



**2021 ROADWAY IMPROVEMENT PROJECT
SOUTH BROADWAY DRAINAGE AND ROADWAY IMPROVEMENTS
SALEM, NH**

ADDENDUM No. 1

February 16, 2021

This Addendum forms part of the Bidding and Contract Documents and modifies the Drawings and Contract and Specifications for the 2021 Roadway Improvement Project – South Broadway Drainage and Roadway Improvements. The items set forth herein, whether of omission, addition, substitution or clarification, are all to be included in and shall form part of the proposed work and Bids submitted to the Town of Salem, New Hampshire. Inclusion of this Addendum shall be acknowledged by inserting its number in the space provided in the Bid Proposal form (Section 00301A). Failure to acknowledge any and all addenda in the above specified Bid Proposal form may be cause for rejection of the bid by the Owner on the grounds that it is not responsive.

ADDEDNDUM No. 1

Bidders are advised the following clarifications and changes are hereby incorporated into the CONTRACT DOCUMENTS AND SPECIFICATIONS:

1. **Insert** the attached Section 00301A (Bid) in the CONTRACT DOCUMENTS AND SPECIFICATIONS and **Discard** the original version of Section 00301A.

The revised document provides for drain manholes omitted from the previous version. The revised document further provides for a water service stub at 179 South Broadway to be provided at a location determined by the landowner. Finally, the document updates quantities of item(s).

2. **Insert** revised Contract Drawings and **Discard** the original version located in Appendix A.

The revised document provides for a water service at 179 South Broadway and provides clarification of drain pipe inspection at two locations. Where the existing drain pipe is determined to be an appropriate material and in sound condition it shall be left in place.

3. **Insert** Special Provision – SECTION 611 – WATER SYSTEM INSTALLATION into the CONTRACT DOCUMENTS AND SPECIFICATIONS.

The special provision provides direction on water service installation.



4. Is there an Engineer Opinion of cost?

Estimated project cost range is \$365,000 – \$395,000.

5. Can EJ Foundry CB Frame/Grate Model 532013 and Frame/Cover Model #200611 be used in place of the specified Neenah frame and grate.

Yes. Alternate castings may be considered if dimensioning, rating and style are exact such that they are interchangeable with the specified castings.

6. Is there a specific make/model for fabric specified over underdrain shown on the detail?

For this project the contractor may use standard NHDOT Class 3 non-woven drainage fabric. The specified monofilament micro-weave fabric shall be the contractor's option for this project. The contractor shall submit a cut sheet of proposed fabric choice.

7. Please clarify the wearing course paving intent.

Wearing course for the stretch of road between the intersection of Rockingham Blvd and Cluff Crossing road shall be completed in a single mobilization such that there are no transverse seams. The selected contractor shall coordinate with the intersection contractor. It is most probable that the intersection paving contractor will be the paver completing wearing course for this project.

The two possible scenarios are either (1) the intersection contractor completes the wearing course and the wearing quantities are removed from this contract, OR (2) the selected contractor for this project completes all wearing course up to the Rockingham Blvd edge of pavement and those quantities are added to this contract. Each project sequence and schedule will determine the most appropriate and efficient approach such that neither contractor is delayed by the other.

Note also that striping will also be completed by the same sub-contractor such that there are no stop/start points between projects.

****END OF ADDENDA NO. 1****

Bid Schedule

**2021 Roadway Improvement Project
South Broadway Resurfacing and Drainage Improvements
Salem, New Hampshire**

ITEM	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE		EXTENDED TOTAL
				Words	Figures	(Figures)
202.7	REMOVAL OF GUARDRAIL	770	LF			
203.1	COMMON EXCAVATION (WHERE DIRECTED)	480	CY			
203.6	EMBANKMENT IN PLACE (WHERE DIRECTED)	50	CY			
206.19	COMMON STRUCTURE EXCAVATION EXPLORATORY	50	CY			
214.	FINE GRADING	1	U			
304.4	CRUSHED STONE (FINE GRADATION)	86	CY			
403.11A	HOT BITUMINOUS PAVEMENT, MACHINE METHOD (BINDER MIX)	220	TON			
403.11B	HOT BITUMINOUS PAVEMENT, MACHINE METHOD (WEARING MIX)	810	TON			
403.12	HOT BITUMINOUS PAVEMENT, HAND METHOD	57	TON			
417.	COLD PLANING BITUMINOUS SURFACES	7800	SY			
603.83212	12" SMOOTH INTERIOR, DOUBLE WALL (TYPE S)	130	LF			
603.83224	24" SMOOTH INTERIOR, DOUBLE WALL (TYPE S)	85	LF			
604.0007	POLYETHYLENE LINER	6	EA			

Bid Schedule

2021 Roadway Improvement Project

South Broadway Resurfacing and Drainage Improvements

Salem, New Hampshire

ITEM	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE		EXTENDED TOTAL
				Words	Figures	(Figures)
604.124	CATCH BASINS TYPE B, 4-FOOT DIAMETER	9	EA			
604.324	DRAINAGE MANHOLE, 4-FOOT DIAMETER	2	EA			
604.45	ADJUST CATCH BASIN GRATES & FRAMES	3	EA			
604.5	ADJUST MANHOLE COVER & FRAME (SEWER OR DRAIN)	10	EA			
605.82453	48" AGGREGATE UNDERDRAIN WITH 24" PERFORATED CPE	1010	LF			
608.36	6" REINFORCED CONCRETE SIDEWALK	15	SY			
608.54	DETECTABLE WARNING DEVICES, CAST IRON	1	SY			
609.01	STRAIGHT GRANITE CURB	1500	LF			
609.02	CURVED GRANITE CURB	200	LF			
609.5	RESET GRANITE CURB	330	LF			
611.05206	6" Cement Lined Ductile Iron Pipe, CL 52	40	LF			
611.70006	6" Fitting	1	EA			
611.71006	6" Gate Valve w/ gate box	1	EA			

Bid Schedule

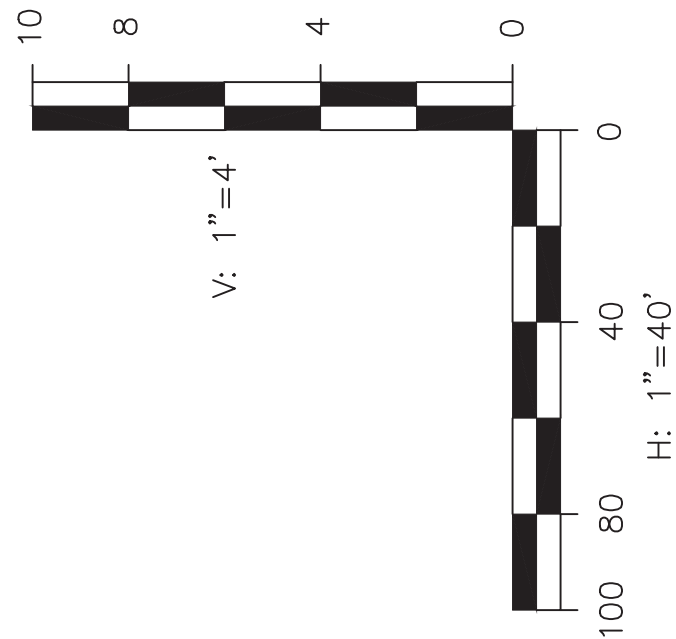
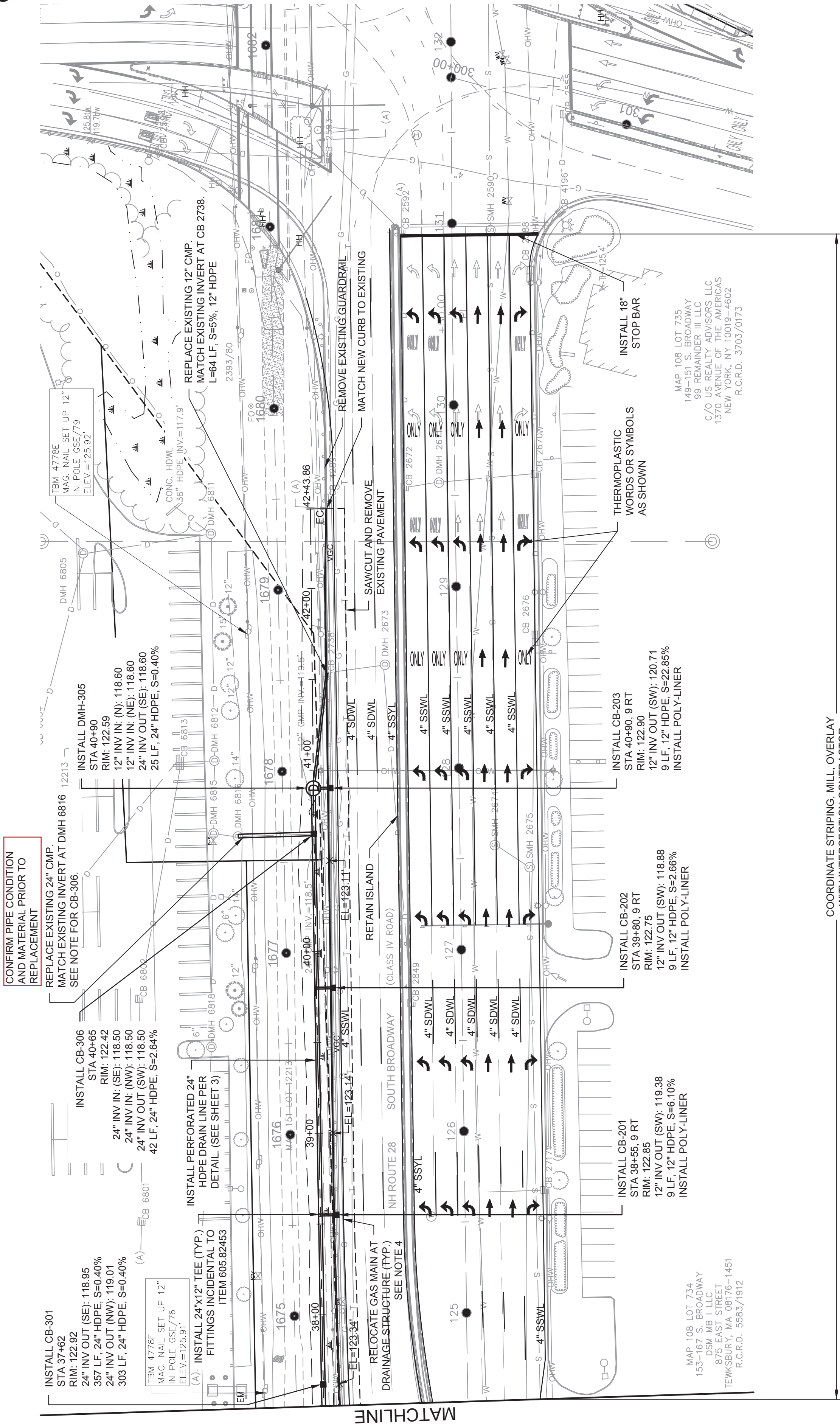
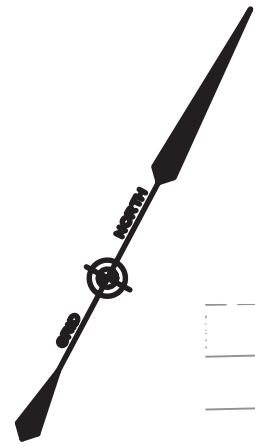
2021 Roadway Improvement Project

South Broadway Resurfacing and Drainage Improvements


Salem, New Hampshire

ITEM	DESCRIPTION	EST. QTY.	UNIT	UNIT PRICE		EXTENDED TOTAL
				Words	Figures	(Figures)
611.71912	12x6 Tapping Sleeve	1	EA			
618.6	UNIFORMED OFFICERS	20000	ALLOW	TWENTY THOUSAND DOLLARS AND NO CENTS	\$20,000.00	\$20,000.00
619.1	MAINTENANCE OF TRAFFIC	1	LS			
632.0104	RETROREFLECTIVE PAINT PAVE. MARKING, 4" LINE	20600	LF			
632.3118	RETROREFLECTIVE THERMO. PAVE. MARKING, 18 IN (STOP BARS)	150	LF			
632.32	RETROREFLECT. THERMOPLAS. PAVEMENT MARKING, SYMBOL OR WORD	1100	SF			
645.441	SEDIMENT FILTER LOGS (COMPOST SOCK)	800	LF			
645.531	SILT FENCE	800	LF			
645.533	INLET FILTER BASKET	17	EA			
646.512	TURF ESTABLISHMENT WITH MULCH, TACKIFIERS, AND LOAM (F)	2100	SY			
692	MOBILIZATION	1	LS			
TOTAL AMOUNT						

Key to Units: LF = Linear Feet; VF = Vertical Feet; SY = Square Yards; CY = Cubic Yards; LS = Lump Sum; EA = Each

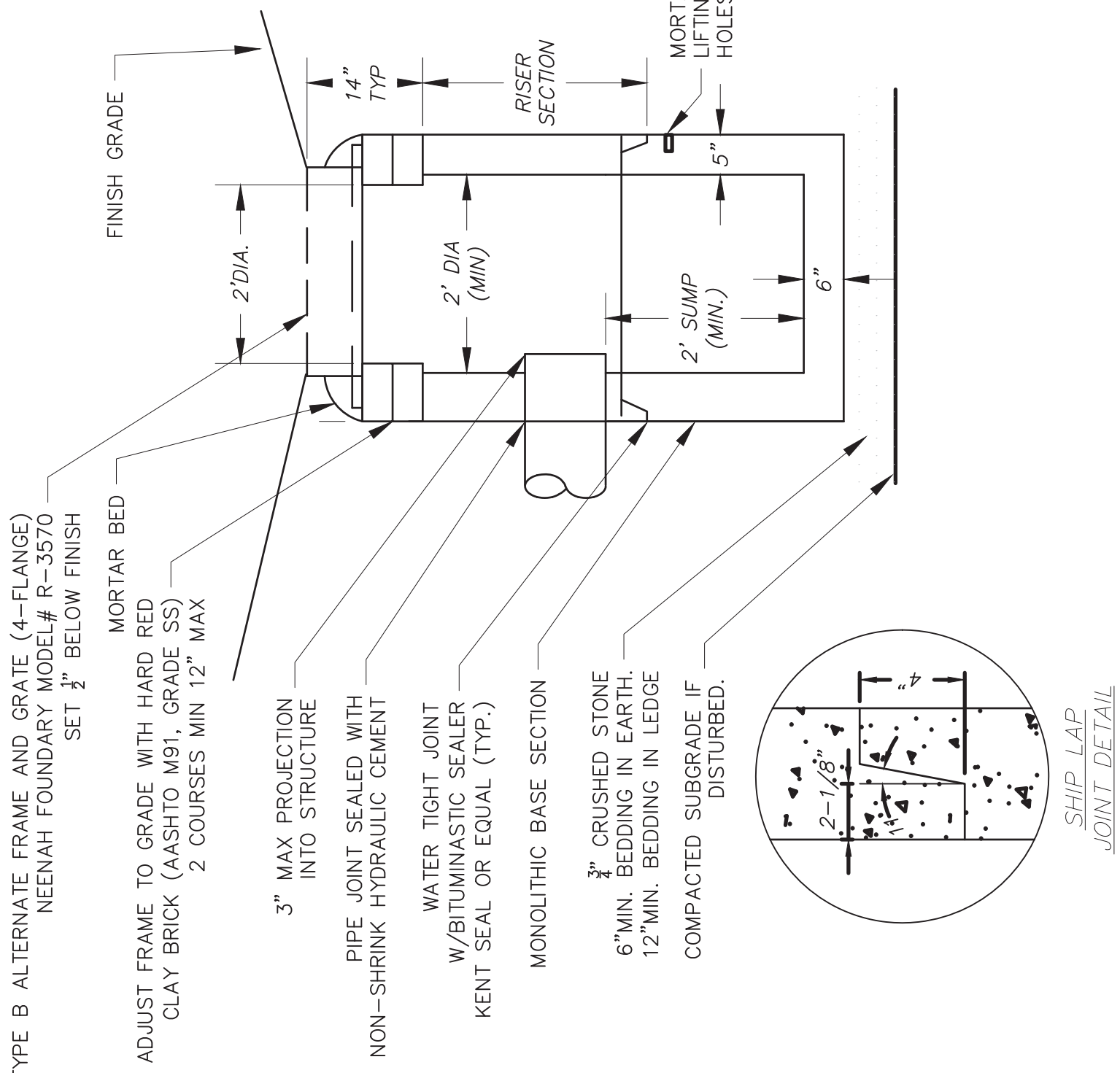


COORDINATE STRIPING, MILL, OVERLAY
WITH INTERSECTION CONTRACTOR
SEE GENERAL CONSTRUCTION NOTE #2 & #5

		TOWN OF SALEM SALEM, NEW HAMPSHIRE				
		2021 ROADWAY IMPROVEMENT PROJECT				
		SOUTH BROADWAY INFILTRATION TRENCH PLAN (SHEET 2 OF 2)				
1	01.14.21	ADDENDUM #1	BY			
			DESCRIPTION			
		 McFarland Johnson 53 REGIONAL DRIVE CONCORD, NEW HAMPSHIRE 03301				
		SCALE: AS SHOWN	DESIGN: MKM			
		DRAWN: MKM	PROJECT: 18587.06			
		CHECKED: BRC	DATE: DECEMBER 2020			
		2 OF 3				

