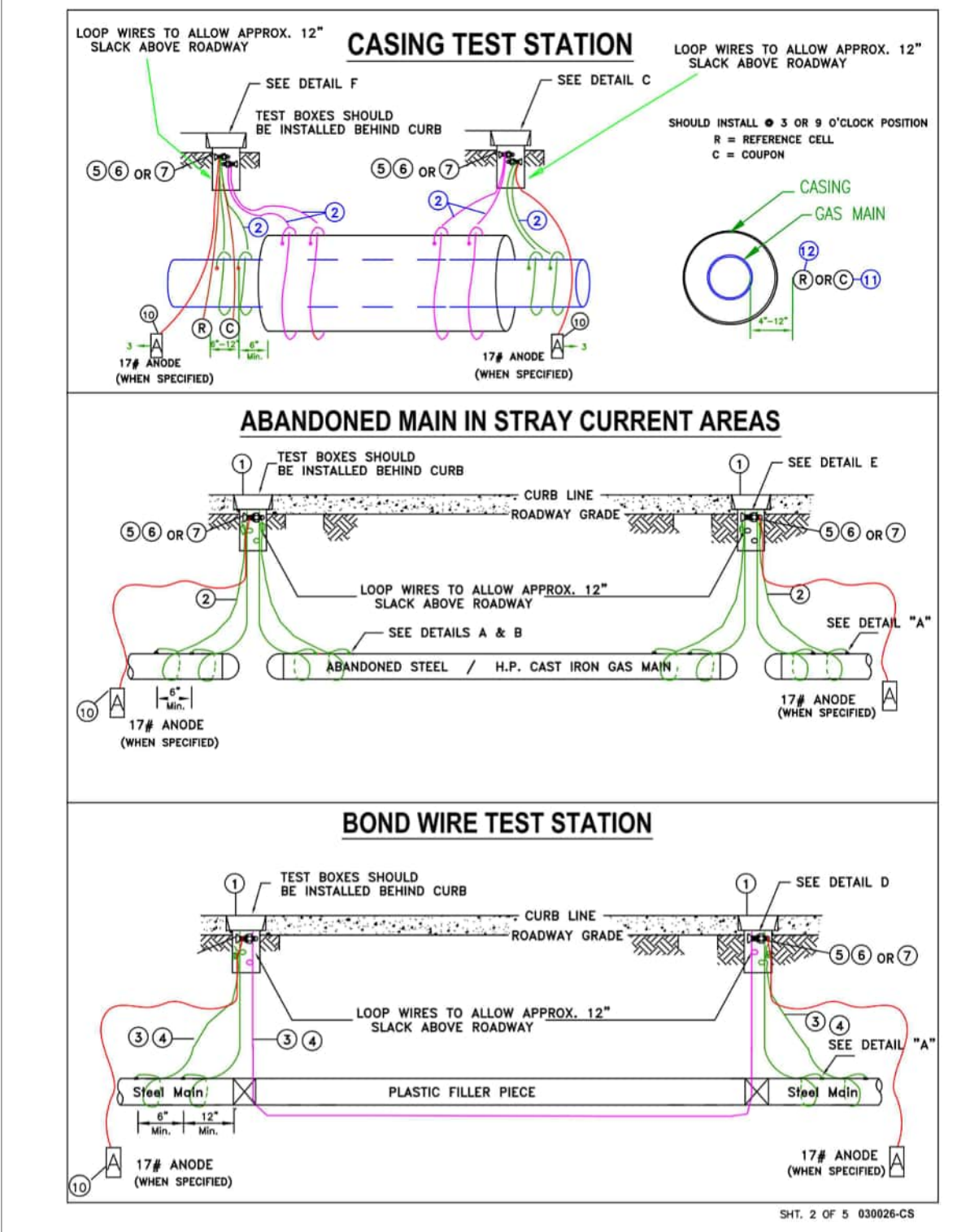
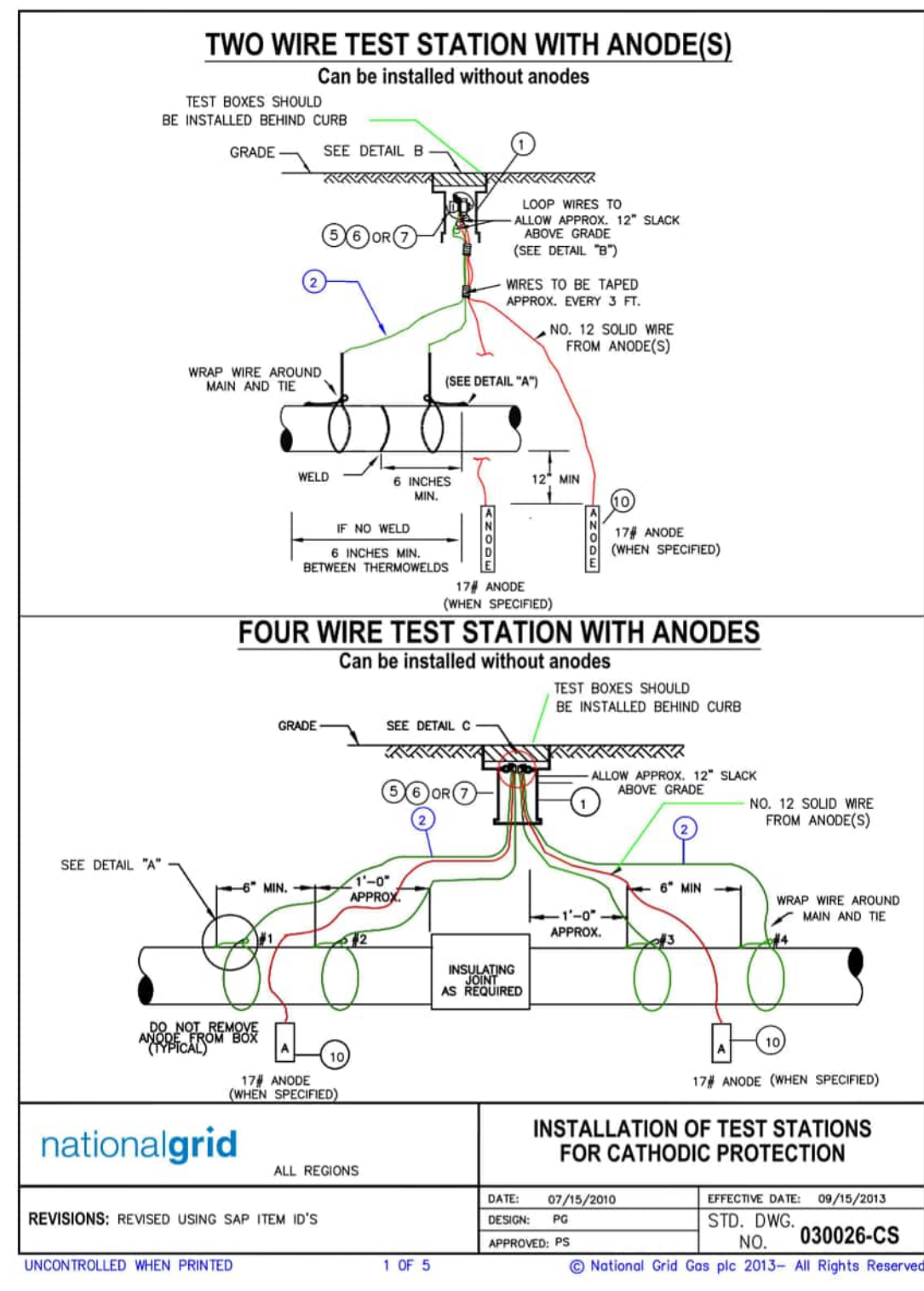
EFFECTIVE DATE: 10/31/2019
STD. DWG. NO. CNST-6030-MA-RI

SHT. 1 OF 1



ITEM #	DESCRIPTION	ITEM ID
1	YELLOW BURIAL MARKER TAPE L/M/ANY/INVC	9341904
1	YELLOW BURIAL MARKER TAPE R.L.	9310333
2	STEEL PLATE 5/8" X 24" X 24"	9325829
2	STEEL PLATE 5/8" X 48" X 18"	9325830

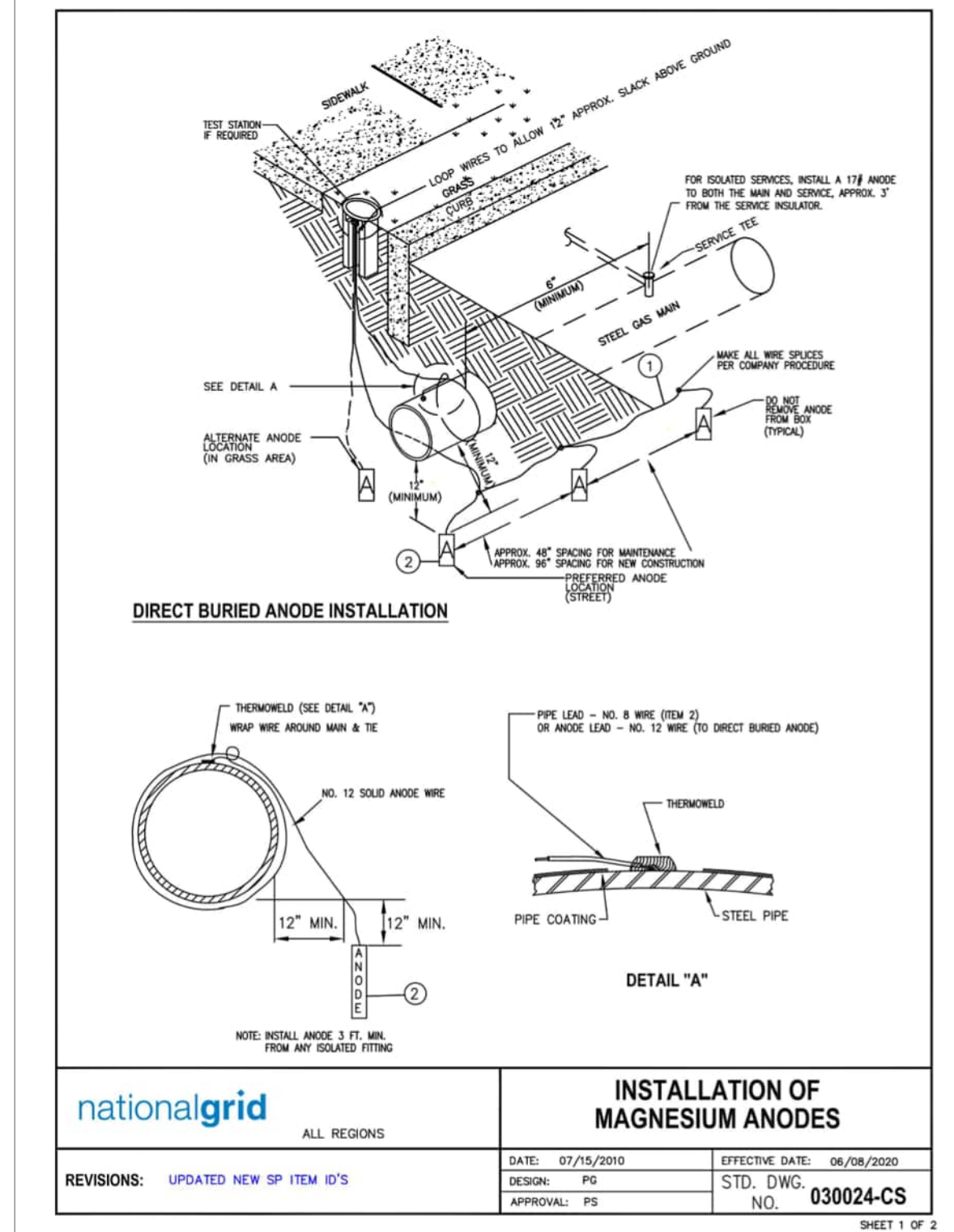
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 Saved: 11/7/2024 4:33:34 PM Plotted: 11/7/2024 8:18:50 AM Current User: Perkins, Peter Last Saved By: 6236