GENERAL DRAIN STRUCTURE NOTES:

- REFERENCE NHDOT SECTION 604 AND TOWN OF SALEM SUPPLEMENTAL SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
- SEPARATE CONSTRUCTION SPECIFICATIONS ARE ATTACHED OR INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD DRAWINGS ARE NOT COMPLETE WITHOUT SPECIFICATIONS.
- ALL STRUCTURE COMPONENTS INCLUDING CASTING ASSEMBLIES WILL BE INSPECTED FOR ACCEPTABILITY. REJECTED MATERIALS SHALL BE REMOVED FROM THE SITE.
- FLAT TOP OPTION: FOR STRUCTURES WITH A DIAMETER GREATER THAN 4 FEET THE DIAMETER MAY BE CONSTANT FROM TOP TO BOTTOM WITH A FLAT TOP LID OR A RISER SECTION THAT REDUCES FROM THE LARGER DIAMETER TO THE STANDARD 4" ECCENTRIC CONE SECTION.
- ADJUSTMENT BRICK SHALL CONFORM TO AASHTO M32, GRADE SS SEMER BRICK. MAX ABSORPTION SHALL BE 3%-4% DURING THE 5-HOUR BOIL TEST.
- BRICK FACE WORK SHALL BE LAID CLOSE WITH JOINTS NOT EXCEEDING 1/4". JOINTS SHALL BE FILLED AND POINTED. CONCRETE COLLARS ARE NOT ALLOWED.
- CB AND DI GRATES IN PAVED AREAS SHALL BE SET ACCORDING TO THE STANDARD SALEM PAVEMENT DEPRESSION DETAIL.
- INVERTS SHALL BE CONSTRUCTED USING GRADE SS SEMER BRICK (SEE ADJUSTMENT BRICK ABOVE). POURED AND SHAPED CONCRETE INVERTS SHALL NOT BE ALLOWED.
- DOUBLE GRATES: WHERE DOUBLE GRATES ARE NEEDED A 5-FOOT MIN. DIAMETER STRUCTURE WITH FLAT TOP LID SHALL BE USED. DOUBLE GRATE SHALL BE EJ MODEL #0MA552000066.
- BEDDING 3/4" CRUSHED STONE CONFORMING TO NHDOT ITEM 304.4 SHALL BE USED FOR BEDDING. WHERE ORDERED BY THE ENGINEER TO STABILIZE THE BASE ADDITIONAL SCREENED GRAVEL OR CRUSHED STONE 1/2 TO 1-1/2 INCH SHALL BE USED.
- PIPE TO MANHOLE JOINTS SHALL BE ELASTOMERIC. RUBBER SLEEVE WITH WATERTIGHT JOINTS AT THE MANHOLE OPENING AND OPENING SURFACES; OR CAST INTO THE WALL AND SECURED WITH STAINLESS STEEL CLAMPS. ELASTOMERIC SEALING RING SHALL FORM A WATER TIGHT SEAL ON THE SURFACE OF THE PIPE BY COMPRESSION OF THE RING. NON-SHRINK GROUT SHALL BE PLACED IN THE ANNULAR SPACE BETWEEN THE SEALING BOOT AND PIPE.
- CORE SPACING: ALL STRUCTURES WITH MULTIPLE PIPES SHALL HAVE A MINIMUM OF 12" OF OUTSIDE SURFACE BETWEEN CORE HOLES. NO MORE THAN 75% OF A HORIZONTAL CROSS SECTION SHALL BE CORE HOLES AND CORE HOLES SHOULD BE 6" TYPICAL FROM JOINTS BUT IN NO CASE CLOSER THAN 3" AS APPROVED.
- THE CORE HOLE SHALL NOT BE CLOSER THAN 3" TO JOINTS WITH USE OF AN ELASTOMERIC BOOT CONNECTOR. ELASTOMERIC BOOT CONNECTORS FOR INVERTS SHALL NOT BE ALLOWED IN SHALLOW TRENCHES (LESS THAN 3.5 FEET RIM TO INVERT)
- CORES: WHERE IT IS NECESSARY TO CORE AN EXISTING STRUCTURE THE CORE SHALL BE COMPLETED WITH A CIRCULAR HOLE SAW AND SHALL BE LARGE ENOUGH TO RECEIVE THE PIPE AND NEOPRENE BOOT. CRUDE METHODS WITH A PIPE SAW, SLEDGE HAMMER OR OTHER TOOLS ARE UNACCEPTABLE. FIELD CORES SHALL BE INCIDENTAL UNLESS SPECIFICALLY PROVIDED FOR.
- OUTSIDE EDGES OF THE OUTLET PIPE SHALL PROJECT NO MORE THAN 3" BEYOND THE INSIDE WALL OF THE STRUCTURE.
- LIFTING HOLES SHALL BE FILLED WITH MORTAR.
- UNSATISFACTORY MATERIAL & OVER EXCAVATION: PAY LIMITS FOR STRUCTURE INSTALLATION SHALL BE COMPLETE IN PLACE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MEANS AND METHODS OF STRUCTURE INSTALLATION. CLAIMS FOR OVER EXCAVATION SHALL NOT BE GRANTED. EXCAVATION AREAS SHALL BE BACKFILLED WITH APPROPRIATE BEDDING MATERIALS. REMOVAL OF UNSUITABLES AND REPLACEMENT WITH SUITABLE GRANULAR FILL ARE SUBSIDIARY.
- BACKFILL WITHIN 1-FOOT OF THE STRUCTURE WALL SHALL BE SAND CONFORMING TO NHDOT MATERIAL SPEC ITEM 304.1. REMAINING BACKFILL SHALL CONFORM TO SALEM TYPICAL TRENCH REQUIREMENTS. BACKFILL SHALL BE COMPACTED IN 6" LIFTS.
- STEPS ARE NOT ALLOWED.
- CASTINGS. CASTINGS SHALL BE EVEN-GRAINED CAST IRON. SMOOTH AND FREE FROM SCALE, LUMPS, BLISTERS, SAND HOLES AND DEFECTS. CONTACT SURFACES OF FRAMES AND GRATES SHALL BE MACHINED AT THE FOUNDRY TO PREVENT ROCKING OF COVERS IN ANY ORIENTATION. ALL CATCH BASIN FRAMES (SINGLE AND DOUBLE) INSTALLED AT GRANITE CURBING LOCATIONS SHALL BE 3-FLANGED. ALL CATCH BASIN FRAMES (SINGLE AND DOUBLE) INSTALLED WITH BITUMINOUS CURB OR NO CURBING SHALL BE 4-FLANGED.
- ALL STRUCTURES SHALL BE H20 LOAD RATED.
- ALL PRECAST SECTIONS SHALL CONFORM TO ASTM C-478. ALL REINFORCING STEEL SHALL CONFORM TO AASHTO M31 (ASTM A616) GRADE 60, AND SHALL MEET THE REQUIREMENTS OF SECTION 544 REINFORCING STEEL OF THE NHDOT STANDARD SPECS.
- CONE SECTIONS SHALL BE ECCENTRIC. WHERE PIPE CORE WOULD OTHERWISE ENTER INTO THE CONE SECTION AN H-20 LOAD RATED FLAT TOP ECCENTRIC LID MAY BE USED.
- CIRCUMFERENTIAL REINFORCEMENT REQUIREMENTS SHALL CONFORM TO THE LATEST ASTM A185 SPECIFICATIONS.
- ALL SECTIONS SHALL BE CONCRETE CLASS AA (4000 PSI).
- CIRCUMFERENTIAL REINFORCEMENT SHALL BE PLACED IN THE CENTER THIRD OF THE WALL
- EACH COMPONENT OF THE SHIP LAP JOINT SHALL CONTAIN ONE LINE OF CIRCUMFERENTIAL REINFORCEMENT EQUAL TO 0.12 SQ. IN. PER L.F.

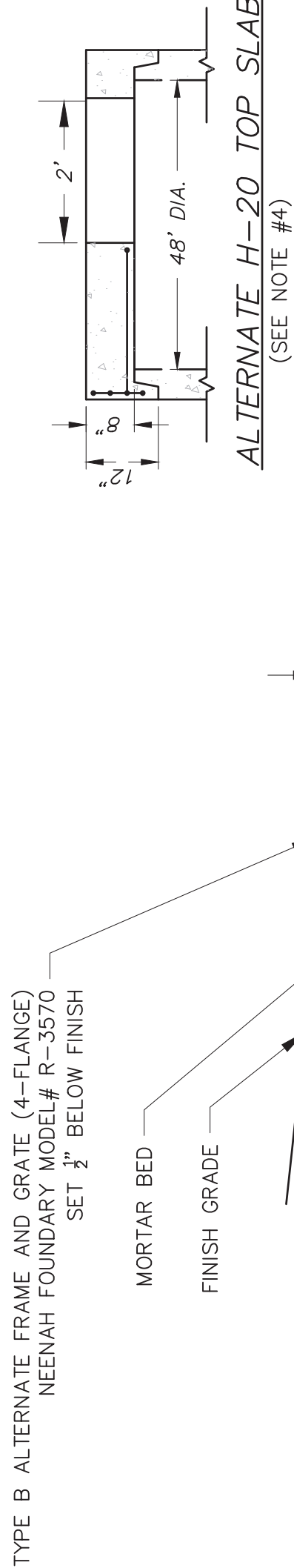


DROP INLET:

- REFERENCE GENERAL DRAIN STRUCTURE NOTES, NHDOT SECTION 604, AND TOWN OF SALEM SUPPLEMENTAL SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
- SEPARATE CONSTRUCTION SPECIFICATIONS ARE ATTACHED OR INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD DRAWINGS ARE NOT COMPLETE WITHOUT SPECIFICATIONS.
- USE OF A DROP INLET IN THE PUBLIC INFRASTRUCTURE SHALL BE SOLELY GOVERNED BY THE SALEM ENGINEERING DEPARTMENT AND SHALL BE ON A CASE BY CASE BASIS. NORMAL ENGINEERING PRACTICE IN SALEM SHALL NOT PERMIT THE USE OF A DROP INLET.
- IF/WHERE A DROP INLET IS ALLOWED THERE SHALL NOT BE ANY STRUCTURE OR INLET UPSTREAM OF IT.
- BOOT CONNECTORS ARE GENERALLY NOT USED IN TRENCHES LESS THAN 3.5 FEET. USE OF A BOOT CONNECTOR ON A DROP INLET SHALL BE DETERMINED AT THE TIME OF SHOP DRAWING SUBMITTAL.
- USE OF POLY-LINER ON DROP INLETS SHALL BE SITE SPECIFIC BASED ON INVERT DEPTHS. TRIMMING MAY BE REQUIRED TO PREVENT BLOCKAGE OF THE INVERTS.

Precast Reinforced Drop Inlet (Square or Round)

NO SCALE



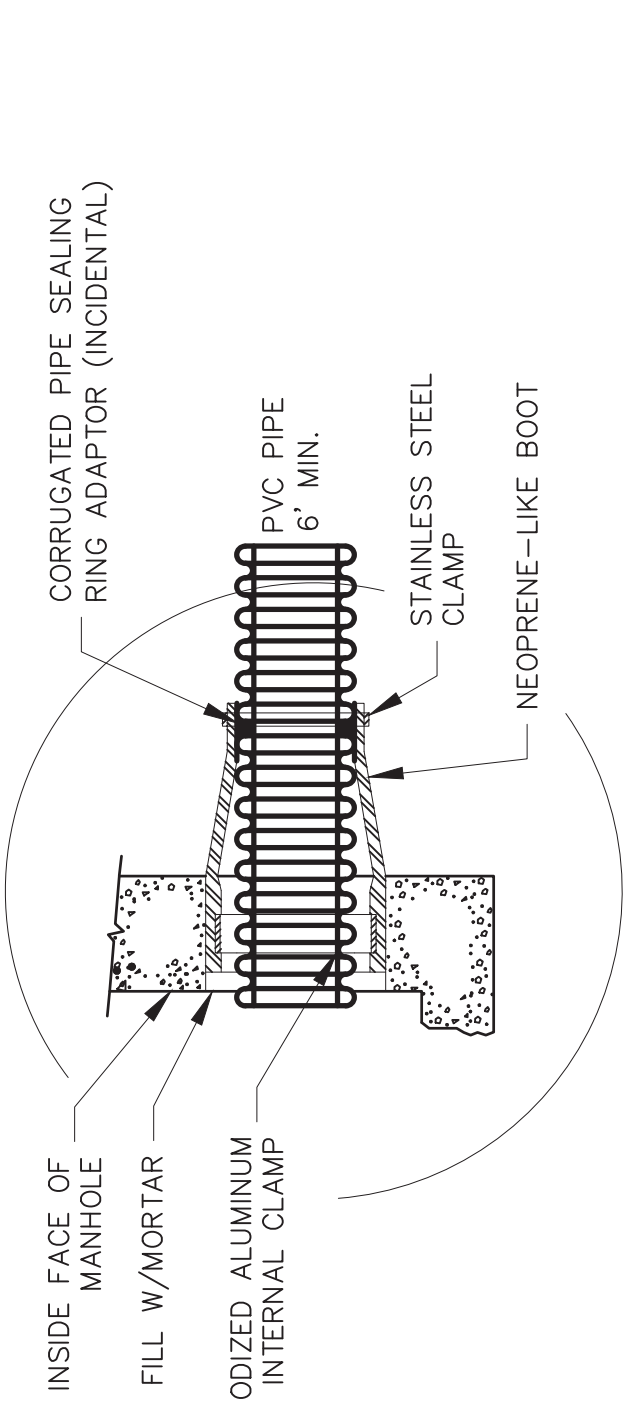
DIAMETER	WALL THICKNESS MIN.	FLOOR THICKNESS MIN.
4"	5"	6"
5"	6"	8"
6"	7"	8"
7"	8"	10"
8"	9"	10"

CB NOTES:

- REFERENCE GENERAL DRAIN STRUCTURE NOTES, NHDOT SECTION 604, AND TOWN OF SALEM SUPPLEMENTAL SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
- SEPARATE CONSTRUCTION SPECIFICATIONS ARE ATTACHED OR INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD DRAWINGS ARE NOT COMPLETE WITHOUT SPECIFICATIONS.

Precast Reinforced Catch Basin

NO SCALE

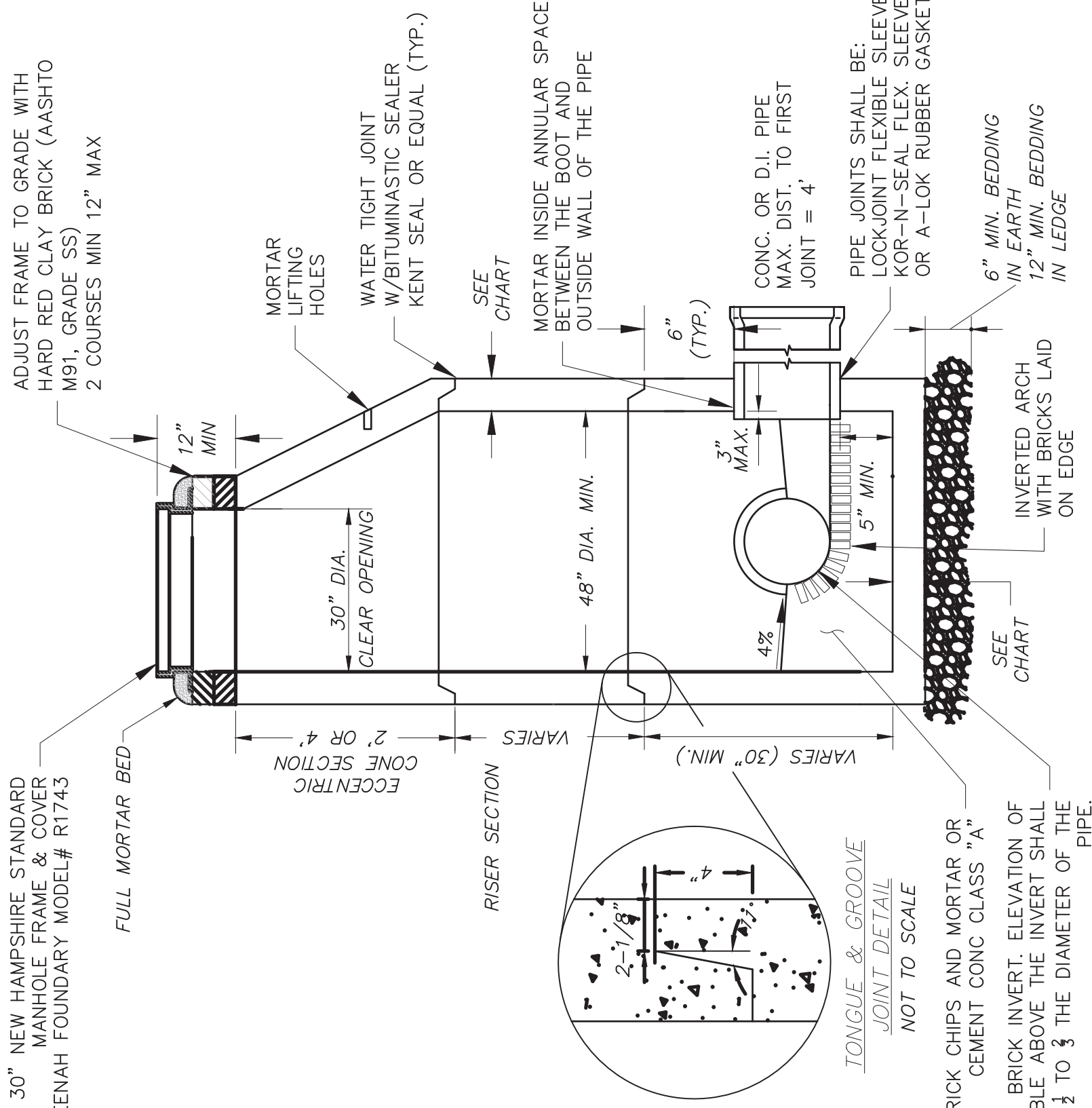


Corrugated Pipe/Boot Connection Detail

NO SCALE

DMH NOTES:

- REFERENCE GENERAL DRAIN STRUCTURE NOTES, NHDOT SECTION 604, AND TOWN OF SALEM SUPPLEMENTAL SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
- MANHOLE FRAMES AND COVERS SHALL PROVIDE A THIRTY INCH CLEAR OPENING. A 3-INCH (MINIMUM HEIGHT) WORD "DRAIN" SHALL BE CAST INTO THE TOP SURFACE.
- SEPARATE CONSTRUCTION SPECIFICATIONS ARE ATTACHED OR INCLUDED IN THE CONTRACT DOCUMENTS. THESE STANDARD DRAWINGS ARE NOT COMPLETE WITHOUT SPECIFICATIONS.



Pre-cast Reinforced Concrete Drain Manhole

NO SCALE

Precast Reinforced Catch Basin

NO SCALE

TOWN OF SALEM
SALEM, NEW HAMPSHIRE
2021 ROADWAY IMPROVEMENT PROJECT

McFarland Johnson
53 REGIONAL DRIVE
CONCORD, NEW HAMPSHIRE 03301

CIVIL DETAILS 4

SCALE: N.T.S.	DESIGN: BEP	12 OF 16
DRAWN: MRV	PROJECT: 18587.06	
CHECKED: BRC	DATE: DECEMBER 2020	

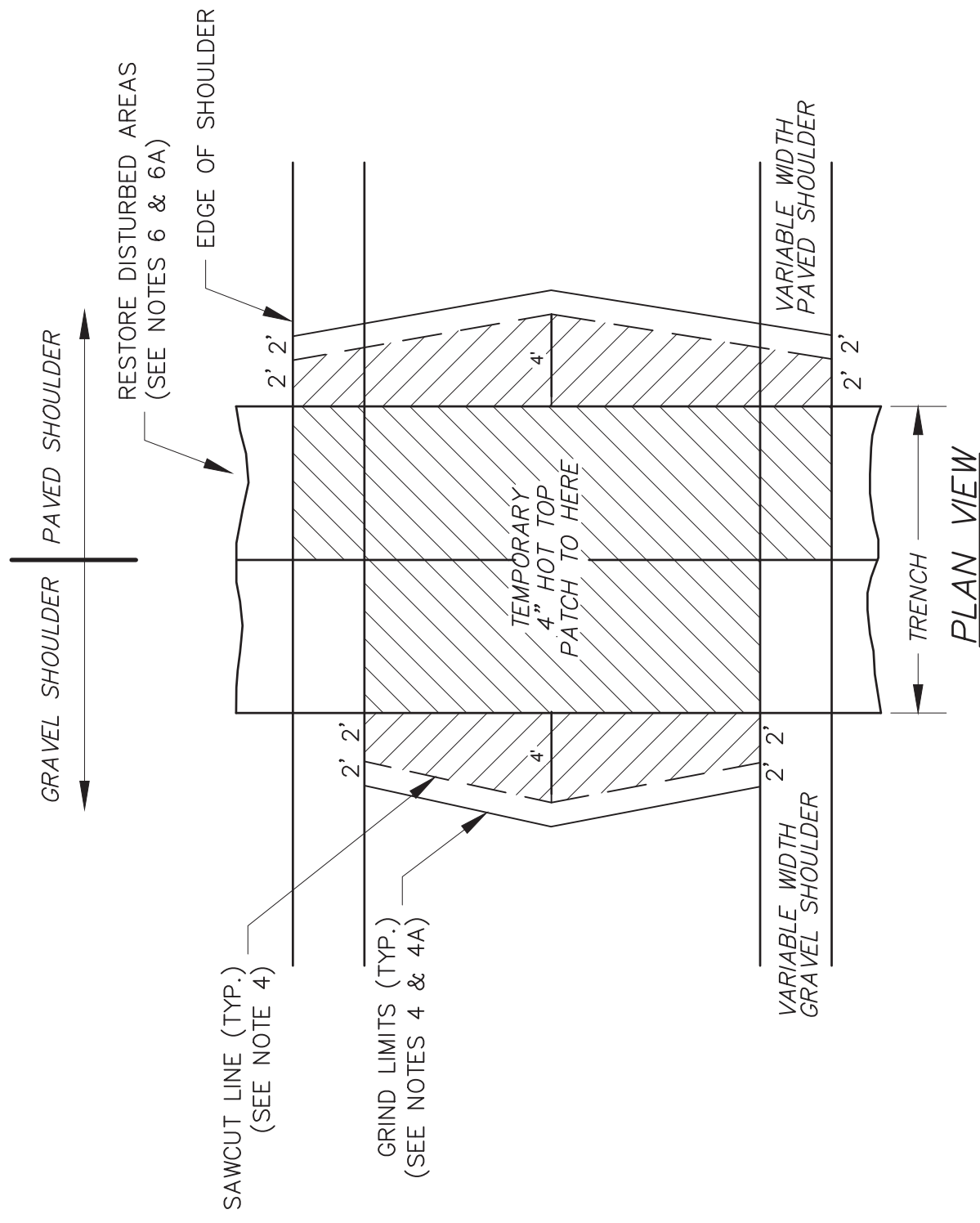


Standard Salem Pavement Depression Detail

NO SCALE

NOTES:

1. EXACT TRENCH PATCH METHODS SHALL BE DETERMINED BY THE ENGINEER BASED ON SITE SPECIFIC CONDITIONS. REFERENCE APPLICABLE TOWN OF SALEM TRENCH SECTION DETAILS FOR PROPER BEDDING REQUIREMENTS.
2. REFERENCE TOWN OF SALEM STREET EXCAVATION REQUIREMENTS FOR ADDITIONAL REQUIREMENTS AND INFORMATION. THIS DETAIL IS NOT COMPLETE WITHOUT ALL REFERENCED ITEMS.
3. TEMPORARY PATCHING: AN APPROVED BITUMINOUS PLANT MIX MATERIAL SHALL BE PLACED AND CAREFULLY GRADED AND ROLLED TO THE ADJACENT PAVEMENT GRADE AS A TEMPORARY PATCH. JUST BEFORE COMPLETION OF THE PROJECT AND AFTER SUITABLE EXPOSURE OF THE TEMPORARY PATCHES TO TRAFFIC COMPACTION, THE PAVEMENT SHALL BE SAWCUT, REMOVED AND REPAVED AS SHOWN.
4. TWO FOOT MINIMUM OVERLAP ON UNDISTURBED MATERIAL SHALL BE SAWCUT IN A DIAMOND SHAPE PATTERN THAT WILL PERMIT ONLY ONE WHEEL OF A VEHICLE AT A TIME TO STRIKE THE PATCH AREA. ON WIDER ROADS THE 4-FOOT DIMENSION AT THE CENTER OF THE ROAD MAY NEED TO BE EXTENDED TO MEET THIS INTENT. ALL SAW CUTS FOR THE FINAL PATCH SHALL BE AS DIRECTED BY THE PERMITTING AUTHORITY.
- 4A. INITIAL CUT LINE IN PAVEMENT SHALL BE ESTABLISHED DIRECTLY OVER TRENCH WALLS. FINAL CUT LIMITS SHALL NOT BE DONE UNTIL AFTER ALL EXCAVATION AND BACK FILL ACTIVITIES HAVE BEEN COMPLETED.
- 4B. CUT AND GRIND LIMITS SHALL BE EXTENDED FOR LARGER TRENCHES. SPECIFIC GRIND LIMITS SHALL BE DETERMINED BY THE PERMITTING AUTHORITY AT THE TIME OF CONSTRUCTION. ADDITIONAL CUT/GRIND LIMITS SHALL BE FIELD DETERMINED BASED ON DAMAGE TO THE SURROUNDING PAVEMENT.
5. SHOULDERS, OTHER THAN PAVED, DISTURBED DURING CONSTRUCTION, SHALL BE RESTORED BY EXCAVATING TO A DEPTH SUFFICIENT TO RECEIVE 6" CRUSHED BANK RUN GRAVEL WHICH SHALL BE GRADED AND COMPACTIONED ON A SLOPE OF 5% AWAY FROM THE PAVEMENT OR AS ORDERED BY THE TOWN. PAVED SHOULDER SHALL BE RECONSTRUCTED WITH IN-KIND GEOMETRY AND ACCORDING TO THE PAVEMENT SECTION DESCRIBED ON THIS TYPICAL.
6. OTHER HIGHWAY SLOPES AND SHOULDERS DISTURBED SHALL BE RESTORED IN-KIND WITH APPROPRIATE SLOPE AND EROSION PROTECTION MEASURES OR INSTRUCTIONS ISSUED BY THE TOWN.
- 6A. ALL OTHER DISTURBED AREAS (CURB, SIDEWALK, GRASSED AREAS, WALLS, ETC.) SHALL BE RESTORED IN-KIND AND/OR AS DIRECTED BY THE TOWN ACCORDING TO ACCEPTED CONSTRUCTION PRACTICES.
7. TRAFFIC SHALL BE MAINTAINED, CONTROLLED AND PROTECTED BY SUITABLE WARNING AND/OR CHANNELIZING DEVICES, ADVANCE WARNING SIGNS AND FLAGS DURING THE PERFORMANCE OF THE WORK IN ACCORDANCE WITH THE TOWN REQUIREMENTS AND ACCEPTED CONSTRUCTION PRACTICES.
8. THE CONTRACTOR SHALL MARK ALL HAZARDS WITHIN THE LIMITS OF THE PROJECT AND CONNECTING ROADS. THESE DEVICES SHALL BE MOVED, SUPPLEMENTED, CHANGED OR REMOVED DURING THE PROGRESS OF THE CONSTRUCTION. UNIFORMED TRAFFIC CONTROL OFFICERS SHALL BE PROVIDED FOR THE PROTECTION OF THE PUBLIC WHILE WORKING WITHIN A TOWN RIGHT-OF-WAY.
9. IN ALL CASES, TRENCH SHALL BE PAVED FLUSH WITH EXISTING PAVEMENT AT THE END OF THE WORK DAY EXCEPT AS ALLOWED BY PERMITTING AUTHORITY.
10. UPON COMPLETION OF BACK FILL OPERATIONS THE EXISTING ROAD GRAVELS SHALL BE OVER EXCAVATED 12" BEYOND THE TRENCH WALL. THIS WORK SHALL NOT BE COMPLETED PRIOR TO COMPLETING BACKFILL AND COMPACTION.