MATERIAL LIST

Description	Down State SAP Item ID	Upstate SAP Item ID	New England SAP Item ID	Rhode Island SAP Item ID	MATERIAL NOTES
1 TEST BOX WITH COVER	9339992	9312291	9339992	9312099	NON LOCKING COVER. DISCARD FOOT PIECE.
TEST BOX 9" SQUARE HEAVY DUTY	9339991	9312291	9339991	9312099	WEIGHS 95 LBS. STREET USE, WITHOUT COVER
COVER FOR 9" SQUARE BOX	9339797	9339797	9339797	9331208	NON-LOCKING COVER
2 WIRE, NO. 8, 7 STRAND	9307539	9307539	9307539	9307539	TEST WIRE ONLY, NOT FOR GROUND BEDS. UPSTATE AND RI WIRE HAS 19 STRANDS.
3 WIRE, NO. 6, 7 STRAND	9311795	9311795	9311795	9311795	BOND WIRE ONLY, NOT FOR GROUND BEDS.
4 WIRE 10 - 19 STRAND 600 V - 1/IC	9334171	NON STOCK	9334171	NON STOCK	USE IN STRAY CURRENT AREAS
5 TAPE, PVC - 1/2" WIDE	9334056	9316070	9334056	9316070	NOT FOR PIPE COATING.
6 CONNECTOR, SPLIT BOLT, TYPE 6	9331578	9316630	9331578	NON STOCK	USE WITH NO. 6 CABLE
7 CONNECTOR, SPLIT BOLT, TYPE 1/01	9331612	9331612	9331612	9331612	USE WITH 1/0 CABLE
8 CONNECTOR, TWIST-ON WIRE NUT	9330683	9314631	9330683	9314631	USE WITH 1/0 CABLE
9 TAG, ADHESIVE NUMBER 1	9307918	9307918	9307918	9307918	LABEL WITH #1 (N) OR (E), CONSECUTIVELY TO (S) OR (W)
NUMBER 2	9307896	9307896	9307896	9307896	SEE DETAILS "B" AND "C"
NUMBER 3	9307895	9307895	9307895	9307895	SEE DETAILS "B" AND "C"
NUMBER 4	9307894	9307894	9307894	9307894	SEE DETAILS "B" AND "C"
LETTER A	9307893	9307893	9307893	9307893	USE TO LABEL ANODES
10 GROUNDING CELL	NON STOCK	9315642	NON STOCK	NON STOCK	CORROSION ENGINEERING AS SPECIFIED BY
ANODE, MAGNESIUM 17LBS	9311183	9311183	9311183	9311183	SATURATE WITH WATER BEFORE BACKFILL. ANODE MAY BE INSTALLED VERTICALLY OR HORIZONTALLY.
11 COUPON	9386100	By Corrosion	9386100	By Corrosion	MC MILLER OR EQUAL
12 REFERENCE CELL	9385758	By Corrosion	9385758	By Corrosion	BORIN MFRGR INC OR EQUAL

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MATERIAL LIST

Description	Down State NY Item ID	Upstate NY Item ID	New England Item ID	Rhode Island Item ID	MATERIAL NOTES
1 CABLE NO. 8 - 1/IC	9334425	9311214	9334425	9311214	Upstate and RI cable has 19 strands
2 ANODE, MAGNESIUM 17 LB	9311183	9311183	9311183	9311183	
3 ANODE, MAGNESIUM 3 LB	9315645	9315645	9315645	9315645	Use on Tracer wire and all isolated fittings.
4 ANODE, MAGNESIUM SPIKE 3 LB	9308624	9308624	9308624	9308624	Use on Service Risers ONLY
5 CLAMP, GROUNDING 1/2IN - 1IN DIA.	9386544	9386544	9386544	9386544	Grounding clamp for attaching spike anode lead wire to service riser.
6 CLAMP, GROUNDING 1-1/4IN - 2IN DIA.	9386559	9386559	9386559	9386559	Grounding clamp for attaching spike anode lead wire to service riser.

* Spike Anode Ground Clamp

REVISIONS:	DATE:	DESIGN:	APPROVAL:	STANDARD:	DATE:	NO.
NEW DRAWING	07/15/2010	PG	PS	DWG.	08/08/2020	030024-CS

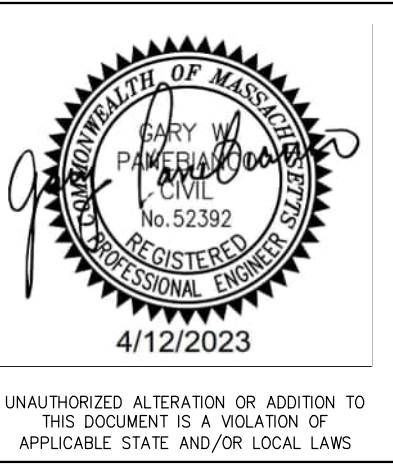
INSTALLATION OF MAGNESIUM ANODES

ALL REGIONS

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NO.	DESCRIPTION	DATE	DR. BY	CK. BY	APP. BY

BOSTON GAS COMPANY
d/b/a
nationalgrid
170 DATA DRIVE
WALTHAM, MA 02451

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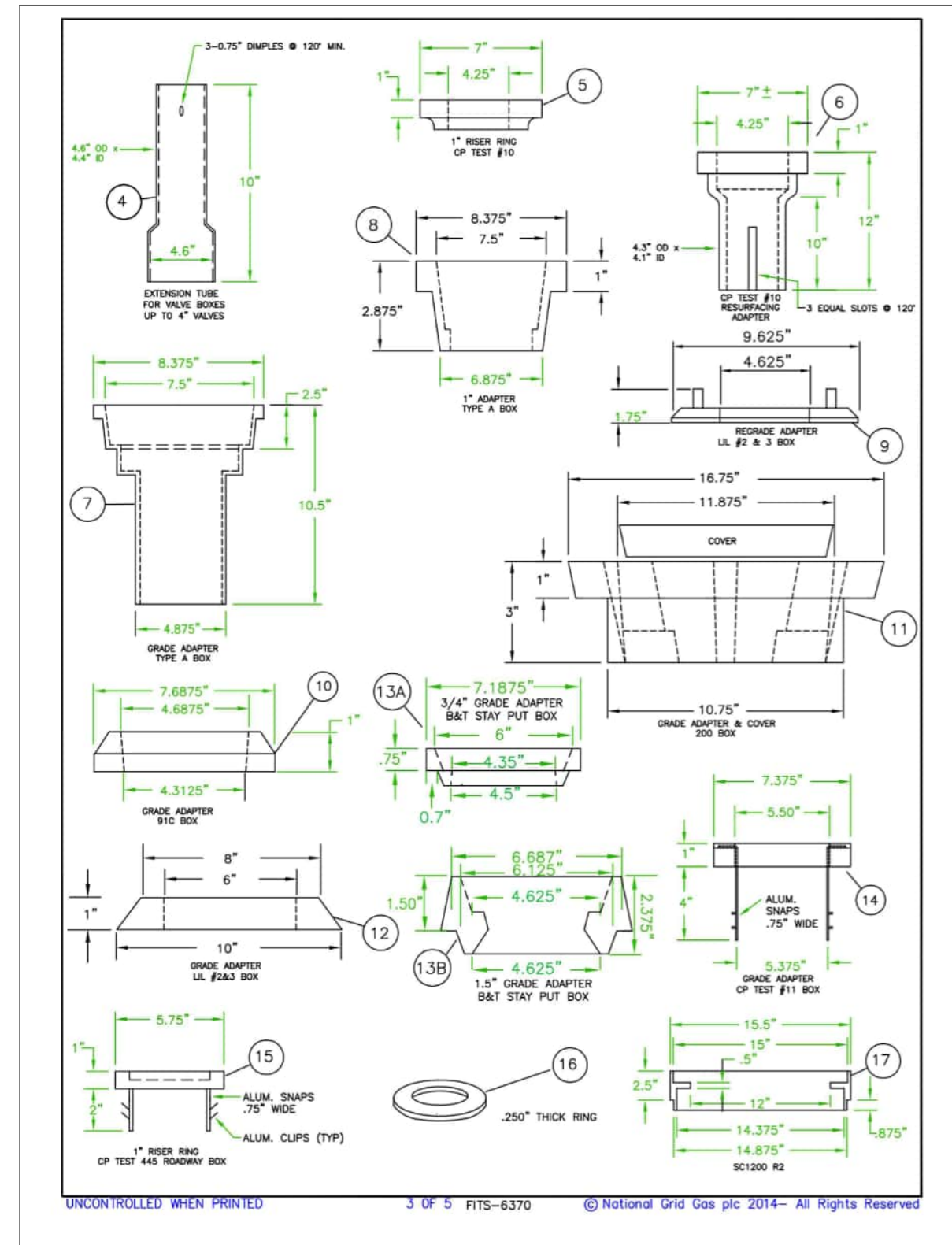
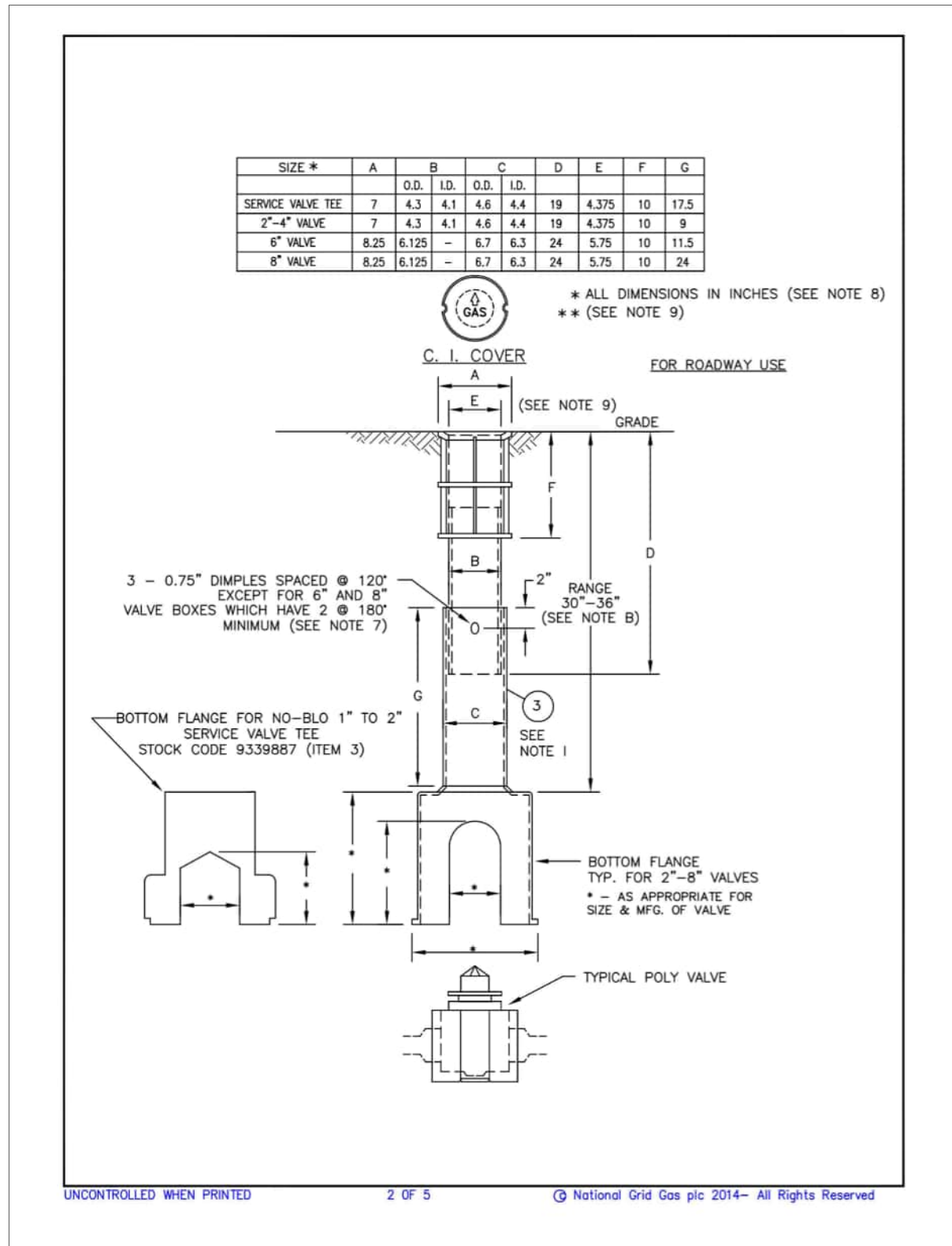
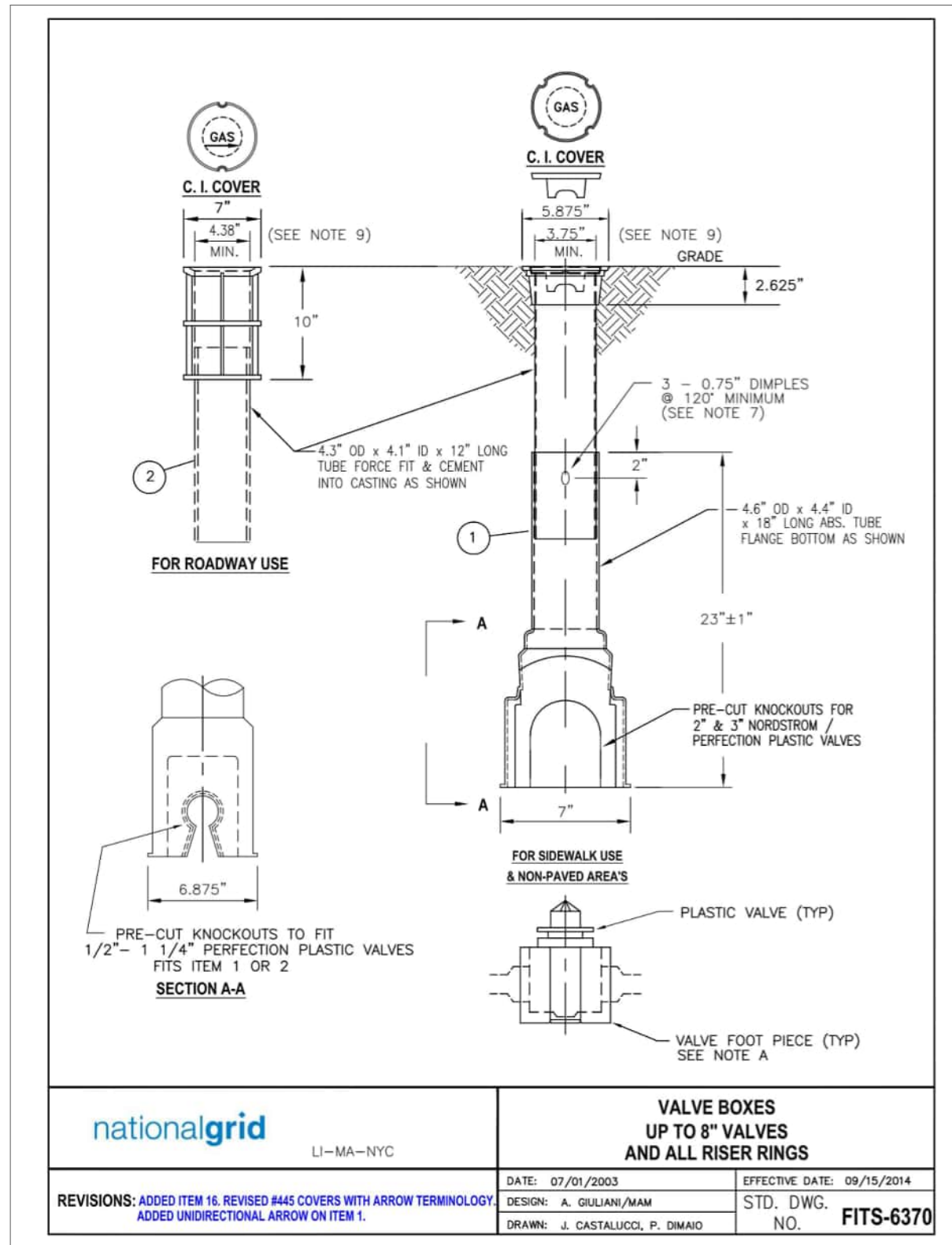
PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

NATIONAL GRID STANDARD CONSTRUCTION DETAILS

DWG SIZE	DESIGNER	ENGINEER	DATE:	ASSET I.D.	W.O. NO.:
22"x34"	A. ROSA	M. THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243965

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DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	C-302



INSTALLATION NOTES:

- VALVE FOOT PIECE TO BE INSTALLED AROUND THE VALVE THEN INSERTED INTO THE BOTTOM FLANGE OF THE VALVE BOX.
- THE RANGE OF THE VALVE BOX FROM TOP OF GRADE TO TOP OF VALVE, IS 24" TO 36". FOR DEEPER VALVES USE EXTENSION TUBE STOCK CODE 9339823.
- THESE BOXES CAN ALSO BE USED WITH THE APPROPRIATE SIZE STEEL VALVE. IF USED WITH A STEEL VALVE THE VALVE FOOT PIECE IS NOT TO BE USED, HOWEVER, PRIOR TO BACKFILLING INSTALL THE LOWER PORTION OF THE VALVE KEY ON THE VALVE OPERATING RIT THEN PLACE THE LOWER SECTION OF THE BOX ON THE VALVE. WHEN THE BOTTOM SECTION IS BACKFILLED TO WITHDRAW FROM ITS TOP REMOVE THE VALVE KEY & INSTALL THE TOP SECTION OF THE BOX.
- ITEM 2 SHALL ONLY BE USED IN SIDEWALK AND NON-PAVED, NON TRAFFIC AREA EXCEPT DRIVEWAYS.
- USE ITEM 1 ON MAIN LINE VALVES INSTALLED IN PAVED AND NON-PAVED AREAS.
- AFTER INSTALLATION OF MAIN LINE VALVE & BOX NOTIFY GSO OF COMPLETION.

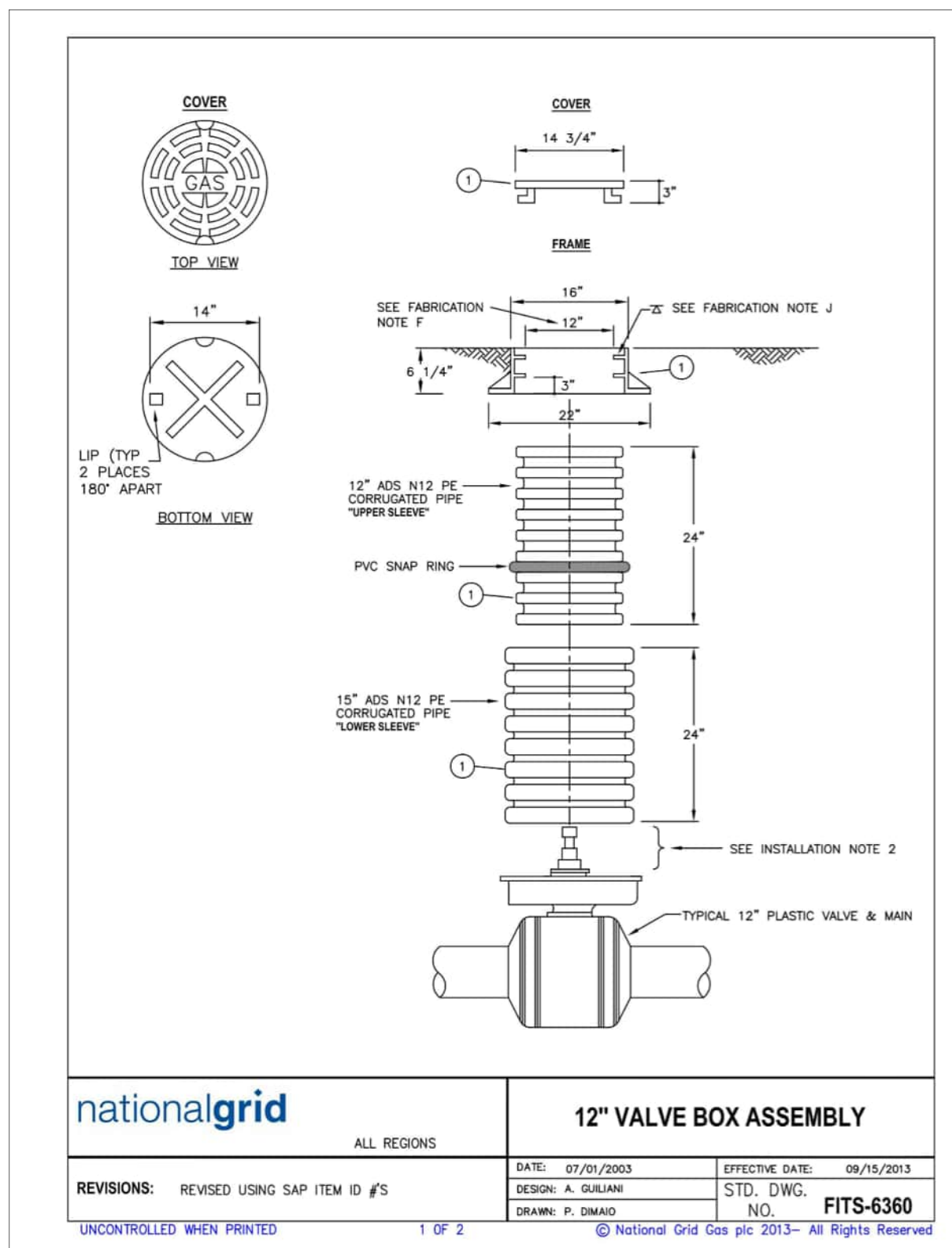
MANUFACTURING NOTES:

- ALL TOPS & BOTTOMS SHALL BE INTERCHANGEABLE.
- THE TOP OF THE BOX ASSEMBLY SHALL BE FABRICATED SO AS TO FIT INSIDE THE BOTTOM SECTION.
- MATERIAL SHALL CONFORM TO ASTM SPECIFICATIONS FOR GREY CAST IRON CASTINGS, DESIGNATED A8, CLASS 25.
- COVER SHALL CREATE A TIGHT FIT WITH TOP OF CASTING TO PREVENT RATTLING. FOR CODES 0030854 & 0030855 COVER SHALL BE OF VENTED DESIGN. FOR OTHER STOCK CODES THE COVER SHALL INCLUDE A DIRECTIONAL ARROW. THIS SHALL BE DESIGNED TO ALLOW THE ARROW TO BE POSITIONED AT 60 INTERVALS.
- ALL SURFACES SHALL BE COVERED WITH ONE COAT OF FLINTKOTE HYDRAI PROTECTIVE COATING, C-13-E OR APPROVED EQUAL.
- THE PLASTIC USED FOR THE TUBES SHALL BE PROTECTED FROM UV RAYS AND AVOID HAVE THE PROPER INHIBITORS TO PROTECT FROM BRITTLENESS AT ZERO DEGREES.
- DIMPLES SHALL BE FORMED SO AS TO EXERT ENOUGH PRESSURE ON INNER TUBE TO SUPPORT ENTIRE ASSEMBLY IN EXTENDED POSITION.
- DIMENSIONAL TOLERANCES: MANUFACTURE SHALL ADHERE TO THE FOLLOWING DIMENSIONAL TOLERANCES ALL PLASTIC TUBING SHALL BE $\pm .015"$ TO THOSE SHOWN ON THE DRAWING. ALL CASTINGS SHALL BE MANUFACTURED TO WITHIN $\pm 0.0625"$ TO THE DIMENSIONS SHOWN ON THE DRAWING.
- DIMENSIONS SHALL BE CONSISTENT THROUGHOUT THE CASTING.
- TOP SECTION OF VALVE BOX SHALL HAVE THE PLASTIC TUBE FORCED FIT AND CEMENTED INTO THE CASTING. THIS JOINT SHALL BE CAPABLE OF WITHSTANDING A PULL OUT FORCE OF 200 LBS.
- MANUFACTURER SHALL SUBMIT SAMPLES TO THE ENGINEER FOR APPROVAL PRIOR TO BID ACCEPTANCE.
- STREET BOXES SHALL BE DESIGNED TO HANDLE TO AN H-20 ROADWAY LOADING.
- TOP FLANGE OF ROADWAY BOX SHALL BE FLAT AND WIDE ENOUGH TO ACCOMMODATE A 3/8" METAL NUMBER STAMP EMBEDDED INTO THE CASTING BY CRD IN THE FIELD.
- THE VALVE FOOT PIECE SHALL BE DESIGNED TO FIT THE FOLLOWING MANUFACTURER'S VALVES:
 1/2" - 1 1/4" PERFECTION
 2" - NORDSTROM OR PERFECTION UNIVERSAL FOOT PC FOR BOTH MFG.
 4" - NORDSTROM

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NO.	ITEM	N.G. CODE NO.
18	PENTAGON KEY FOR ITEMS 8B AND 11B (NOT SHOWN)	9354644
17	2" REGRADE ADAPTER FOR 12" LOCKING BOX SC1200 R2	9384175
16	VALVE BOX ADAPTER RING, 1/4" THICK X 7/8" HIGH I.D. X 10-12 IN O.D. FLAT RING TO RAISE OLD LEGACY OBSOLETE LULU ROUND CASTINGS	9353359
15	ONE INCH GRADE ADAPTER & COVER FOR CP TEST #445 ROADWAY BOX - 18H ONLY	9339913
	REPLACEMENT COVER FOR 1/2" VALVE BOX - LI ONLY	9339829
	COVER MARKED "GAS" FOR 445 BOX (WITH UNIDIRECTIONAL ARROW)	9339828
	COVER MARKED "GAS" FOR 4" STAY PUT BOX - NYC ONLY	9339759
	COVER MARKED "GAS" FOR #11B BOX	9339858
	COVER MARKED "GAS" FOR #10 BOX RESURFACE REPAIR SLEEVE RING	9339762
14	1" REGRADE ADAPTER WITH COVER FOR CP TEST # 11B BOX - SEE NOTE B	9382011
13A	1/2" REGRADE ADAPTER FOR 8" B&T STAY PUT SERVICE BOX WITH SLOTS NYC ONLY	9339850
13B	1/2" REGRADE ADAPTER FOR 8" B&T STAY PUT SERVICE BOX WITH SLOTS NYC ONLY	9339775
12	1" REGRADE ADAPTER FRAME FOR THE LULU 2 & 3 VALVE BOX.	9339859
*	COVER FOR ABOVE (NOT SHOWN) - LI ONLY	9339860
11B	COVER, REPLACEMENT, LOCKING, MARKED "GAS" FOR EXISTING LOCK TYPE 200 BOX, WITH PENTHEAD BOLT - LI ONLY (NOT SHOWN)	9384338
11A	COVER, REPLACEMENT, NON-LOCK, MARKED "GAS" FOR EXISTING NON-LOCK TYPE 200 BOX - LI ONLY (NOT SHOWN)	9339798
11	1" REGRADE ADAPTER FRAME FOR 200 VALVE BOX - LI ONLY	9339826
*	2-1/2" REGRADE ADAPTER FOR 200 VALVE BOX. FITS EXISTING COVER. (NOT SHOWN) - LI ONLY	9339799
10	1" REGRADE ADAPTER & COVER FOR 91C BOX - LI ONLY	9339781
9	1 1/2" REGRADE ADAPTER FOR LULU 2 & 3 BOX - LI ONLY	9339758
8B	COVER, REPLACEMENT, LOCKING, MARKED "GAS" FOR 7-1/2" EXISTING TYPE "A" LOCK VALVE BOXES, WITH PENTHEAD BOLT - LI ONLY (NOT SHOWN)	9339760
8A	COVER, REPLACEMENT, MARKED "GAS" FOR 7-1/2" EXISTING TYPE "A" NON-LOCK VALVE BOXES AND ALL TYPE "A" ADAPTER BOXES - LI ONLY (NOT SHOWN)	9384430
8	1" REGRADE ADAPTER FOR TYPE "A" VALVE BOX, FITS EXISTING COVER - LI ONLY	9339827
7	2-1/2" REGRADE ADAPTER FOR TYPE "A" VALVE BOX 2-1/2 IN MIN TO 8 IN MAX RISE. FITS EXISTING COVER - LI ONLY	9339763
6	1" REGRADE ADAPTER RING EXTENSION WITH 10" PLASTIC SKIRT TO REPAIR TOPS OF CP TEST #10 BOX	9381407
5	1" REGRADE ADAPTER FOR CP TEST #10 BOX	9339823
4	EXTENSION TUBE - FOR CP TEST #11 BOX	9382019
	EXTENSION TUBE - FOR CP TEST #10 BOX	9339824
*	EXTENSION TUBE, FOR CP TEST #608 BOX, 16" LONG - (NOT SHOWN) - HE ONLY	9383199
	EXTENSION TUBE, FOR CP TEST #334 BOX, 24" LONG - (NOT SHOWN) - HE ONLY	9383198
	ROADWAY BOX ASSEMBLY AND COVER FOR 8" POLY VALVE CP TEST #11B OR APPVD EQUAL	9339893
	ROADWAY BOX ASSEMBLY AND COVER FOR 6" POLY VALVE CP TEST #11B OR APPVD EQUAL	9339892
3	ROADWAY BOX ASSEMBLY AND COVER FOR 4" POLY VALVE CP TEST #10 OR APPVD EQUAL	9339891
	ROADWAY BOX ASSEMBLY AND COVER FOR 2" AND 3" POLY VALVES CP TEST #10 OR APPVD EQUAL	9339890
	ROADWAY BOX ASSEMBLY AND COVER FOR 1.2" MUELLER SERVICE VALVE TEE CP TEST #10 OR APPVD EQUAL	9339887
2	ROADWAY SERVICE BOX AND COVER FOR 1/2" TO 1" PLASTIC VALVE-HE ONLY CP TEST #10 OR APPVD EQUAL	9382767
1	SIDEWALK VALVE BOX ASSEMBLY AND UNIDIRECTIONAL ARROW COVER FOR 1/2" TO 1 1/2" PLASTIC VALVES CP TEST #445 OR APPVD EQUAL	9339888
	SIDEWALK VALVE BOX ASSEMBLY AND UNIDIRECTIONAL ARROW COVER FOR 2" TO 3" PLASTIC VALVES CP TEST #445 OR APPROVED EQUAL	9339889

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FABRICATION NOTES:

- MATERIAL FOR AND COVER SHALL CONFORM TO ASTM SPECIFICATIONS FOR GREY CAST IRON CASTINGS, DESIGNATED A8, CLASS 25.
- ALL CASTING SURFACES SHALL BE COVERED WITH ONE COAT OF FLINTKOTE HYDRAI PROTECTIVE COATING, C-13-E OR APPROVED EQUAL.
- DIMENSION SHOWN ARE OF A GENERAL NATURE, MANUFACTURER SHALL SUPPLY DETAIL SHOP SUPPLY DETAIL DRAWINGS WITH BID.
- CASTING & ENTIRE SYSTEM SHALL BE DESIGNED TO WITHSTAND H-20 ROADWAY LOADING.
- PIPE USED FOR SLEEVES SHALL BE HIGH DENSITY POLYETHYLENE ADS 11-12 CORRUGATED PIPE.
- THE INSIDE DIMENSION OF THE FRAME SHALL BE A MINIMUM OF A CLEAR 12".
- THE COVER SHALL BE FABRICATED TO ENSURE EASE OF REMOVAL IN TO & OUT OF THE CASTING AND SHALL CONTAIN LIPS AT 180 DEGREES APART TO ACT AS A LOCKING DEVICE.
- THE FRAME SHALL HAVE A RAISED MARK THAT IS CAST INTO THE FRAME TO INDICATE ALIGNMENT OF THE LIPS ON THE COVER WITH THE SLOTS ON THE FRAME. THE WORD "GAS" ON THE COVER SHALL ALIGN WITH THIS MARK ON THE FRAME.
- PACKAGING: THE COVER, FRAME & BOTH SLEEVES SHALL BE SHIPPED AS A UNIT TOTALLY SECURED TO ENSURE NO SEPARATION OF ANY OF THE PARTS PRIOR TO INSTALLATION.
- THIS IS THE RESTING FACE AND SHOULD BE SMOOTH.