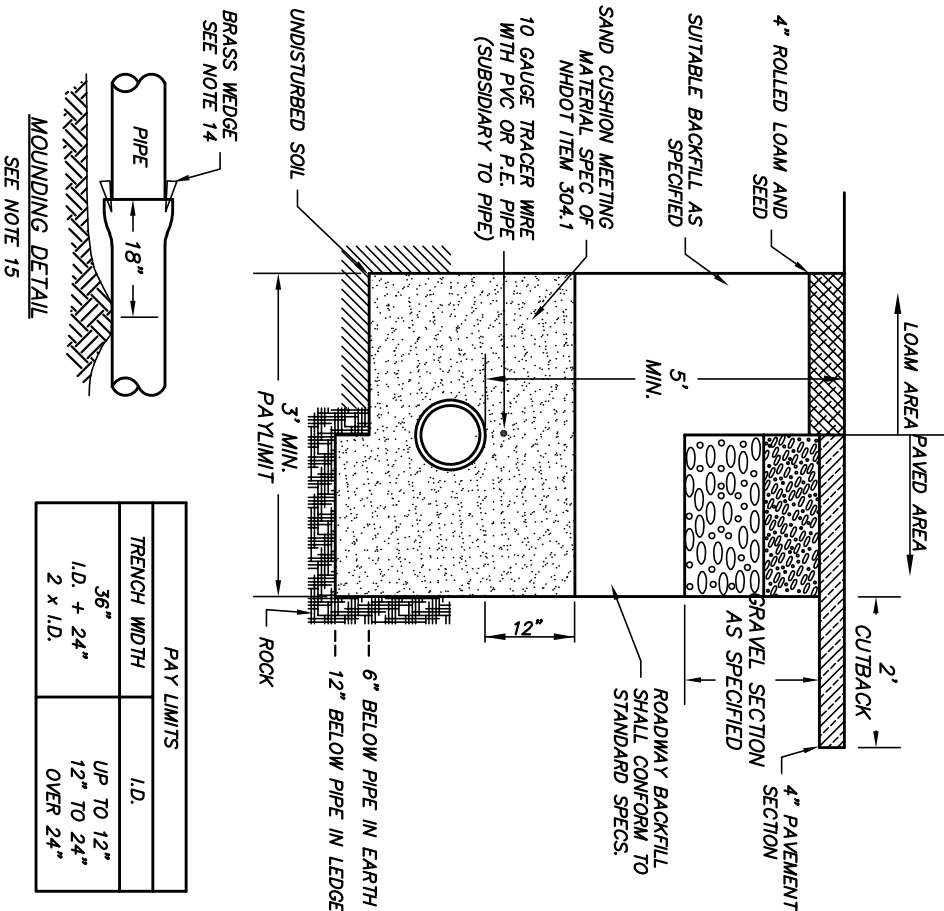


NO SCALE

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WATER TRENCH NOTES:

1. REFERENCE TOWN OF SALEM STANDARD SPECIFICATIONS FOR METHOD OF MEASUREMENT AND PAYMENT.
2. PAVEMENT REPAIR IN EXISTING ROADWAYS SHALL CONFORM TO STREET OPENING REGULATIONS.
3. ALL LOCAL STATE AND FEDERAL SAFETY STANDARDS SHALL BE STRICTLY ADHERED TO.
4. NEW ROADWAY CONSTRUCTION SHALL CONFORM TO TOWN OF SALEM SUBDIVISION REQUIREMENTS
5. SEE TOWN OF SALEM PERMANENT PAVEMENT REPAIR DETAIL FOR CUTBACK AND GRIND REQUIREMENTS WITHIN EXISTING ROADWAYS.
6. BITUMINOUS PAVEMENT, DEPTH EQUAL TO EXISTING PAVEMENT WITH 4" MIN. (1.5" WEARING (1 1/2" MIX), 2.5" BASE (3/4" MIX)). PAVEMENT SHALL CONFORM TO NHDOT ITEM 403.11.
7. DAMAGED OR OTHERWISE DEFICIENT PIPE SHALL BE REJECTED AND REMOVED FROM THE JOB SITE
8. INSPECTION: FOLLOWING INSTALLATION WATER LINES SHALL BE CLEANED AND VISUALLY INSPECTED AND TESTED ACCORDING TO TOWN OF SALEM SPECIFICATIONS.
9. UNSUITABLE MATERIAL & OVER EXCAVATION: ANY EXCAVATION OUTSIDE OF DEFINED PAY LIMIT SHALL BE STRICTLY COORDINATED AND MEASURED WITH THE ENGINEER FOR PAYMENT. ANY MATERIAL REMOVED WITHOUT PRIOR AUTHORIZATION SHALL NOT BE PAID. EXCAVATION AREAS SHALL BE BACKFILLED WITH APPROPRIATE BEDDING MATERIALS. UNSUITABLE REMOVAL AND REPLACEMENT WITH GRANULAR MATERIAL WITHIN TRENCH PAY LIMITS IS SUBSIDIARY.
10. MATERIAL SHALL BE REPLACED IN KIND OF WHENEVER POSSIBLE.
11. SUITABLE MATERIAL: IN ROADS, ROAD SHOULDERS, WALKWAYS AND TRAVELED WAYS, SUITABLE MATERIAL FOR TRENCH BACKFILL SHALL BE THE NATURAL MATERIAL EXCAVATED DURING THE COURSE OF CONSTRUCTION, SHALL EXCLUDE DEBRIS, PIECES OF PAVEMENT, ORGANIC MATTER, TOP SOIL, ALL WET OR SOFT MUCK, PEAT OR CLAY, ALL EXCAVATED LEDGE MATERIAL AND ALL ROCKS OVER SIX INCHES IN THE LARGEST DIMENSION, OR ANY MATERIAL WHICH, AS DETERMINED BY THE TOWN OF SALEM DEPARTMENT OF ENGINEERING, WILL NOT PROVIDE SUFFICIENT SUPPORT OR MAINTAIN THE COMPLETED CONSTRUCTION IN A STABLE CONDITION. SUITABLE MATERIAL SHALL BE PLACED IN 6" LIFTS AND THOROUGHLY COMPACTED.
12. COMPACTION: BACKFILL OF THE TRENCHES SHALL BE COMPACTED TO TO 95% MAX. DRY DENSITY UNDER ALL PAVED AREAS AND 92% MAX. DRY DENSITY UNDER OTHER AREAS IN ACCORDANCE WITH NHDOT STANDARD SPECIFICATIONS - SECTION 304.
13. IF TRENCH BOTTOM IS DISTURBED THEN CONTRACTOR SHALL COMPACT AS APPROPRIATE.
14. WHERE ROCK IS ENCOUNTERED IN TRENCH EXCAVATION, ALLOWABLE PAY LIMIT SHALL BE AS DEFINED IN THE CHART SHOWN IN THIS DETAIL TO 12-INCHES BELOW PIPE.
15. BRASS WEDGES SHALL BE INSERTED AT THE JOINTS OF ALL PUSH-ON DUCTILE IRON PIPE. SEE SPECIFICATION FOR PLACEMENT AND NUMBER AT EACH JOINT. (SUBSIDIARY TO PIPE ITEM)
16. MOUNDING UNDER THE PIPE SHALL BE PROVIDED AT THE TIME OF PIPE INSTALLATION TO ENSURE PROPER PIPE ALIGNMENT, LEVEL TRENCH BOTTOM, AND PROPER DEPTH OF SAND BEDDING.



PIPE
18"
MOUNDING DETAIL
SEE NOTE 15

Typical Water Trench Detail

NO SCALE

DATE:
02/21

DWG.
E1

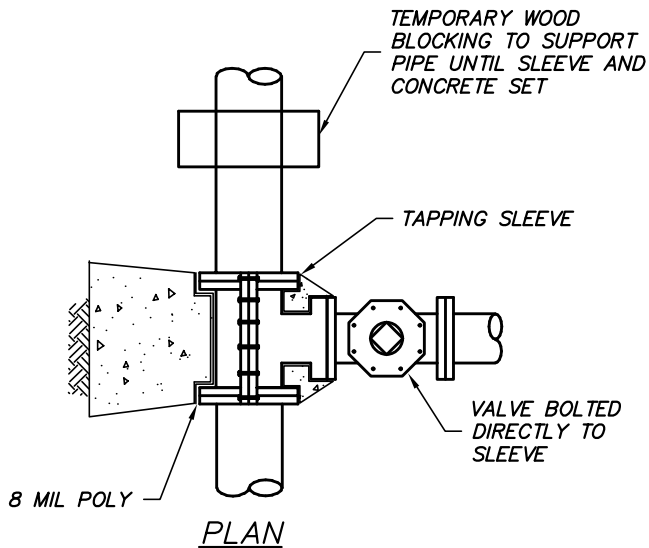
JOB NO.

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SCALE:
N.T.S.

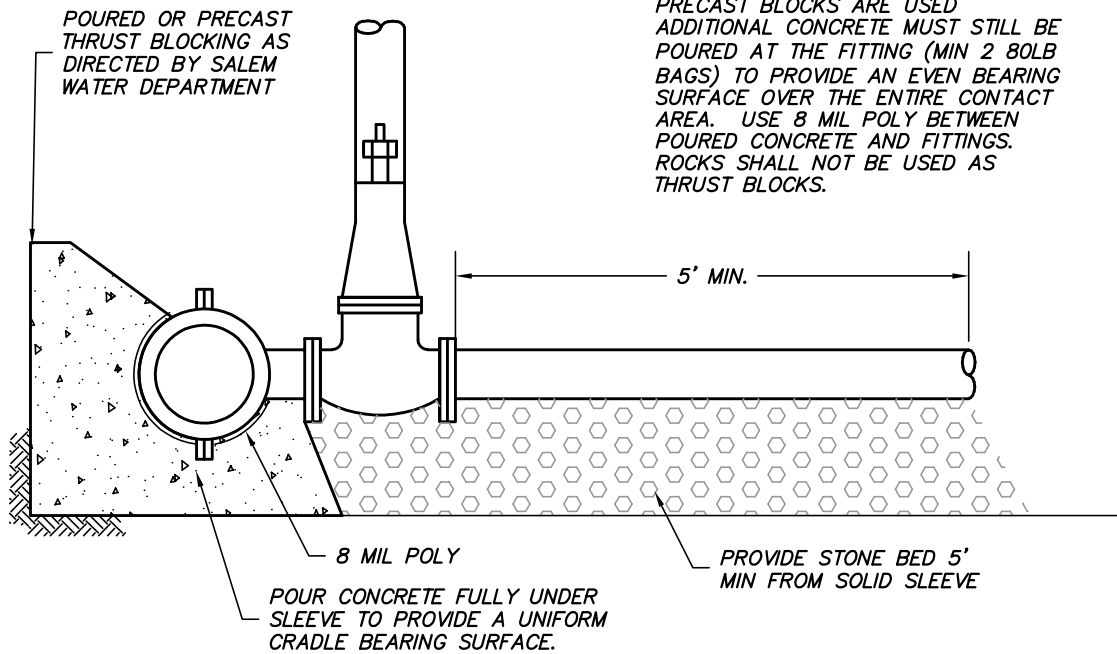
TOWN OF SALEM
ENGINEERING DEPARTMENT
33 GEREMONTY DRIVE
SALEM, NH 03079

WATER TRENCH




NOTES:

1. ALL MATERIAL AND INSTALLATION PROCEDURES WILL CONFORM TO TOWN OF SALEM TECHNICAL SPECIFICATIONS.
2. ALL PIPE SHOULD HAVE A MINIMUM DEPTHS OF 5' FROM TOP OF PIPE TO FINISH GRADE.
3. ALL JOINTS SHALL BE MEGA-LUG CONSTRUCTION.
4. PROVIDE MIN 2'x2'x4' PRECAST OR POURED CONCRETE THRUST BLOCK AGAINST UNDISTURBED EARTH - SIZE TO BE BASED ON SIZE OF FITTING AND PRESSURE IN WATER MAIN. WHERE PRECAST BLOCKS ARE USED ADDITIONAL CONCRETE MUST STILL BE POURED AT THE FITTING (MIN 2 80LB BAGS) TO PROVIDE AN EVEN BEARING SURFACE OVER THE ENTIRE CONTACT AREA. USE 8 MIL POLY POURED CONCRETE AND FITTINGS. ROCKS SHALL NOT BE USED AS THRUST BLOCKS.



SECTION

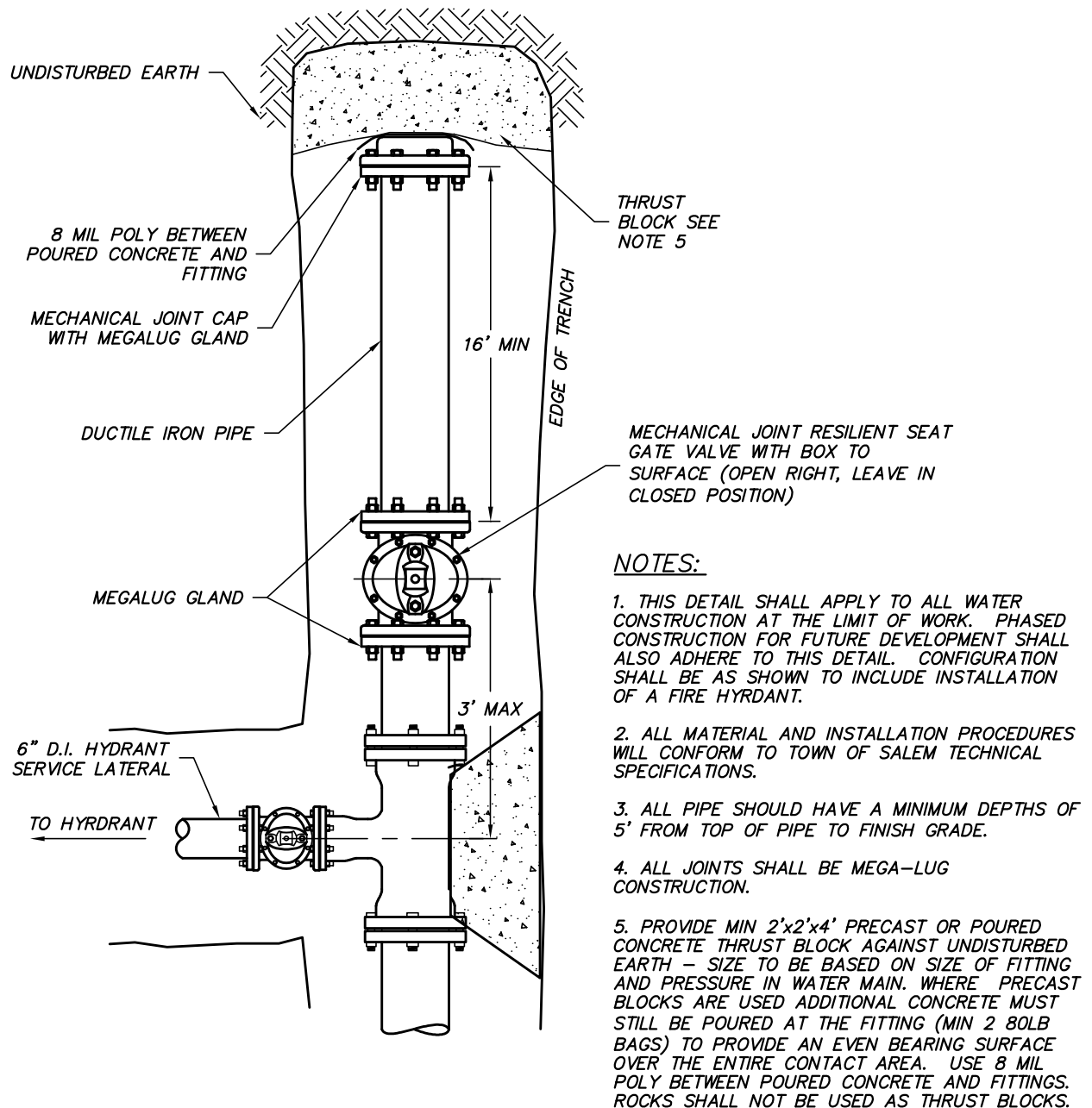
 **Water Tapping Sleeve**


NO SCALE

DATE: 02/21	JOB NO. —
DWG. E2	SCALE: N.T.S.