INSTALLATION INSTRUCTIONS:

- MEASURE AND CUT THE BOTTOM SLEEVES TO THE APPROPRIATE LENGTH REQUIRED, BASED ON THE DEPTH OF THE MAIN.
- INSTALL THE LOWER SECTION SO AS TO CENTER IT OVER THE VALVE OPERATOR, RESTING IT ON THE GEAR OPERATOR. IF INSTALLED OVER A DRP STANDPIPE OR GAGE LINE, POSITION IT TO ALLOW FOR EASY ACCESS TO THE BLOW DOWN VALVE BACKFILL & PROPERLY COMPACT.
- CUT THE UPPER SLEEVE TO THE APPROPRIATE LENGTH ALLOWING FOR A MINIMUM OF 4" TO A MAXIMUM OF 6" TO PROTRUDE INTO THE LOWER SLEEVE.
- INSTALL THE UPPER SLEEVE INTO THE BOTTOM SLEEVE & SECURE IT INTO POSITION USING THE PVC SNAP RING SUPPLIED ON THE UPPER SLEEVE. THIS IS ACCOMPLISHED BY MOVING THE RING TO A POINT WHERE IT RESTS ON THE TOP OF THE LOWER SLEEVE.
- SET THE CASTING ONTO THE UPPER SLEEVE ENSURING IT IS LEVEL WITH THE EXISTING GRADE. COMPLETE THE BACKFILL AND COMPACTION TO THE APPROPRIATE DEPTH DEPENDING ON THE TYPE OF PAVING TO BE PERFORMED.
- COVER INSTALLATION: ALIGN THE LIPS ON THE UNDERSIDE OF THE COVER WITH THE SLOTS IN THE FRAME AND DROP THE COVER IN PLACE. TURN AND ALIGN THE RECESSED SLOTS IN THE TOP OF THE COVER AT 90 DEGREES. THIS IS THE LOCKING FEATURE ON THE COVER.
- TO REMOVE THE COVER ALIGN THE WORD "GAS" WITH THE RAISED KNOB ON THE FRAME. THEN USE AN APPROPRIATE LIFTING BAR TO REMOVE THE COVER.

NOTE: THIS UNIT IS PURCHASED AS A COMPLETE ASSEMBLY WITH ALL PARTS AS SHOWN ON THE ATTACHED DRAWING.

NO.	ITEM	ORACLE ITEM ID LI / NYC / MASS / NH	PEOPLESOFT ITEM ID RICKLE ISLAND UPSTATE NEW YORK
1	12" VALVE BOX, COMPLETE, WITH LOCKING COVER	9382026	9307586

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BOSTON GAS COMPANY
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nationalgrid

170 DATA DRIVE
 WALTHAM, MA 02451

FINAL

PROPOSED GAS MAIN REPLACEMENT
 92-108 WEST MAIN STREET
 AYER, MA

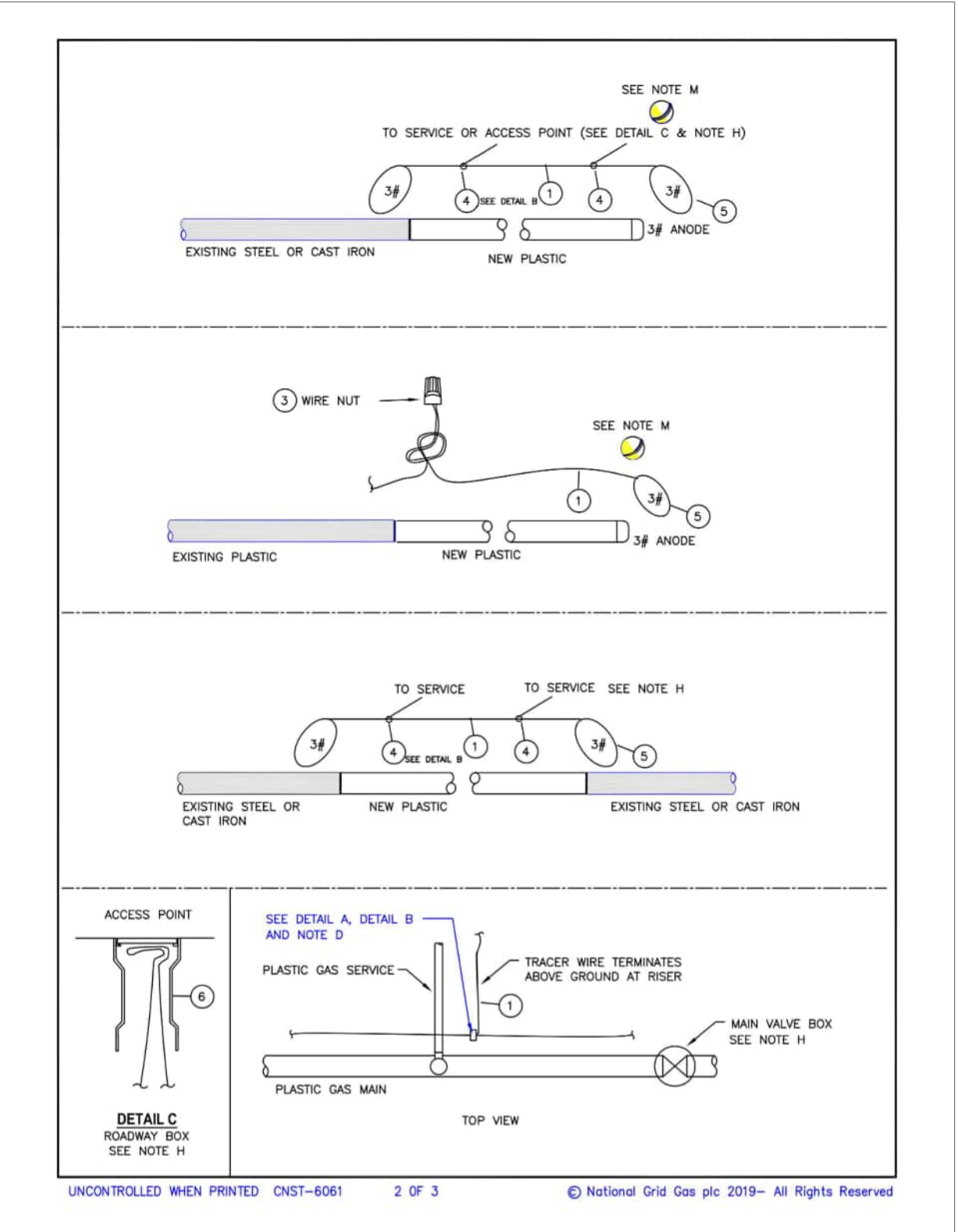
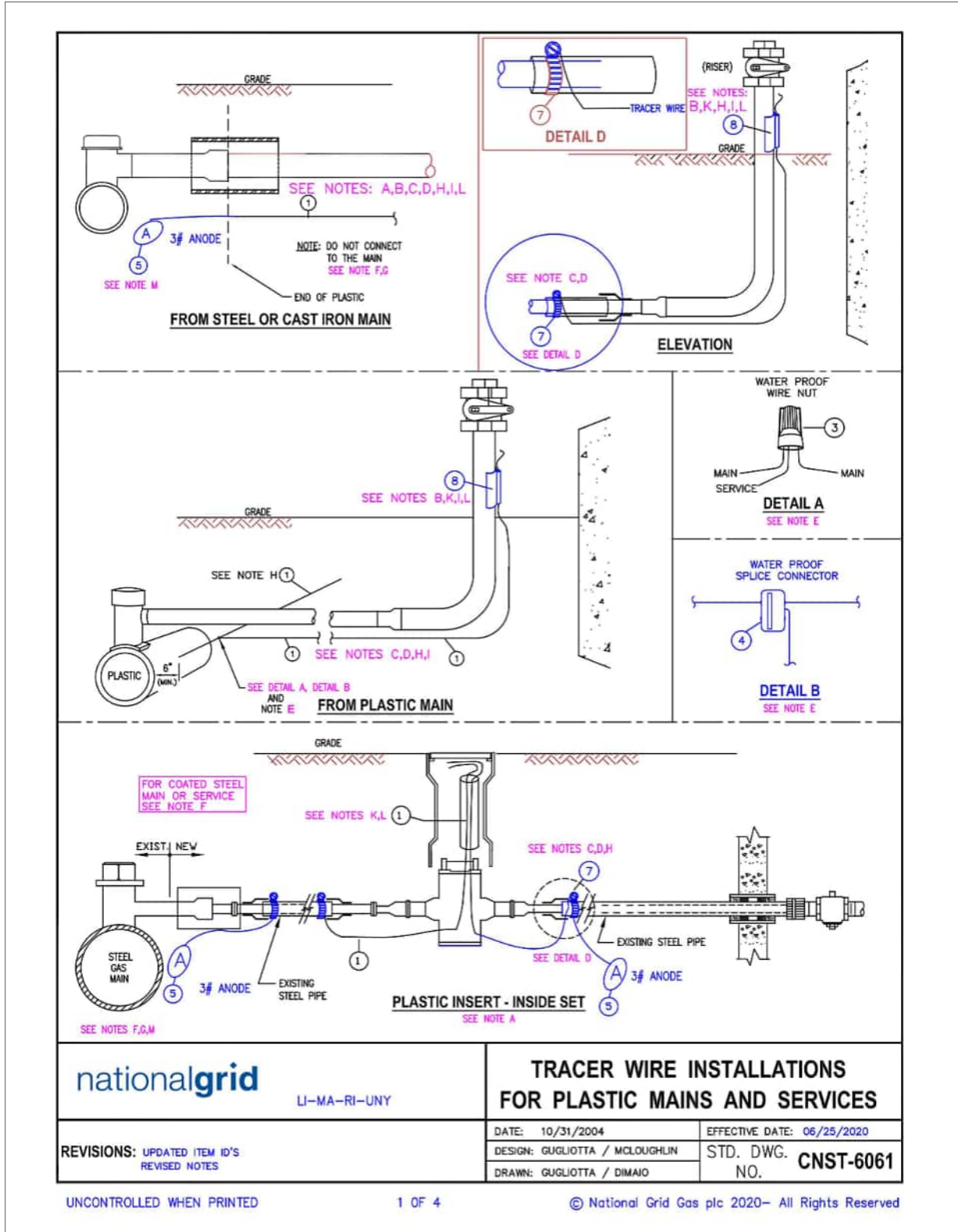
**NATIONAL GRID STANDARD
 CONSTRUCTION DETAILS**

DWG SIZE	DESIGNER	ENGINEER	DATE:	ASSET I.D.	W.O. NO.:
22"x34"	A. ROSA	M. THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243965

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DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	C-303

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NO.	ITEM	SAP ITEM ID
8	TRACER WIRE SNAP, 2" (represents steel size)	9386134
8	TRACER WIRE SNAP, 1 1/2" (represents steel size)	9386156
8	TRACER WIRE SNAP, 1" (represents steel size)	9386150
8	TRACER WIRE SNAP, 3/4" (represents steel size)	9385568
7	CLAMP, STAINLESS	9331708
6	VALVE BOX, ROADWAY	9338990
5	ANODE, 3 LB MAGNESIUM	9315645
4	WIRE SPLICE CONNECTOR, WATERPROOF	9386038
3	WIRE NUT, PLASTIC, WATERPROOF	9321644
2	WIRE, DIRECTIONAL DRILL, STAINLESS, STRANDED 10 AWG	9314187
1	TRACER WIRE, DIRECT BURY, COPPER, 12 AWG	9315005

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A. Inside sets: Terminate tracer wire in the curb valve box. Allow enough wire to extend 18" to 24" above grade.