TOWN OF SALEM
ENGINEERING DEPARTMENT
33 GEREMONTY DRIVE
SALEM, NH 03079

TAPPING SLEEVE



 Typical Water End of Main Installation

NO SCALE

DATE: 02/21	JOB NO. —
DWG. E3	SCALE: N.T.S.

TOWN OF SALEM
ENGINEERING DEPARTMENT
33 GEREMONTY DRIVE
SALEM, NH 03079

WATER MAIN STUB

SPECIAL PROVISION

SECTION 611 -- WATER SYSTEM INSTALLATION

Description

1.1 This work shall consist of all plant, labor, equipment, and materials, and performing all operations in connection with the furnishing and installing pipe, pipe fittings, specials, jointing, encasement materials, and accessories, of various sizes, classes, joints and types, and appurtenant work, at the locations and to the lines and grades indicated, complete in place in accordance with the plans and as specified herein or as ordered.

1.1.1 The Contractor shall furnish all materials, labor, tools and equipment, and perform all operations, testing, disinfection, flushing, and incidentals necessary for a complete operating water main installation, as outlined herein and on the plans and setting up and maintaining a temporary water system to maintain water service at all times, except for authorized shutdowns approved by the Salem Water Department. The Contractor shall be fully responsible for achieving the specified test results and shall submit results of pressure and leakage tests and bacteriological tests to certify compliance with the Specifications.

1.2 This work shall consist of all plant, labor, equipment, and materials, and performing all operations in connection with the furnishing, installing and testing of valves and appurtenances at the locations indicated and/or as directed, complete in place, in accordance with the Drawings and Specifications.

1.3 This work shall consist of furnishing of all plant, labor, equipment, appliances, and materials, and performing all operations in connection with individual water services including but not limited to furnishing, installing and testing of pipe, pipe fittings, corporations, curb stops, jointing materials, and accessories of various materials, sizes, classes, joints, and types and appurtenant work, complete in place, in accordance with the Drawings and Specifications.

1.4 This work shall consist of furnishing of all plant, labor, equipment, and materials, and performing all operations in connection with the furnishing, installing and testing of hydrants and appurtenances at the locations indicated and/or as directed, complete in place, in accordance with the Drawings and Specifications.

1.5 This work shall consist of maintaining continuous water service to affected customers via a temporary water system, except when construction requires an interruption of water service. A service interruption may last for a maximum of six hours. The Contractor must obtain written approval from the Owner prior to interruption of water service to affected water users.

1.6 This work shall also consist of removal and salvage of all hydrants, valves, fittings, pipe, curb boxes, and any other system component in accordance with the plans and as specified herein or as ordered.

1.7 At project close-out, submit record drawings showing locations of installed services to include at least two swing ties to fittings, bends, corporation stops, curb stops, existing water system components discovered or known, sketches at adjacent structures, and any other information as may be required by the Salem Water Department. Record drawings shall be subsidiary to water system items. Swing ties shall be from permanent points such as building corners, property markers, manholes, hydrants, and

other existing water system components. Unacceptable swing tie points are those subject to movement such as signs, pavement corners, fences, and utility poles.

1.7.1 Record Drawings shall consist of any and all information as may be required by the Salem Water Department necessary for accuracy in locating water system components. Necessary information shall include, but is not limited to various swing tie information as identified in Paragraph 1.7; material size, type, and configurations; ledge locations and elevations; depth from grade and elevations of any and all system components; pipe elevations every 50-feet; any necessary dimensioning as may be required to determine the path and location of the water main; sketches adjacent to structures, pipes, utilities, any type of crossing, and similar conflict points.

Materials

2.1 The Contractor shall provide the following material for the installation of the water mains, services, and appurtenances. Any material which does not conform to the requirements of these Specifications shall be immediately removed from the site and replaced by the Contractor without compensation.

2.1.1 Common Backfill. Common backfill shall be granular material, consisting of hard sand and gravel meeting NHDOT Item 209. Common backfill shall conform to NHDOT Item 209.1.

2.1.2 Sand Bedding and Blanket. Sand bedding and blanket material required for installation of the water mains, services, and appurtenances shall meet NHDOT Item 304.1.

2.1.3 Gravel Fill. Gravel fill shall meet material requirements of NHDOT Item 304.2 and consist of hard, durable gravel free from trash, organic matter, clay, surface coatings, and other deleterious materials.

2.1.3.1 When approved by the Owner, gravel fill used for pipe bedding shall have a maximum stone size of 1-1/2 inches (37.5 mm).

2.1.4 Crushed Gravel. Crushed gravel shall meet material requirements of NHDOT Item 304.3 and consist of hard durable sand and gravel, free from trash, organic matter, clay, surface coatings, and other deleterious materials.

2.2 Water Mains and Appurtenances. All products and materials shall conform to the Town of Salem Water Department requirements and to the latest appropriate section of American Water Work Association (AWWA) and American National Standards Institute (ANSI) Standards and as otherwise specified hereinafter.

2.2.1 Handling and Storage: Pipe and accessories shall be kept in a sound, undamaged condition. Pipe and accessories shall, at all times, be handled with care and shall not be bent, dropped, dumped or bumped against any other object. Only nylon-protected slings shall be used for handling the pipe. No chains, hooks or bare cables will be permitted during the handling or installation of pipe. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors. Damaged material shall be replaced at no cost to the Owner, at any time during the construction that the damage is identified or occurs. Pipe shall be stored off the ground at a height no greater than 5 feet, and with even support for the pipe barrel.

2.2.2 Ductile Iron Water Main Pipe:

2.2.2.1 Class 52 push-on type ductile iron water pipe - Water pipe for shall be minimum 18-foot long ductile iron complying with ANSI A21.51 and AWWA C 151, Class 52. Pipe shall be double cement-lined 1/8" (3 mm) thick and seal coated inside and out in accordance with ANSI A21.4 and AWWA C 104. All pipe shall be marked with the class, thickness designation and initials of the manufacturer. Joints shall be mechanical joints or rubber gasket, push-on type in accordance with ANSI A21.11 and AWWA C 111. Use only lubricant that is specified by the pipe manufacturer.

2.2.2.1.1 Pipe shall be furnished with necessary materials and equipment recommended by the manufacturer for use in joining pipe lengths and fittings.

2.2.2.1.2 Pipe shall be manufactured in the United States by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, Griffin Pipe Co., or approved equal.

2.2.2.1.3 In accordance with Section 01300 of the Contract Specifications the Contractor shall submit manufacturer's certificates of compliance with these Specifications and certification that ductile iron pipe has been tested at the foundry with the Ball Impression Test, Ring Bending, or approved equal.

2.2.2.2 Mechanical Joint Ductile Iron Pipe for use on bridge crossings shall conform to ANSI A21.51/AWWA C 151 Class 52. Mechanical joint fittings shall be ductile iron conforming to ANSI A21.10/AWWA C 110. Pipe and fitting joint shall meet ANSI A21.11/AWWA C 111 standards and shall include plain rubber gaskets. Pipe and fittings shall be double cement lined and seal coated inside and outside in accordance with ANSI A21.4/AWWA C 104. All pipe and fittings shall be furnished with ductile iron retainer glands.

2.2.2.3 Flanged joints will be made with bolts, bolt studs with a nut on each end or studs with nuts where the flange is tapped. The number and size of bolts will conform to the same ANSI Standard as the flanges. Bolts and nuts will, except as otherwise specified or noted on the drawings, be Grade B conforming to the ASTM Standard Fasteners, Designation A307. Bolts and studs will be of the same quality as machine bolts. Flanged ductile iron pipe from 3 to 48 inches in diameter will be classified by Underwriter Laboratories, Inc., in accordance with ANSI/AWWA C115/A21.15, latest edition.

2.2.2.4 Alternate pipe material: In general all new pipe installations shall be ductile iron as described in this section. However; in some cases the Town of Salem Water Department may allow alternate pipe material based on a specific need such as very aggressive and corrosive soils or avoiding open cuts in environmentally sensitive areas such as wetland crossings. Use of alternate pipe materials will be solely at the digression of the Salem Water Department.

2.2.2.4.1 Tracer wire: Where alternate pipe material such as plastic is authorized by the Salem Water Department tracer wire shall be installed. Wire shall be 10-gage high-tensile strength as manufactured by BMS, Division of Ablestar Corporation, Avon, MA, or equal. Tracer wire shall be subsidiary to the pipe item number.

2.2.3 Brass Wedges. Brass wedges shall be installed in all push-on type joints to provide electrical conductivity between pipe lengths. For pipe sizes 4" to 12" the Contractor shall install two brass wedges 180-degrees apart at the 3 o'clock and 9 o'clock position. For pipe sizes 14" to 24" the Contractor shall install 4 wedges (2 pairs) 180-degrees apart at the 3 o'clock and 9 o'clock position. Brass wedges shall be subsidiary to the pipe item.

2.2.4 Ductile Iron Fittings shall be short body ductile iron Class 350 mechanical joint type with a 350 psi (2.40 Mpa) pressure rating in accordance with ANSI A21.53/AWWA C153, latest edition, for pipe sizes 24 inches and smaller, unless specifically stated otherwise in the Specifications or on the Drawings. Fittings shall have the same lining and coating as the pipe specified above. All fittings shall be marked with the weight and shall have distinctly cast upon them the pressure rating, the manufacturer's identification, nominal diameter of openings and the number of degrees or fraction of the circle on all bends. Fittings shall be manufactured in the United States by U.S. Pipe and Foundry Company, Atlantic States Cast Iron Pipe Co., Clow Corporation, Griffin Pipe Co., or equal. See paragraph 2.3 for thrust restraint.

2.2.4.1 Caps and plugs installed in all new work shall be provided with a $\frac{3}{4}$ inch threaded corporation so that air and water pressure can be relieved prior to future connection. Alternate methods of pressure relief may be approved by the Salem Water Department when requested by the Contractor in writing.

2.2.4.2 Contractor shall provide all adapters, fittings, and couplings as determined in the field, necessary to complete all connections whether or not specifically stated on the Drawings and in the Specifications.

2.2.5 Mechanical Joint Restraining Devices shall be used with all mechanical joints. Glands shall be manufactured of ductile iron conforming to ASTM A 536. The ring shall be grade 65-45-12 ductile iron in accordance with ASTM A 536. Mechanical Joint restraining devices shall be Mega-Lug as manufactured by Ebaa Iron Co., or equal. Restraints for push-on joints shall be "fieldlock" wedge gaskets manufactured by US Pipe, or approved equal. Restrained mechanical joints shall be furnished for installation on all fittings, valves and hydrants. At a minimum, restrained joints shall be furnished for installation on all push-on joints for pipe adjacent to fittings, valves and hydrants according to the following:

1. For pipe adjacent to tees, restrain all branch pipe joints within 18 linear feet of tee.
2. For pipe adjacent to 45° bends, restrain all pipe joints within 15 linear feet of bend.
3. For pipe adjacent to 22.5° bends, restrain all pipe joints within 2 linear feet of bend.
4. For pipe adjacent to 11.25° bends, restrain all pipe joints within 1 linear feet of bend.
5. For pipe adjacent to valves, restrain all pipe joints within 24 linear feet of valve.
6. For pipe adjacent to caps, restrain all pipe joints within 24 linear feet of cap.
7. Restrain all pipe joints located between anchor tee and hydrant.

Note: these recommended distances are a minimum standard and shall be verified with AWWA M41 design criteria when considering soil conditions, pipe size, and bury depth.

2.2.5.1 Push on Joint Restraint may be authorized and/or required under specific guidance of the Salem Water Department. Where authorized, restraint at push-on pipe joints shall be Field-Lok 350 gaskets.

2.2.6 Couplings shall be Class 350 mechanical joint solid sleeve-type couplings for plain-end pipe shall be provided with plain rubber gaskets and steel tee-head bolts with nuts. This type coupling will be used for all new pipe to new pipe connections requiring couplings, and all new pipe to existing

pipe of the same outside diameter connections requiring couplings. All couplings located within areas of restrained joints shall be restrained with bituminous coated tie-rod assemblies.

2.2.6.1 Couplings or adapters as required for connecting new pipe to existing pipe of varied outside diameters will be ductile or cast iron type and furnished as required and designed for compatibility with the pipe and operating pressures encountered. Couplings will be Smith-Blair "441", Romac "501" or approved equal.

2.2.6.2 Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe. The gaskets shall have metallic tips to provide electrical continuity through the joint.

2.2.6.3 Couplings for exposed pipe shall be of steel and shall be Dresser Style 38, Smith-Blair Style 411, Baker Allsteel, or equal. The couplings shall be provided with steel bolts and nuts.

2.2.7 Gate Valves shall be in accordance with AWWA C 509 or C 515, current version. Gate valves shall be resilient-wedge type with a non-rising bronze stem, 2-inch (50 mm) AWWA operating nut, double O-ring seals (two above and one below the thrust collar), and ferrous coated surfaces with a fusion bonded epoxy coated both inside and out conforming to AWWA C550, latest revision. The valves shall be Model R/W as manufactured by Clow Corporation, AFC, Kennedy, M&H, Mueller, or equal. Valves shall open right.

2.2.7.1 Resilient wedge valves shall be iron body, bronze mounted, resilient seated type, with mechanical joint ends. The valves shall be designed for 200 psi working pressure and 400 psi test pressure.

2.2.7.2 Wedge rubber will be molded in-place and bonded to the ductile iron portion. The wedge rubber will not be mechanically fastened with screws and rivets or similar fasteners.

2.2.7.3 Gate valves shall have restrained mechanical joints as specified above.

2.2.7.4 Valve operating nuts with depths from finish grade of more than 5 feet, must have an approved operating nut extension.

2.2.8 Tapping valve and sleeve. Tapping valve shall be as herein specified for gate valves and in accordance to AWWA C223-07. Sleeves shall be ductile iron, flanged by mechanical joint and designed to fit transite, AC, ductile or cast iron pipe. Tapping sleeves shall be flanged along the vertical centerline and furnished with o-ring gaskets. All exposed portions of any bolts shall be bituminous coated. Tapping sleeve and valve shall be as manufactured by Mueller Company or U.S. Pipe Company. The Contractor may use stainless steel in-lieu sleeves in-lieu of ductile iron components.

2.2.9 Butterfly Valves shall be in accordance with AWWA C 504. Butterfly valves shall be used for size 18 in and above. The valves shall be Henry Pratt Co. 'Groundhog', Dresser 450BF, or Allis-Chambers 'Steamseal'.

2.2.10 Valve Boxes shall be cast iron, tar coated, sliding, heavy pattern type, consisting of three (3) pieces; a flanged bell type base section; a top flange type upper section; and a cover with two lifting holes and the word "WATER" cast on the top. A minimum 6-inch overlap is required between sliding sections. The upper section shall have a bottom flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve. The inside diameter of boxes shall be a minimum 5-1/4 inches. Section lengths shall be as necessary to

suit ground elevation. Valve boxes shall be Caldwell #664 by Tyler Pipe, #5664 by Central Foundry, Bibby V683STF, or approved equal. Valve boxes shall be provided for each buried valve.

2.2.11 Hydrants and Appurtenances:

2.2.11.1 Hydrants shall have a rated working pressure of 200 psi and test pressure of 400 psi and shall conform to the latest revision of AWWA C502. Hydrants shall be equipped with a main valve opening of 5-1/4 inches and a standpipe or barrel diameter of 8-1/2 inches, with drains left unplugged and unobstructed to allow barrel to drain, one 4½-inch National Standard pumper connection, and two 2½ inch National Standard Thread hose connections. Each hydrant shall be equipped with a gate valve on the branch line as specified herein.

2.2.11.2 Hydrants will be marked with an arrow and the word "open" to indicate the direction to turn the stem to open the hydrant. Hydrants shall open right (clockwise).

2.2.11.3 Hydrants shall be traffic models, draining type with a 66-inch depth of bury (bottom of pipe) as indicated on the Drawings. Hydrants shall be American Darling Model B-62-B, with a 6" mechanical joint inlet connection to the main. Hydrants shall have been manufactured no earlier than one year prior to installation.

2.2.11.4 Hydrant tees shall have a rotatable mechanical joint gland on the 6-inch plain end branch to provide positive valve restraint, unless otherwise directed by the Engineer.

2.2.11.5 Valves to be used on hydrant branches shall be connected directly to anchor tees and shall be compatible for use with the anchoring tee.

2.2.11.6 Hydrants shall be thoroughly cleaned and given two shop coats of paint in accordance with AWWA Specification C 502. Paint color shall be the standard hydrant color of the Salem Water Department, **Benjamin Moore Industrial Urethane Alkyd Gloss, Safety yellow, M22-15**. Hydrants shall be touched up with paint as required after installation.

2.2.11.7 Blow-off hydrants shall be Model No. 500-B, as manufactured by Kupferle Foundry, or approved equal

2.2.12 Corporation Stops shall meet the most recent version of the AWWA standard "Threads for Underground Service Line Fittings" (AWWA C800). Corporation stops shall be bronze, ball type, designed for the specified service tubing and shall be suitable for 175 psi test pressure. Inlet threads shall be AWWA (CC) type thread. End connections shall be compression type joint. Stops shall have full keyway. Corporation stops shall be Mueller 110, Model H-15008 as manufactured by Mueller, Inc., or approved equal.

2.2.13 Service Saddles shall be required for corporation stops in accordance with paragraph 3.10 herein. 2-inch taps shall be Smith Blair 317 Double Strap, or equal. Bodies shall be ductile iron, epoxy coated with double stainless steel straps. Units shall be complete with Buna-N gaskets.

2.2.14 Service Pipe: Unless otherwise approved, all pipe for services shall be Type K Annealed (soft) seamless copper tubing for buried service. Tubing shall be manufactured in the United States and shall meet the requirements of Federal Specification WW-T 7996 and will conform to the provisions of ASTM B-88, B-75, and B-68 as they apply to Type K copper tubing. Tubing shall conform to AWWA 800. The name of trademark of the manufacturer and type shall be stamped at intervals along the pipe.

2.2.15 Curb Stops shall meet AWWA 800. Curb stops shall be quarter-turn ball valve type. Curb stops shall have compression type connections suitable for use with copper tubing hereinbefore specified and designed to ensure conductivity through the fitting. No stop and waste ports are permitted. Curb stops shall be Mueller 110, Model 300 B-25209 as manufactured by Mueller, Inc., or approved equal.

2.2.16 Curb Boxes For all 2" or smaller services, curb boxes shall be cast iron Erie Style slide type for 4-1/2 foot to 5-1/2 foot cover. The curb box shall have a plug-type cover and 24" x 5/8" heavy duty stainless steel rod. The cover shall be clearly marked "WATER".

2.2.17 Service Pipe Couplings and Fittings: Unless otherwise approved only compression type fittings manufactured by Mueller Inc. or equal shall be installed. Couplings and adapters required to allow connection to existing services shall be provided by the Contractor as required. The Contractor shall provide all couplings, adapters and fittings necessary to complete all connections, whether or not specifically stated in the Drawings and Specifications.

2.2.18 Temporary Water Main and Fittings shall be as approved by Town of Salem Water Department. The Contractor shall submit in writing a temporary water service plan depicting layout, connection points, sizes, materials, system protections, and any other item as may be required by the Salem Water Department. All materials shall meet the requirements of this specification, manufacturer specification, and the Salem Water Department.

2.2.19 Temporary Service Pipe and Fittings shall be as specified in paragraphs 2.2.10, 2.2.11, 2.2.12, 2.2.13, 2.2.14, and 2.2.15.

2.3 Thrust blocks will be installed at all hydrants, fittings and bends and will be constructed with poured concrete meeting Class B material specification identified in NHDOT Item 520. Location and size of thrust blocking shall be as required by the Town Engineer and in accordance with the plans. In certain circumstances, and subject to prior approval by the Owner, precast concrete thrust blocks may be utilized. The Contractor shall provide no less than (2) 80-lb bags of concrete with 8 mil poly to form a cradle between the precast block and water appurtenance. See Salem typical water details for sizing requirements.

2.3.1 Large rocks or boulders shall not be used as thrust blocks.

2.4 Trench insulation shall be rigid extruded polystyrene 8 feet long, 2 feet wide and 2 inches thick (2.45 m long, 0.6 m wide, 50 mm thick,) having an in-place density of 2.5 pcf, and a "K" factor of 0.14 BTU/in./hr./°F/sq. ft and conforming to ASTM C 578, Type VII, and shall be STYROFOAM HI-60 as manufactured by Dow Corning Chemical Co. or approved equal.

2.4.1 Straight joints between insulated pipe lengths, and the end sections of non-insulated pipe shall be sealed with heat shrinkable wrap-around polyethylene as supplied by the manufacturer and field installed by the Contractor.

2.4.2 Insulation jacket shall be 20-gauge corrugated aluminum pre-formed to be fastened with stainless steel screws and bands. Jacket shall have one layer of one mil polyethylene film with a protective coat of 40-lb. virgin kraft paper to act as a moisture and galvanic corrosion barrier.

2.4.3 Insulation shall be manufactured by Thermal Pipe Systems, Braintree, Massachusetts, Atlas Insulation, Ayer, Massachusetts or Insulated Piping Systems Inc., Canton, Massachusetts, or other approved manufacturer

2.5 Casing Pipe. Casing pipe where used shall be steel and shall be in accordance with AP1 STD.5L, Grade B, X-42, ASTM A 139. Alternate materials may be submitted to the Town of Salem Water Department for approval for use.

2.5.1 Casing Pipe:

<u>Description</u>	<u>150 mm (6") Carrier Pipe</u>
Yield Strength (min)	35,000 psi (241 Mpa)
Type of Joint	Butt Welded
Type of Coating	None

2.5.2 Tolerance - Out-of-round tolerance shall not exceed 0.50 inches (12.5 mm).

2.5.3 Pipe Spacers shall be a two-piece 14-gauge (1.90 mm) T-304 stainless steel assembly with stainless steel bolts. Assembly shall be the restrained positioning type. The runners shall be a ultra high molecular weight polymer with a maximum coefficient of friction 0.12. The assembly shell liner shall be 0.090" (2.3 mm) ribbed PVC with 85-90 durometer. Spacer assembly shall be as manufactured by Cascade Waterworks MFG. Co. or approved equal.

2.5.4 Carrier Pipe shall be mechanical joint steel. The contractor shall submit a material specification for approval prior to acquisition of pipe. Alternate materials may be submitted to the Town of Salem Water Department for approval for use.

2.5.5 Bulkhead Materials shall be one of the following: (see plan for type)

2.5.5.1 Brick and Mortar. Brick for bulkheads shall be sound, uniformly burned and shall comply with ASTM C 32, Grade SA. Mortar shall consist of one part cement, one-quarter part lime, and two parts sand. Sand shall comply with ASTM C 144; lime shall comply with ASTM C 207, Type S; cement shall comply with ASTM C 150, Type II.

2.5.5.2 Plug. Water mains to be abandoned shall be plugged with appropriate size and type of fitting approved for use by the Town of Salem Water Department.

Construction Requirements

3.1 General. The Contractor shall furnish all water main pipe, fittings, services and related material and appurtenances, labor, tools and equipment, granular material, and concrete; and perform all operations and incidentals necessary for complete excavation, installation, backfill, and testing as outlined herein and on the plans; and maintain service at all times. Additionally, the Contractor shall provide all adapters and fittings, as determined in the field, necessary to complete all connections whether or not specifically stated on the Drawings and in the Specifications

3.1.1 Contractor to coordinate all water service work with Town of Salem Water Department. Contractor shall not operate any water system valves or curb stops without the express permission of the Owner or Engineer. **Operation (opening/closing) of any water main valve, service shut-off or**

hydrant that is supplied water by the Salem Municipal Water System, without express written consent of the Utilities Manager shall be considered unauthorized entry to the water system and therefore subject to the rules and fines as specified in Chapter 304, Section 7, Paragraph C of Salem Town Codes and Section 1-4. 4.1 Of the Salem Fire Prevention Code Ordinance of 1996.

3.1.2 The Contractor shall be responsible for the layout of the work. The temporary and permanent water mains, service connections and appurtenances shall be built at the locations indicated on the plan to facilitate reconstructing other facilities within this area of the project.

3.1.3 The Contractor shall be responsible to field locate all existing water services for the purpose of connecting them to the proposed mains. This may involve exploratory test pits of which payment may be made under NHDOT Item 206.19; as directed by the Engineer.

3.1.4 Location of new water services for all lots throughout the project area as part of the new water line will be as determined by the Owner.

3.1.5 Prior to the start of work the Contractor shall be familiar with all existing conditions regardless of information shown on the plan. Conflict points of known conditions (crossings, services, drainage, sewer, gas, other utilities, etc.) shall be found and resolution be determined. Where work has proceeded without determining potential conflict points and subsequent resolution, the Contractor shall be responsible for any and all necessary re-installation, supplemental fittings or components, and repair without compensation.

3.1.6 Care shall be taken to prevent damage to water system components during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials, all debris and foreign material shall be cleaned out of valve openings, all operating mechanisms shall be operated to check their proper functioning, and all nuts and bolts shall be checked for tightness. Water system components which are damaged, do not operate easily, or are otherwise defective, shall be repaired or replaced to the satisfaction of the Owner and Engineer at no additional cost to the Owner.

3.1.7 The Contractor shall maintain the water system, surrounding property, utilities, roadway, natural resources, etc.. Consequential damages resulting from the Contractor not locating the facilities as shown on the plan are the responsibility of the Contractor and shall be restored or replaced at no cost to the Owner. The Contractor shall immediately notify the Engineer, Owner and utility authority in the event of an emergency water main break.

3.1.8 The Contractor, at the completion of each part of the work, shall furnish the as-built locations of the water main and appurtenances referenced to the Construction Base Line and Bench Marks. The as-built locations shall be to an accuracy of plus or minus 0.10 feet (0.03 m) in plan and elevation. As-built drawings shall include swing ties to services boxes and locations of corporations and any other information required by the Salem Water Department as outlined in Paragraph 1.7.

3.1.9 Any deviations from the locations shown on the plans require the Owner's and the Engineer's approval. Any discrepancies with locations shown on the plans will be brought to the Engineer's attention and subsequently resolved between the Owner, the Engineer and the Contractor.

3.1.10 Salvaged items shall be delivered to the Town of Salem Water Department. No additional compensation shall be granted for delivery of items.

3.1.11 Testing: All testing and disinfection procedures shall be in accordance with paragraphs 3.12 & 3.13 below. Prior to testing and disinfecting the water lines, the Contractor shall submit a plan on the method of flushing, testing and disinfecting for review. The plan will include the name of the qualified third party testing company, which will perform the testing and disinfection and the qualified third party testing company and/or laboratory that will be taking and analyzing samples for bacteriological testing to meet verification requirements.

3.2 Temporary Water System:

3.2.1 Notice. Contractor shall coordinate with Town of Salem water department to provide a forty-eight (48) hour notice to the affected residents for disruptions in service. The Town of Salem will be responsible for contacting all water users regarding any disruption in service related to the installation and removal of by-pass and temporary service piping.

3.2.2 Temporary Main and Service Locations and Size:

3.2.2.1 The temporary main shall be installed as shown on the Drawings or as determined by the Engineer and Owner in the field.

3.2.2.2 Services to be connected to the temporary main shall be identified and coordinated by the Contractor and Engineer prior to the start of work to ensure all users maintain service in the area(s) of the shut down.

3.2.3 Temporary Water Installation:

3.2.3.1 New temporary services shall be connected to existing service piping and installed in accordance with these specifications. Materials shall be as specified herein and shall include piping, saddles, corporation stops, copper tubing and compression couplings.

3.2.3.2 The temporary system shall be pressure and leakage tested and disinfected in accordance with applicable AWWA specifications.

3.3 Trench Excavation:

3.3.1 General. Excavation shall be carried out in such a manner as to eliminate any possibility of undermining or disturbing the foundations of any existing structure or utilities.

3.3.2 The trench shall conform to Town of Salem Typical Water Trench Detail and NHDOT Item 206 - Structure Excavation for pipes and other minor structures. The Contractor shall provide trench shoring and dewatering, as necessary, to provide a stable and dry trench at all times in accordance with standard trenching practices. Where standard trenching practices are not adequate to maintain a dry and stable trench refer to Field Engineering, Section 01050 of the Contract Specifications for Unfavorable Construction Conditions.

3.3.2.1 Excavations shall be kept dry until the pipes and appurtenances to be built therein have been completed to the extent that they will not be damaged. Dewater activities shall maintain a ground water level at least 18-inches below the pipe or structure. Discharge shall be in accordance to local, state, and federal erosion control and treatment practices. Contractor shall obtain any necessary permits and shall assume full responsibility of his operation and any damage caused by it. Dewatering activities are incidental to applicable unit items.

3.3.2.2 Treatment of Dewatering Operations Discharges: Provide such additional treatment devices as may be required to meet the provisions of the Contract. This may include the construction of sumps and/or settling basins, stone rip-rap, silt fences or other requirements. The treatment devices shall be later removed and/or filled in with acceptable backfill material, and restored to original conditions once they are no longer needed. Unless specifically provided for all work and material associated with treatment of dewatering shall be at no additional cost to the Owner.