B. Outside Sets: Tracer wire should be extended approximately 18" above grade at riser. Connect tracer wire to the riser using a "tracer snap", Item #8. If the appropriate tracer snap is not available, wrap or tie the tracer wire to the riser. Do not permanently attach tracer wire to the riser. Tracer wire should not exceed 6" above the point where it is secured to the riser.

C. Partially tubed services: When the abandoned portion of an existing steel service pipe is used as a sleeve for the new plastic, all cut out sections of the steel pipe to be inserted with plastic, shall be connected using a section of tracer wire to maintain continuity. If the existing service is coated steel, see [Installation of Test Stations for Cathodic Protection \[030026-CS\]](#) and [Installation of Test Stations for Cathodic Protection \[COR04003\]](#) or contact corrosion department for more guidance.

D. Thermite welding of tracer wire to abandoned steel service is only acceptable prior to insertion of the plastic tubing. See [Installation of Test Stations for Cathodic Protection \[030026-CS\]](#).

E. Plastic Mains: The service tracer wire shall be connected to the plastic main tracer wire using Item #3 detail A or item #4 (detail B - preferred) in accordance with [Installing Wire Connections \[COR04004\]](#).

F. Coated Steel Mains: Do not connect the tracer wire to the steel main. See [Installation of Test Stations for Cathodic Protection \[030026-CS\]](#) and [Installation of Test Stations for Cathodic Protection \[COR04003\]](#) or contact corrosion department for more guidance.

G. Cast Iron or Bare Steel Mains: Do not connect the tracer wire to the main. It is required in LI and MA, and suggested in all other areas to terminate the tracing wire with a 3# anode.

Tracer Wire Installation Notes

H. Install tracer wire in close proximity to the plastic pipe. Approximately 4" to 6" away from the pipe. LI & MA - Above or alongside, UNY - alongside, RI - Under or alongside. Exception: For trenchless pipe installations, the minimum clearance is waived.

I. Maintain separation of approximately 4" from service riser. Do not permanently connect the tracer wire to the riser.

J. For horizontal directional drill installations, use stainless wire, Item #2.

K. Tracer wire installed in boxes should allow enough wire to extend 18" to 24" above grade.

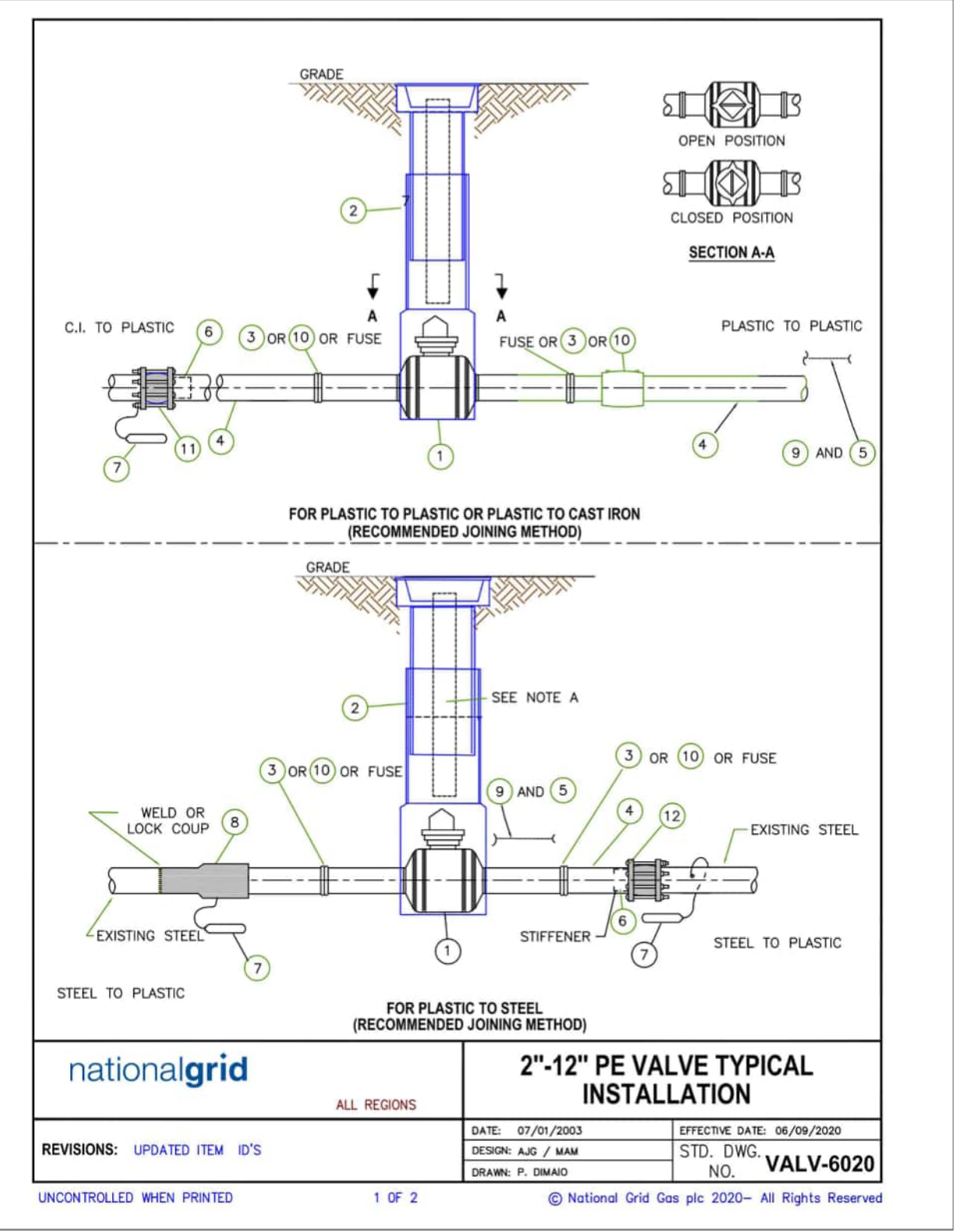
L. Verification: upon completion, the installer shall verify the location of the main or service using the tracer wire and locating device and perform a mark out using the conductive method.

M. LI and MA: Required to terminate the tracing wire with a 3# anode. This is to ground the tracer wire and increase signal strength when locating. This practice is recommended in all areas where signal strength is an issue.

Regional Notes

NYC ONLY: refer to [Installation of Marker Tapes and EMS Pipeline Locators for Mains and Services \[CNST6060-NYC\]](#) for installation of electronic marker ball in place of tracer wire.

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NOTES:

A. IN DRY LI REGION, INSTALL A LENGTH OF 2" DIAMETER PE OR SMALLER TUBING IN THE VALVE BOX TO IDENTIFY THE VALVE AS PLASTIC.

B. INSTALL TRACER WIRE OR BALL MARKERS AS REQUIRED IN YOUR REGION FOR PE INSTALLATIONS.

C. NOT USED ON THE DRY LI 90 & 124 PSIG SYSTEM.

D. REFER TO REGIONAL STANDARDS FOR MATERIAL IDS NOT GIVEN BELOW.

	SAP ID	SAP ID	SAP ID
1	UNY AND RI LP TO 100 PSIG HD	LI ONLY 99 AND 124 PSIG HD	LI, NYC AND NE LP TO 60 PSIG MEDIUM DENSITY
	9311203 12" DR 11 FULL PORT W/ GEAR OPERATOR RI ONLY	9341706 8" RED PORT DR 9	9341704 12" FULL PORT DR 13.5
	9307909 12" DR 13.5 FULL PORT W/ GEAR OPER UNY ONLY	9341705 6" RED PORT DR 9	9386054 8" FULL PORT DR 13.5
	9311173 8" DR 11 FULL PORT RI ONLY	9341700 4" RED PORT DR 9	9320023 6" FULL PORT DR 11.5
	9315189 8" DR 13.5 FULL PORT UNY ONLY	9341999 2" FULL PORT DR 9	9341700 4" FULL PORT DR 11.5
	9315116 6" DR 11 FULL PORT		9325096 3" FULL PORT DR 11
	9312058 4" DR 11 FULL PORT		9341784 2" FULL PORT DR 11
	9308561 3" DR 11 FULL PORT		9341408 8" RED PORT DR 13.5
	9312060 2" DR 11 FULL PORT		9341757 6" RED PORT DR 11.5
	9311446 2" DR 11 FULL PORT WITH PERMANENT ENDS		9341693 4" RED PORT DR 11.5
			9341756 3" RED PORT DR 11
			100 PSIG HIGH DENSITY (NE ONLY)
		9323610 4" RED PORT DR 11	
		9323611 6" RED PORT DR 11	
		9323612 8" RED PORT DR 11	
		9312060 2" FULL PORT DR 11	
		9312054 4" FULL PORT DR 11	
		9312116 6" FULL PORT DR 11	
2	SELECT ROADWAY VALVE BOX BELOW TO MATCH SIZED VALVE GIVEN	SELECT ROADWAY VALVE BOX BELOW TO MATCH SIZED VALVE GIVEN	SELECT ROADWAY VALVE BOX BELOW TO MATCH SIZED VALVE GIVEN
	SEE DWG FITS 6360 (FOR 12" VALVE) (FOR 2" THRU 8" VALVE)	9341706 8" RED PORT 9341705 6" RED PORT 9341700 4" RED PORT 9341999 2" FULL PORT	9386268 FOR 12" FULL PORT 9386265 FOR 8" FULL PORT 9339892 FOR 6" FULL PORT 9339890 FOR 4" FULL PORT 9339890 FOR 2" FULL PORT
		9339893 FOR 8" RED PORT 9339892 FOR 6" RED PORT 9339891 FOR 4" RED PORT 9339891 FOR 3" RED PORT	

ITEM

3 COUPLING ELECTROFUSE

4 PLASTIC PIPE

5 BURIAL TAPE

6 INSERT STIFFENER (SEE NOTE C)

7 ANODE, 17 LB

8 TRANSITION FITTING STL TO PE

9 TRACER WIRE OR (BALL MARKER IF USED IN REGION)

10 COUPLING 2" PERFECTION PERMASERT (SEE NOTE C)

11 COUPLING, PE TO CI, LOCKING, NON-INSULATING, MECHANICAL

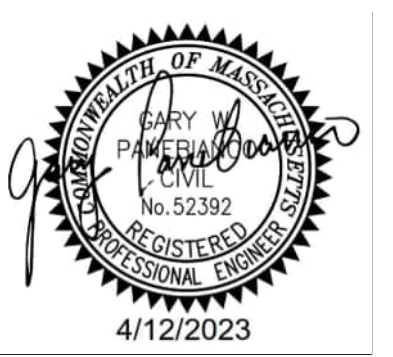
12 COUPLING, PE TO STL, LOCKING, NON-INSULATING MECHANICAL (SEE NOTE C)

No. ITEM

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nationalgrid
170 DATA DRIVE
WALTHAM, MA 02451

FINAL

PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

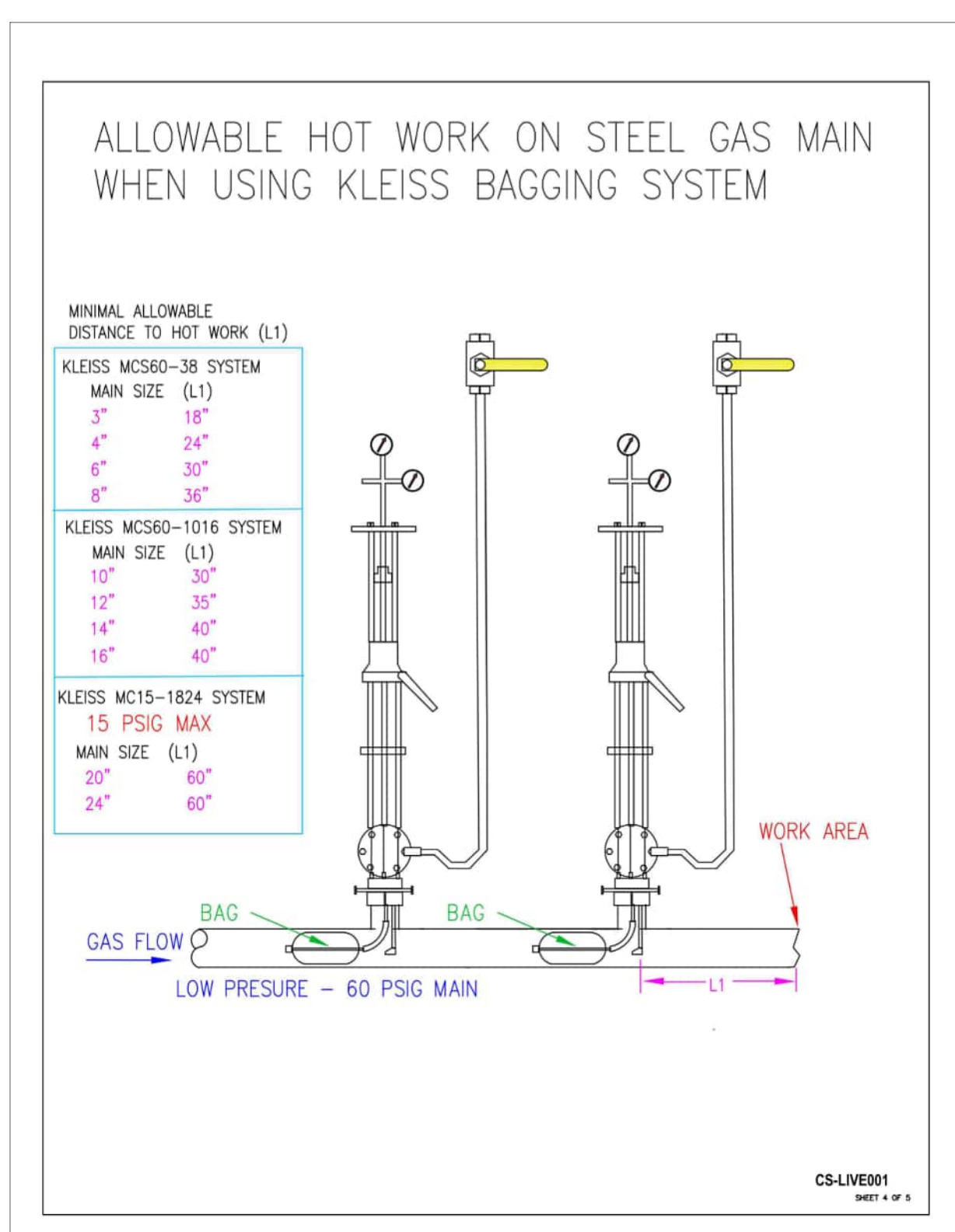
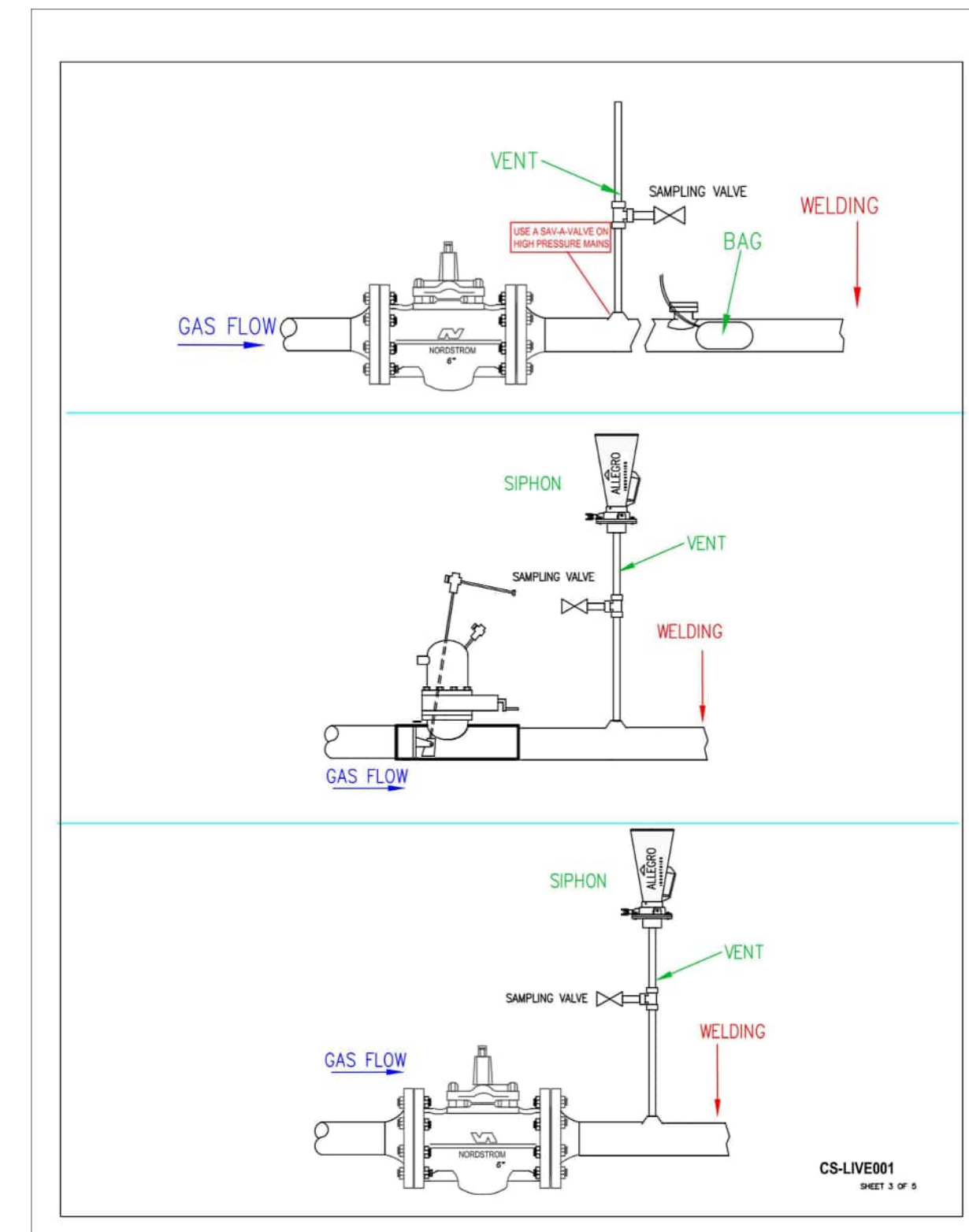
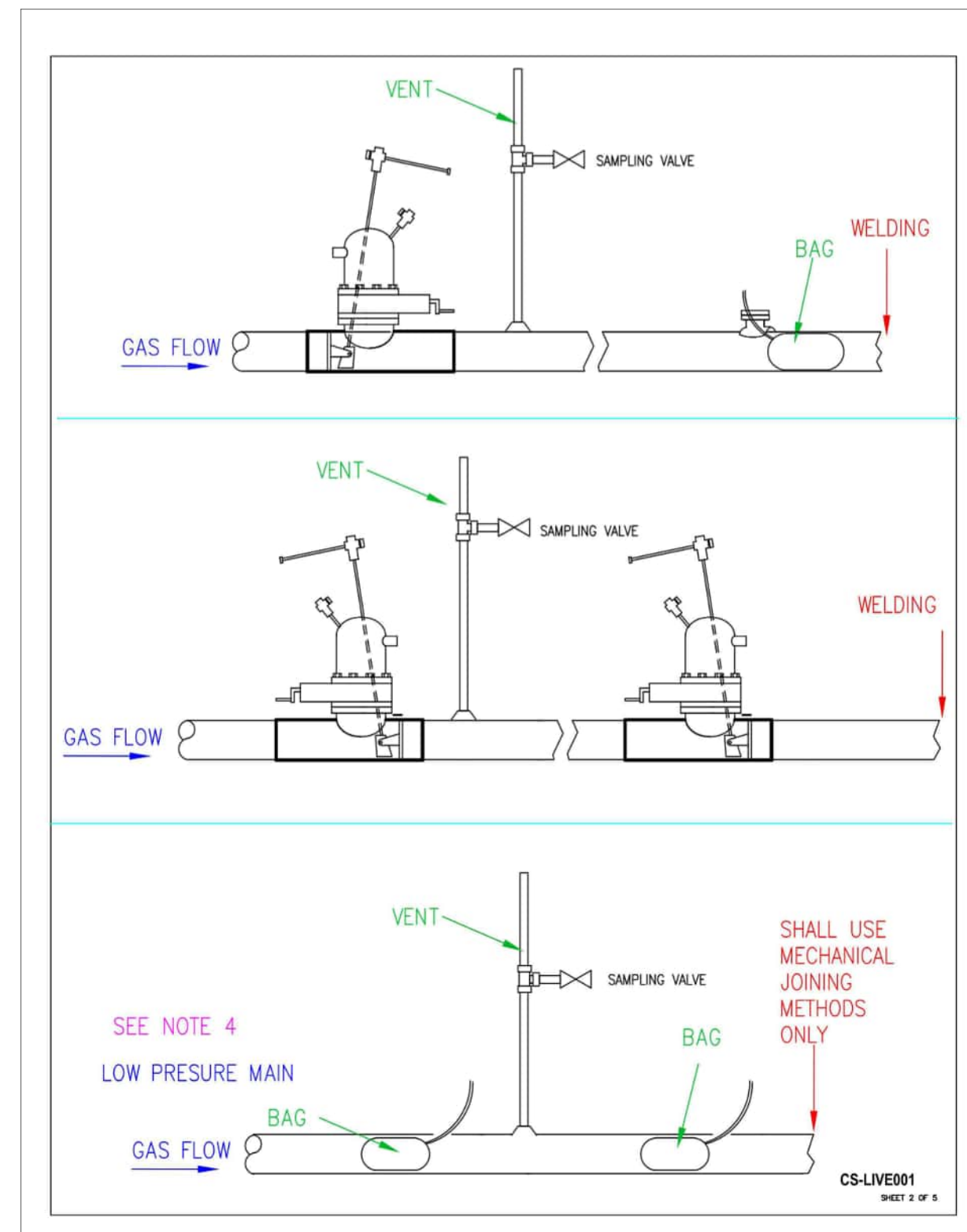
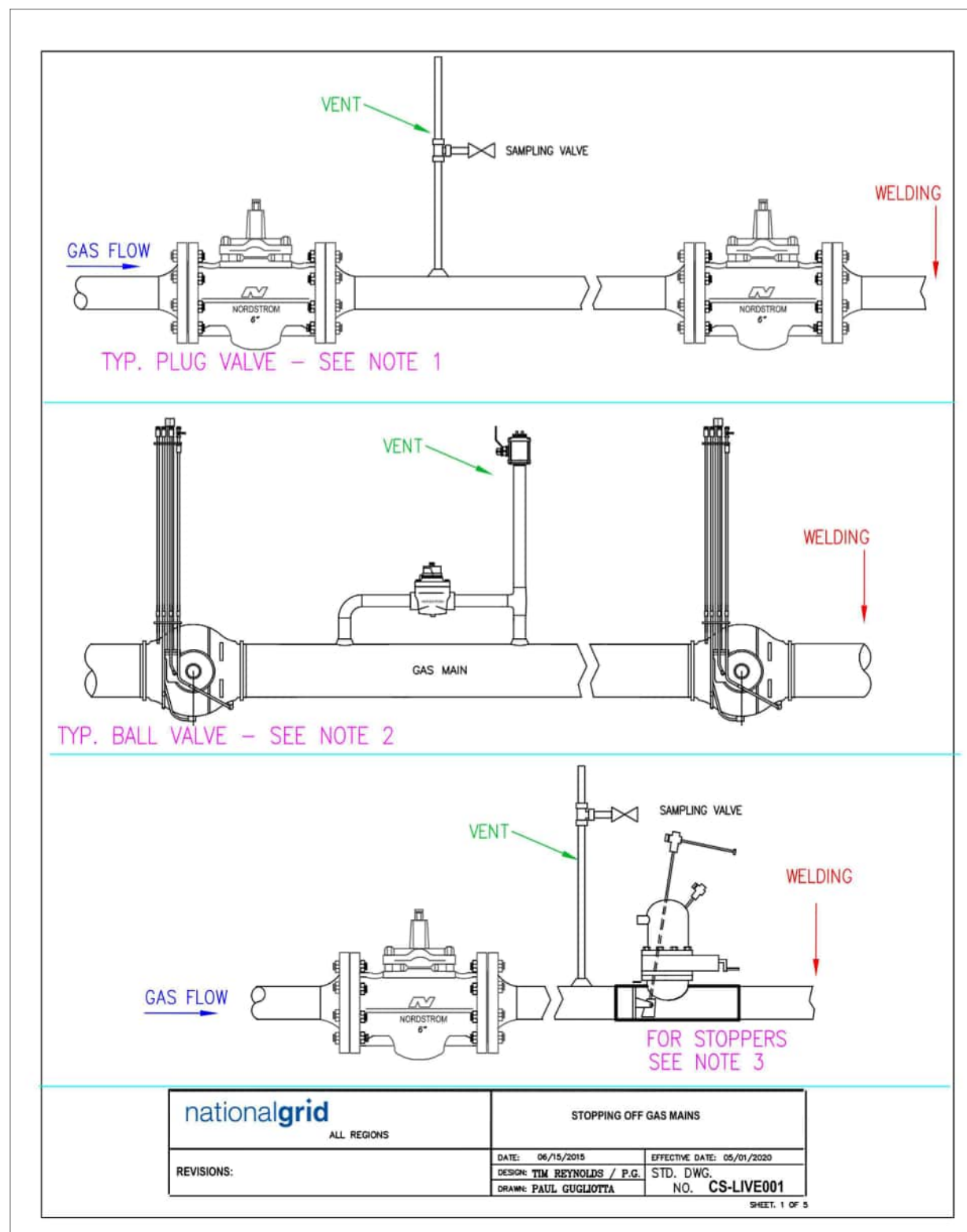
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DRAWING NO.	SHEET NO.
DPL-AYE-076933-1067	C-304