3.3.2.3 Trenching support practices shall be in accordance with all OSHA requirements.

3.3.3 The Contractor shall not be compensated for any additional work involved if a utility line, water line, sewer line or underground structure is in the trench line above or below the water main, except where specifically identified on the Drawings as a pay item or as approved by the Engineer. All other work adjacent to utilities shall be subsidiary. Any damage to the same shall be repaired to the owning entity's satisfaction at no cost to the Owner.

3.3.4 Over-Excavation. If, in the opinion of the Engineer together with the Owner, the material at or below the depth of the trench is unsuitable for foundation, it shall be removed to such depths as directed by the Owner and Engineer and shall be replaced with Granular Backfill (sand), conforming to NHDOT paragraph 209.2.1.1 and placed as provided in NHDOT Item 209.3. See Typical Water Trench Detail on Design Drawings.

3.3.5 If the bottom of the excavation is deeper than the depth shown on the drawings by error of the Contractor, the condition shall be corrected by refilling to the proper grade with compacted Granular Backfill (sand), conforming to NHDOT paragraph 209.2.1.1. All costs shall be borne by the Contractor.

3.3.6 Rock and Boulder Excavation. Rock and boulder excavation shall be in accordance with NHDOT "Section 206, Structure Excavation for Pipes and Other Minor Structures." Pay items for rock and boulder excavation shall be as identified on contract drawings and bid. Where no item exists for Rock Structure Excavation, NHDOT Item 206.2, then it shall be paid under Rock Excavation, NHDOT Item 203.2.

3.3.7 Excess and Unsuitable Excavation. Excess excavation that will not be used for backfill and unsuitable excavation shall be removed from the site and disposed of by the Contractor in accordance with local, state or federal regulations and as identified in respective unit items.

3.4 Trench Backfill:

3.4.1 General. After the pipe has been placed and has been inspected by the Owner together with the Engineer, backfilling shall be performed without delay.

3.4.2 Bedding. Bedding shall meet the requirements of paragraph 2.1.2 and shall extend the full width of the trench from 6 inches below the pipe to 12 inches above the pipe crown. Compact the bedding material to 95% modified proctor (in accordance with ASTM D 157 and ASTM D 2922) in 6-inch lifts or less with approved hand-operated devices. Bedding shall be carried up evenly on both sides of the pipe, so as not to disturb the pipe.

3.4.3 Backfill. Trench shall be backfilled with common backfill defined in paragraph 2.1.1 as approved by the Engineer from the top of the bedding to the underside of the pavement select material profile, or to the underside of loam and grassed areas.

3.4.3.1 Backfill shall be placed and compacted in layers of 6 inches or less. Compact the backfill material to 95% modified proctor (in accordance with ASTM D 157 and ASTM D 2922). Compaction shall be by hand-operated compactors or other approved method.

3.4.3.2 Tamping and compacting of trenches with excavating machines, including plate compactor attachments, is prohibited.

3.4.4.3 Trench areas improperly backfilled or having excessive settlement, as determined by the Engineer, shall be reopened to the required grade, backfilled using proper techniques, and repaved as necessary. The Contractor shall receive no additional compensation for repair of trenches, inclusive of necessary surface treatment, constructed under this Contract.

3.5 Pipe Installation:

3.5.1 Installation. Installation of all buried piping, fittings, and adapters shall be in accordance with Town of Salem, product manufacturer, and AWWA Standard for installation of ductile iron water mains and their appurtenances, AWWA C 600, Sections 9b and 9c, latest edition.

3.5.2 Pipe and fittings shall be thoroughly cleaned before they are placed. All lumps, blisters, and excess coal tar coating shall be removed from the spigot and from the interior of the bell, and these surfaces shall be wire-brushed, wiped clean and dry, and be free from oil and grease before the pipe is laid. Any component not kept clean and clear of foreign material may be rejected by the Owner or Engineer.

3.5.3 All pipes and appurtenances laid in open trench excavation shall be bedded and uniformly supported over their full-length on bedding of the types specified herein and shown on the drawings. Pipe and fittings shall be laid accurately to the line and grades. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner. All work shall be performed in a dry trench.

3.5.4 At all times when pipe laying is not actually in progress, the open ends of pipe in the trench shall be closed by temporary water-tight plugs or by other approved means. If water is in the trench when work is resumed, the plug **shall not be removed** until all danger of water and foreign material entering the pipe has passed. The plug shall remain in place until all excavation and bedding has been completed and may only be removed when the next section of pipe (or component) is ready for installation. Contaminated pipe sections shall be appropriately cleaned and disinfected to the satisfaction of the Salem Water Department.

3.5.5 Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection allowed shall not exceed the manufacturer recommendation required for making a satisfactory joint and shall be subject to the approval of the Owner and Engineer.

3.5.6 When pipe is cut in the field, the cut end shall be tapered back approximately 1/8" (3 mm) at an angle of 30 degrees with the centerline of the pipe with a coarse file or grinder to remove any rough edges which might injure the gasket.

3.5.7 For mechanical joints, the spigot shall be centrally located in the bell, and adequate anchorage shall be provided at abrupt changes in direction and at dead-ends. All surfaces in contact with the rubber gaskets shall be brushed thoroughly with a wire brush immediately prior to assembly.

The contact surfaces and gasket shall then be brushed with manufacturer's recommended lubricant prior to slipping the gasket over the spigot and into the bell. Restraining bolts and flange bolts shall be tightened in accordance with manufacturer recommendations following these general guidelines. The Contractor shall use wrenches as recommended by the manufacturer. When tightening bolts, it is essential that the gland be drawn toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Bolts shall be tightened in an alternating star type pattern. Tighten restraining bolts with appropriate hand wrenches or socket wrenches until they shear (Mega-Lug or Uni-flanged joint restraint). Impact wrenches/drivers shall not be used to shear bolt heads.

3.5.8 For push-on joints, all foreign matter in the gasket seat in the socket shall be removed and the gasket wiped clean and flexed before placing in its seat. A thin film of lubricant shall be applied to the inside surface of the gasket. The plain end of the next pipe, after wiping clean, shall be aligned and carefully entered into the socket until it just makes contact with the gasket. Joint assembly shall be completed by forcing the end of the pipe past the gasket until it makes contact with the bottom of the socket. Install brass wedges in joints. See Paragraph 2.2.3 for use of brass wedges. Brass wedges shall be subsidiary to the pipe item.

3.5.9 Restraint: Restrained push-on joints shall be installed with specified joint restraints. Restraints shall be installed in full accordance with the manufacturers written instructions. Fittings and valves equipped with restrained joints as herein specified will not require thrust blocks unless otherwise indicated on the Drawings or directed by the Engineer.

3.5.10 Thrust Blocking: Bends, tees, and other fittings in pipe lines buried in the ground shall be backed up with thrust restraint Class B concrete, 1/2 cubic yard minimum, against undisturbed earth (bearing area as shown on the drawings). Poured concrete thrust blocks shall be placed with wooden side forms. 8 mil polyethylene sheeting shall be placed between water system component and the poured concrete. See Paragraph 2.3 and 2.3.1 for additional thrust block requirements.

3.5.10.1 Where the soil does not provide firm support bridle rods, clamps, etc. shall be provided to brace the fittings properly. All accessories shall be seal-coated thoroughly and heavily with an approved material per AWWA C 104 after assembly and shall be subsidiary to the ductile iron fitting unit price.

3.5.11 Insulation: Use of insulation shall be determined by the Salem water department but, generally insulation shall be installed over water mains having less than 5-feet of cover and as shown on the drawings. Limits of insulation shall be as shown on the drawings or as directed by the Engineer. Insulated pipe **with jacket** where used shall be approved by and coordinated with the Salem Water Department. Insulation and jacket shall extend a minimum of 10 feet beyond the outside edge of all open structures.

3.5.12 Tracer Wire: Where plastic pipe is authorized for installation by the Salem Water Department, tracer wire shall be installed immediately above the pipe. Material shall conform as described in paragraph 2.2.2.4.1 above. Tracer wire shall be subsidiary to the pipe item.

3.5.13 Work Adjacent to Sewer

3.5.13.1 There shall be no physical connection between a public or private potable water supply system and a sewer, or sewer appurtenance which would permit the passage of any sewage or polluted water into the potable supply. No water pipe shall pass through or come in contact with any

part of a sewer manhole. Locate the new water main with a 10-foot horizontal separation between it and the existing or proposed sewer main. Sewer lines damaged or broken during construction shall be repaired immediately by the Contractor. All necessary repairs shall be made prior to the continuation of any water main work. The Engineer, Owner and utility authority shall be immediately notified of any breaks in the sewer lines.

3.5.13.2 With Owner approval, a deviation from the separation requirements of paragraph 3.5.12.1 above may be allowed where necessary to avoid conflict with subsurface structures, utility chambers and building foundations, provided that the sewer is constructed as follows:

3.5.13.3 Sewer pipe shall be Class 52 ductile iron.

3.5.13.4 Joints shall be pressure tested with zero leakage at 25 psi for gravity sewers, and at 1-1/2 times working pressure for force mains.

3.5.13.5 Sewer Crossings: Whenever sewers must cross water mains, pipes shall cross as close to 90-degrees as possible and joints shall be located at least nine feet horizontally from the water main. Vertical separation of the sewer and water main shall be not less than 18 inches. Sewer lines shall be under water lines unless specifically approved by the Owner and Engineer.

3.5.14 Work Adjacent to Gas Main: Ductile iron pipe installed within 5-feet of cathodically protected gas lines shall be fully encased with polyethylene material. Polyethylene encasement for pipe and fittings shall be 8-mils thick and shall comply with AWWA C105.

3.5.15 Abandon Existing pipe in place.

3.5.15.1 Upon receipt of successful testing and chlorination results and after transfer of existing services to the new main, Contractor shall cut and cap existing mains to be abandoned in place as shown on the Drawings and as directed by the Engineer.

3.5.15.2 Contractor shall close all valves on abandoned mains and lines, and remove existing valve boxes prior to final paving.

3.5.15.3 Contractor shall remove existing hydrants on abandoned water mains, cap all hydrant branches and provide thrust restraint.

3.5.15.4 Contractor shall remove and dispose of any thrust blocks and/or any restraints on existing water mains at connections to the new water main.

3.5.15.5 All as-build information associated with the abandonment of water main shall be shown on the Record Drawings as required by Paragraph 1.7 and 1.7.1.

3.6 Casing Installation:

3.6.1 Casing pipe shall be installed by open cut with bedding and cover material as shown on the drawings.

3.6.2 Casing pipe ends shall be beveled with a single V-groove for field welding. Pipe joints shall be butt welded and shall be a full penetration on the outside circumference of the pipe. The single V-groove butt weld shall conform to the latest AWS Welding Code. All joints of the casing pipe shall be butt welded by a welder certified by the State of New Hampshire for the specific application.

3.6.3 If alternate casing pipe materials are used then connections, jointing and fittings shall be in accordance with the Town of Salem Water Department requirements and per manufacturer specifications.

3.7 Carrier Pipe Installation:

3.7.1 After casing pipe has been installed and cleaned of dirt and debris, pipe spacers shall be attached to carrier pipe as shown on the Drawings. As carrier pipe is jointed, it shall be pushed into position inside the casing pipe.

3.7.2 After the carrier pipe has been tested for leakage, bulkheads shall be constructed at each end of the casing pipe. On brick bulkheads, a "one brick" opening shall be left in the bulkhead at the top of the casing pipe at each end and covered with polyethylene to prevent entry of backfilling materials. The portion of the carrier pipe passing through the brick bulkhead shall be wrapped with three layers of fifteen pound asphalt-impregnated felt before the bulkhead is constructed.

3.8 Valve Installation. Valves and boxes shall be set with the stem vertical and box vertically centered over operating nut. Valves shall be set on a firm foundation and supported by tamping selected excavated material under and at the sides of the valve. The gate box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. Concrete collars shall be poured for all gate boxes. Collars shall be 18-inches minimum in diameter and 6-inches thick set flush with binder grade.

3.8.1 Mainline valves shall be installed within 2 feet of tees at water main interconnection locations.

3.8.2 Tapping Sleeve and valve.

3.8.2.1 Contractor shall confirm the pipe size on which tapping sleeves are to be installed prior to ordering the sleeve.

3.8.2.2 Pipe upon which a tapping sleeve is to be installed, shall be thoroughly cleaned of all foreign matter with scraping tools and wire brushes to a minimum of 6 inches beyond each side of the sleeve. This area shall be washed with a 5% hypochlorite solution. The interior of tapping valve shall also be washed with hypochlorite solution.

3.8.2.3 Clean the flanged surface of the sleeve with a wire brush to remove any excess bituminous coating or burrs. The two sections of the sleeve shall be properly aligned to ensure that they are positioned in the same manner as received from the manufacturer.

3.8.2.4 Sufficient pressure treated blocking and wedges shall be used to secure the sleeve once it has been leveled and positioned.

3.8.2.5 Sleeve bolts shall be alternately tightened from the extreme end on one side to the extreme end of the opposite side with approved torque wrenches until all are securely tightened.

3.8.2.6 Flange bolts shall be tightened in a similar manner, with care being taken not to disturb the gasket.

3.8.2.7 Care shall be taken to ensure that the tapping machine is kept in leveled horizontal position and securely supported so as not to transmit any additional weight to the tapping valve.

3.8.2.8 Blocking shall be left in place after completing the tap.

3.9 Hydrants. Hydrants will be installed in conformance with AWWA C600, Section 11, latest revision and manufacturer instruction, using barrel blocks, tie rods and anchored joints. Hydrants shall be set at the locations shown and bedded on a firm foundation. Each hydrant shall be set in true vertical alignment and properly braced.

3.9.1 Hydrants shall be mechanically restrained per paragraph 2.2.5 by either GripRing or Megalug type joint restraint systems.

3.9.2 Height adjustments shall be made to the hydrants so that the bottom flange of the hydrant is 3 inches above finish grade. Height adjustments shall be made with an extension as manufactured by the hydrant supplier and approved by the Salem Water Department. Adjacent grading intent in the road shoulder and side slopes shall not exceed 4:1 horizontal to vertical.

3.9.2.1 All hydrant extensions shall be considered subsidiary to a new hydrant bid item. Where existing hydrants are to remain in place and need vertical adjustment to meet grading intent according to 3.9.2 then they shall be measured in accordance with 4.5.1.

3.9.3 Wherever a hydrant is set in **soil that is pervious**, a drainage pit 2 ft in diameter and 1 ft deep shall be excavated below each hydrant and filled with coarse gravel or crushed stone mixed with coarse sand, under and around the elbow of the hydrant and to a level of 12-inches above the waste opening and then covered with soil separation fabric. Depth of drainage pit shall increase to 3-feet in **clay or other impervious soil**. Compaction shall be in accordance with NHDOT paragraph 304.3.7.

3.9.4 Hydrants shall be set on a concrete base or other materials approved by the Engineer and shall be well braced and anchored by depositing concrete behind the hydrants on undisturbed earth at the end of the trench, or by wedging granite block in place of concrete.

3.9.5 All newly installed hydrants shall be bagged until they are in service.

3.9.6 Hydrants and hydrant branches shall be pressure tested, flushed and chlorinated. Refer to paragraphs 3.12 and 3.13 for pressure and leakage testing and chlorinating and flushing requirements

3.9.7 Hydrant Removal: When hydrants are to be removed the existing isolation valve shall be removed and hydrant piping shall be removed at the tee and plugged. Place a 0.33 cy concrete thrust block against the cap.