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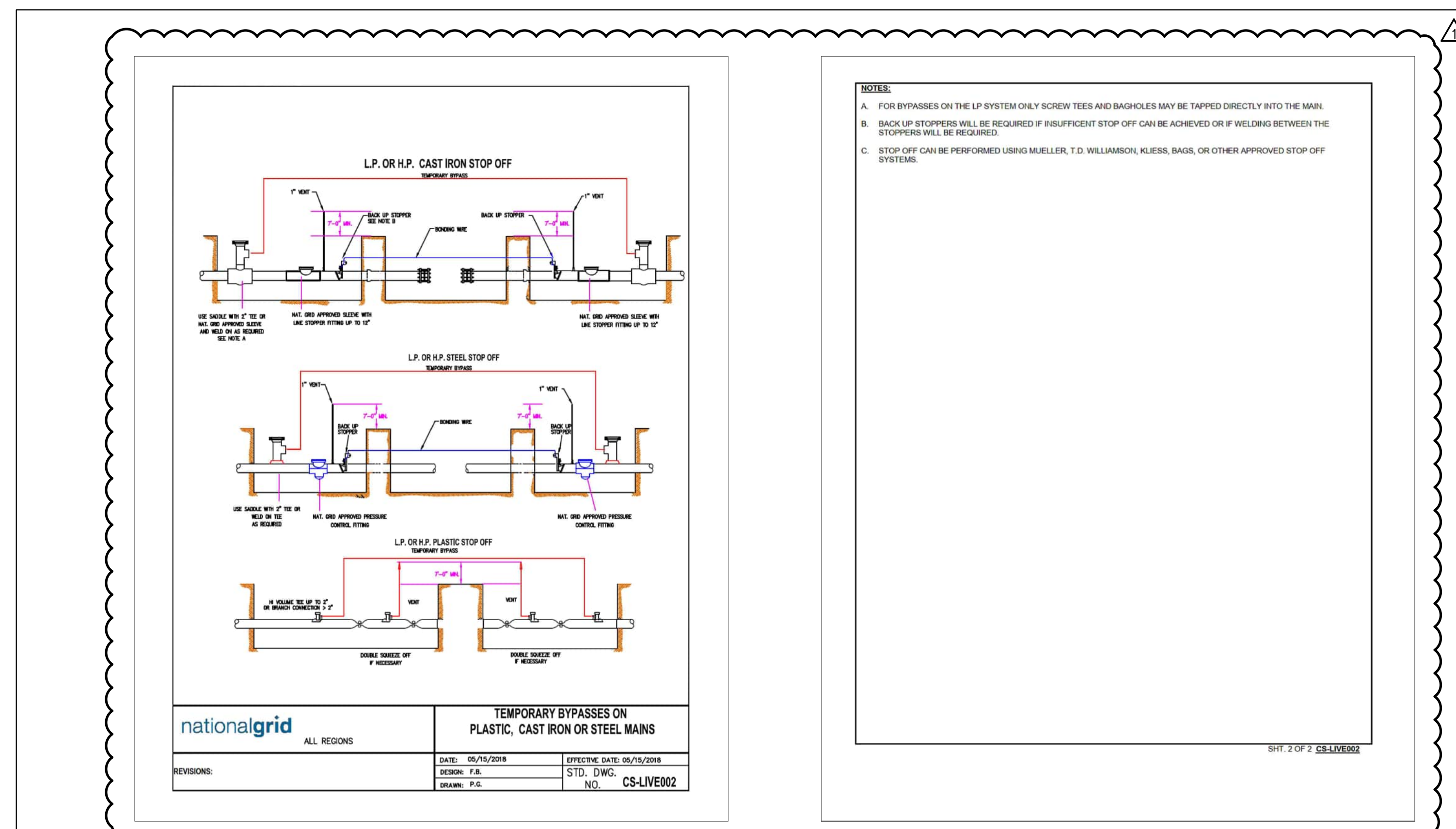


NOTES:

- PLUG VALVES SHOULD BE GREASED PRIOR TO SHUTTING OFF TO INSURE TIGHT SHUTOFF.
- USE THE BALL VALVE'S BLOCK AND BLEED AND / OR PURGE ASSEMBLY IF AVAILABLE TO VENT GAS BETWEEN THE TWO CLOSED VALVES.
- REFER TO MANUFACTURER'S LITERATURE FOR PRESSURE LIMITS OF STOPPERS AND DRILLING EQUIPMENT.
- WELDING SHALL NOT BE PERFORMED AGAINST A BAG WHERE THE BAG IS USED AS THE PRIMARY MEANS OF STOPPING THE GAS FLOW. SEE STOP-OFF OPERATIONS ON LOW PRESSURE MAINS [CNST-03002].

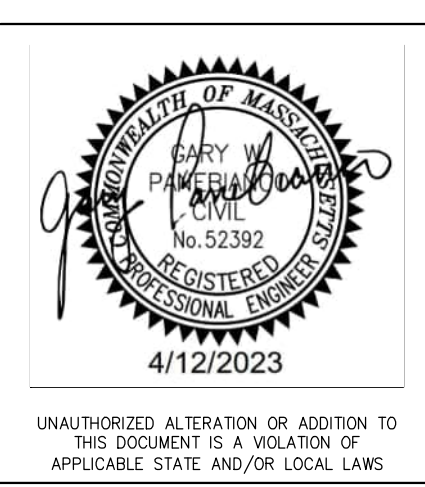
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CS-LIVE001



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NO.	DESCRIPTION	DATE	DR. BY	CK. BY	APP. BY

BOSTON GAS COMPANY
d/b/a
nationalgrid

170 DATA DRIVE
WALTHAM, MA 02451

FINAL

PROPOSED GAS MAIN REPLACEMENT
92-108 WEST MAIN STREET
AYER, MA

NATIONAL GRID STANDARD CONSTRUCTION DETAILS

DWG SIZE	DESIGNER	ENGINEER	DATE	ASSET I.D.	W.O. NO.:
22"x34"	A.ROSA	M.THOMPSON	10/09/2024	DISTRIBUTION & BG-025.0.0	1588874 & 90000243985

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