3.10 Service Installation. After successful testing and chlorination of the main, water services shall be installed as wet taps as shown on the Drawings, as herein specified and as directed by the Engineer. All services and associated components shall be completed in full accordance with manufacturer's written instructions, applicable plumbing codes, and Town of Salem Water Department requirements.

3.10.1 Install corporation stops on the new water main. The tapping machine shall be rigidly fastened to the pipe halfway between the horizontal and vertical position (rotated approximately 35-degrees to 55-degrees to the vertical). The length of travel of the tap should be established so that when the stop is inserted and tightened with a 14-inch wrench, not more than one to three threads shall be exposed on the outside. When a wet tapping machine is used, the corporation stop shall be

inserted with the machine while it is in place. Stops shall be tightened only sufficiently to give water-tightness, and care must be constantly exercised not to over-tighten them.

3.10.2 Service saddles shall be required as indicated by the following chart:

<u>Pipe Size</u>	<u>Saddle Requirements for Class 52 D.I. Pipe</u>
4-inch	Taps > 3/4 inch
6-inch	Taps > 1 inch
8-inch	Taps > 1 inch
10-inch & over	Taps > 1 inch

3.10.2.1 Service saddle requirements are determined by ANSI A212.51 with respect to a minimum of three threads of the corporation fully embedded in the pipe sidewall. Where three threads are not able to be embedded in the pipe wall then a saddle will be required.

3.10.3 Install copper tubing continuously without joints from the corporation stop to the curb stop, in a trench with a depth of at least 5-feet. Care shall be exercised in the placing and laying of copper tubing to be sure that the pipe does not have kinks, impacts, compressions, or abrasions. Joint ends shall be kept clean of any foreign material. Maintain a straight alignment. Tubing size shall be as required on the drawings but, in no case smaller than that of the existing service.

3.10.3.1 Refer to paragraphs 3.3 & 3.4 above for trenching. Alternate methods of trenchless installation shall be reviewed and approved by the Salem Water Department prior to implementation.

3.10.4 Install curb stops and curb boxes at the approximate property line, or as indicated on the drawings. Place concrete block or flat stone beneath curb stop. Install curb box vertically centered over the operating key, with the elevation of the top adjusted to conform to the finished grade. Prior to backfilling, the Contractor shall ensure corporation stops are in the open position and curb stops are fully shut. Adequately support the box during backfilling to maintain vertical alignment. Care must be taken to ensure that the curb box does not rest on the curb stop.

3.10.4.1 Curb box top section shall be cut to length so that the bottom of it sits in the middle of the sleeve on the curb box lower section. After cutting the top section to length the bottom of it shall be flared to prevent turning when the curb stop is operated. Refer to Salem typical details for additional information.

3.10.5 Service Connections shall be flushed prior to connecting to existing service. The Contractor shall also flush existing services and water meters if sediment or debris from existing mains and Contractor operations plugs piping or meters as a result of the work completed under this Contract.

3.10.6 Make connections of new copper services to existing services as directed by the Engineer. Connection shall be made using suitable couplings. Services to properties with no existing service shall be properly capped at the curb stop and the curb stop left closed.

3.10.7 All service lines shall be placed under system pressure with couplings and fittings exposed. This inspection shall be completed in the presence of the Owner and Engineer. Should leakage occur in the service lines or connections, the Contractor shall immediately locate the leak or leaks and repair same at no additional cost to the Owner.

3.10.8 Note: Administrative protocol and service connections shall also be in accordance with the “Salem Water Department – Rules & Procedures for ¾” and 1” Residential Water Services”.

3.11 Inspection. It shall be the Contractor’s obligation to install the water main accurately and correctly. Each section of installed water main will be visually inspected by the Owner and Engineer. The pipe shall be true to both line and grade, shall contain no broken pipe, shall show no leaks, and shall contain no debris or other deposits of which shall in any way reduce the full cross-sectional area of the pipe.

3.11.1 Work shall not be considered complete until the satisfactory installation, inspection and testing of all pipelines and appurtenances has been completed.

3.11.2 Any section of water pipe which does not comply with these inspection criteria, as determined by the Owner and Engineer, shall be promptly corrected, replaced, or repaired by the Contractor at no cost to the Owner. Methods employed for corrective action shall be approved by the Owner.

3.12 Pressure and Leakage Testing. The Contractor shall sub-contract an independent third party to conduct pressure and leak testing. The testing sub-contractor shall furnish all necessary equipment and labor for, and perform, pressure testing and leakage tests on the pipeline in accordance with AWWA C 600 Specifications (latest revision). All testing of pipelines shall be witnessed by the Engineer and Owner and shall be subject to their review and acceptance of the results. The Contractor shall be responsible for coordinating all testing activities with the Engineer and Owner.

3.12.1 The Contractor shall make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing, and also furnish water (subsidiary), small supply tank, a test pump, gauges, and any other equipment required in conjunction with carrying out the hydrostatic tests. Supply tank shall be sufficient to satisfactorily measure volumes pumped into the line. **The Contractor shall at all times protect the new water mains and the existing water mains against the entrance of polluting material.**

3.12.2 Equipment shall be accurately calibrated to NH weights and measures standards, and have a current calibration sticker affixed.

3.12.3 Prior to pressure testing, the entire pipeline shall be water jetted to remove any rocks or debris which may have entered the pipe during construction.

3.12.4 Testing shall be done in valved off sections of approximately 1000-feet maximum test length of the main.

3.12.5 Testing Requirements:

Hydrostatic or Pressure Test:

1. Test duration: Two (2) hours, minimum.
2. Test pressure (pipe & valves): Fill pipe section at normal pressure and remove all entrapped air from the line. Then raise pressure to one hundred and fifty percent (150%) of

maximum operating pressure as determined by the Engineer or 200 psi whichever is higher.

3. Allowable pressure loss: Pressure shall not vary more than 5 psi (34 kPa) for the duration of the pressure test.

Leakage Test:

1. Test Duration: One (1) hour, minimum.
2. The leakage test may be conducted concurrently with the pressure test during the second hour to allow for the seating of gaskets, the absorption of trapped air or the settling of any conditions that may affect the results of the leakage test.
3. At the start of the leakage test an exact reading of the pressure gauge will be recorded along with the start time. **During the one hour of the leakage test, the test section is to remain isolated with all connections closed. No pumping to maintain pressure is allowed.**
4. At the end of the hour, the exact reading of the pressure gauge will be recorded along with the stop time. The test section will then be pumped back up to start pressure. The line will then be bled down to stop pressure, with all the expelled water collected in a vessel calibrated in increments no larger than one ounce. The amount of water drained to lower the test section back to stop pressure will be recorded as the loss or leakage of that section.
5. Allowable leakage: **No pipe installation will be accepted if the leakage is greater than the calculated value for a given length of pipe.** Allowable leakage for ductile iron pipe shall be determined by the following formula:

ENGLISH	METRIC
$L = \frac{SD(P)^{0.5}}{133200}$	$L = \frac{SD(P)^{0.5}}{715317}$
L = allowable leakage, in gallons per hour. S = length of pipe tested, in feet. D = nominal pipe diameter, in inches. P = average test pressure, in psi (gauge).	L = allowable leakage, in liters per hour. S = length of pipe tested, in meters. D = nominal pipe diameter, in mm. P = average test pressure, in kPa.

NOTE: Alternate formulas for alternate materials are required to determine leakage

6. Acceptance of installation shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified, the Contractor shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowance. **Approval does not absolve the Contractor from his responsibility if leaks develop within the new main or water service connections (to curb stops) later within the period of warranty.**

3.13 Disinfection. Before being placed in service, all new and temporary water pipelines shall be chlorinated by an independent third party testing agency subcontracted by the Contractor in accordance with the requirements of AWWA C 651-99.

1. Section 4.1, Forms of Chlorine for Disinfection

2. Section 4.2, Basic Disinfection Procedure
3. Section 4.3, Preventive and Corrective Measures During Construction
4. Section 4.4, Methods of Chlorination, subsections; General 4.4.1, Preflushing 4.4.1.1, filling and Contact 4.4.2.3, and Continuous-Feed Method 4.4.3 (except 4.4.3.1).
5. Section 4.5, Final Flushing

The testing procedure shall be discussed with the Owner and Engineer prior to proceeding with the work. **Only after acceptance of the pressure and leakage tests may the pipe be disinfected. No chlorine of any type is to be placed in the pipe during installation.**

3.13.1 The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for a minimum of 24 hours. The Contractor shall be responsible for complying with all federal, state and local regulations with regards to the disposal of chlorinated water, and shall obtain all necessary permits. The water samples shall be taken and tested once the line has been refilled with new water from the system.

3.13.1.1 Chlorine Tap: a chlorination Tap shall be installed within ten feet of the point of connection to the existing infrastructure at top dead center of the main. All chlorine for disinfection shall be injected from that location. Upon completion of chlorination and bacterial testing the tap must be removed and a brass plug placed in the pipe.

3.13.1.2 Flushing: Prior to chlorination the mains shall be properly flushed by the Contractor under the direction of the Salem Water Department. In general, flushing shall be performed at a flow rate required to achieve a minimum velocity of 2.5 feet per second. Flushing shall be performed for a sufficient period of time to allow for a minimum of 3 volume changes of water in the main (approximately 20 minutes per 1000-foot of main).

3.13.2 Discharge of chlorinated water: Following the chlorination period, all treated water shall be flushed from the lines at their extremities, and replaced with water from the distribution system. The Contractor shall be responsible for complying with all federal, state and local regulations with regards to the disposal of chlorinated water, and shall obtain all necessary permits. The Contractor shall notify the Engineer and Owner of the specific location where chlorinated water will be discharged at least three (3) days in advance of proposed discharge.

3.13.2.1 Water with high concentrations of chlorine (residual greater than 2 mg/l) shall be dechlorinated to a level of 2 PPM or less prior to its discharge. Dechlorination shall be conducted by use of a line purge dechlorinator. Dechlorination shall be in accordance with the manufacturer's instructions and AWWA C651, paragraph 4.5.

3.13.3 Water samples Bacteriological sampling and analysis of the replacement water shall then be made after the replacement water has occupied the chlorinated pipeline for a minimum of 16 hours. Bacteriological analysis shall be completed by a state-certified laboratory in full accordance with AWWA C 651. Water samples will be taken from corporation stops along the length of the water main as designated by the Engineer. A minimum of two (2) samples will be taken per 3000 feet of pipe

or on each street, whichever is lesser, each in duplicate, in sterile bottles and sent to a State approved private laboratory for analysis. The Contractor will perform all necessary work including delivery of samples to a certified laboratory.

3.13.3.1 Testing Results: The results of the tests on these samples will determine the acceptance of the work and allow these new mains to be connected to the Town's system. The failure of any sample to pass the laboratory tests will require the contractor to re-flush and re-chlorinate the mains and resample and test the water until acceptable results are obtained, all at no additional cost to the Owner

3.13.4 Special disinfection procedures, such as soaking or swabbing approved by the Engineer, shall be used in connections to existing mains and where the method outlined above is not practical.

3.14 Spare Parts. The Contractor may be required to have on-site, at all times, various fittings and components for system improvements.

Method of Measurement

4.1 Pipe of the kind, type and size specified will be measured by the linear foot to the nearest 0.1 foot of pipe furnished and installed. Measurements will be taken along the centerline of the pipe, end to end. Deductions will be made for any valves and fittings.

4.2 Water main bridge crossing, including pipe of the kind, type and size specified, shall be measured by the linear foot to the nearest 0.1 foot of pipe from the back wall of abutment A to the back wall of abutment B furnished and installed. Measurements will be taken along the centerline of the pipe, end to end. Deductions will be made any valves and fittings.

4.3 Water main casing pipe, including carrier pipe of the kind, type and size specified, will be measured by the linear foot to the nearest 0.1 foot of pipe installed.

4.4 Valves, valve boxes, fittings, chlorine injection taps, water services, corporation stops, curb stops, and curb boxes will be measured by the each for the number of units furnished and installed.

4.4.1 Where pay items for "water services" are used, the item shall include all necessary components including corporation stop, curb stop, pipe, fittings, couplings, curb box, and items necessary to connect to the existing line from the structure.

4.4.2 Where chlorine injection taps and all necessary components for testing are not specifically identified for payment they shall be considered incidental and subsidiary to the contract.

4.5 Hydrant assemblies including hydrant, anchor tees, 6" DI branch, valve, pipe fittings and any other incidental work as shown on the Drawings will be measured by the number of units furnished and installed.

4.5.1 Hydrant extensions installed in accordance with Paragraph 3.9.2.1 shall be measured as 6" or 8" fittings, whichever is included in the contract and is the greater value of the two items.

4.6 Relocating/Adjusting Hydrants under this project shall be measured per each for each hydrant adjusted or relocated.

4.7 Adjusting valve boxes shall be measured for each existing valve box adjusted.

4.8 Hydrants removed and salvaged including valve, stub pipe, thrust blocking, capping service, etc., under this project shall be measured per each for each hydrant removed and salvaged unless provided for otherwise in the contract.

4.9 Pipe removed and salvaged or discarded shall be measured on a linear foot basis.

4.9.1 All fittings, valves, and any other component in a section of pipe to be removed or salvaged shall not be measured for payment.

4.10 Water main insulation shall be measured per square yard only where a pay item has been provided. Otherwise water main insulation shall be considered incidental to the Contract.

4.11 Temporary water system shall be considered a lump sum item.

Basis of Payment

5.1 The accepted quantity of ductile iron and copper pipe will be paid for at the contract unit price per linear foot of the kind, type, and size specified complete in place as shown on the plan and specified herein, and shall include all necessary excavation and backfill, bedding, components, pipe, labor, testing, and equipment with the following stipulations:

5.1.1 Common structure excavation required for the removal of unsuitable material below the typical trench section will be paid for as provided in NHDOT Item 206. Replacement of unsuitable material within the typical trench section with suitable backfill shall not be measured for payment but shall be subsidiary.

5.1.2 All rock structure excavation, any common structure excavation exploratory and any common structure excavation below the depth specified in NHDOT paragraph 206.4.1.1 shall be paid as provided in NHDOT Item 206. Where the contract does not provide for rock structure excavation the bid item for rock excavation (NHDOT Item 203.2) shall be used for measurement and payment.

5.1.3 Granular backfill (sand), to replace material excavated under paragraph 5.1.1 only, will be paid as provided in NHDOT Item 209.

5.2 The accepted quantity of water main casing pipe, including carrier pipe, will be paid at the contract price per linear foot complete in place as shown on the plan and specified herein, and shall include furnishing and installing casing pipe, assembly of casing pipe, excavation, bedding, blanket, backfill, furnishing and installing carrier pipe, pipe spacers, bulkheads and appurtenances, and all other work required for or incidental to the completion of this item, except as noted below.

5.3 The accepted quantity of water main bridge crossing, including pipe shall be paid at the contract price per linear foot complete in place as shown on the plans and specified herein, and shall include furnishing and installing pipe, insulation, hangers, insulation protection shield, rollers and fittings, expansion joints and all other work required for or incidental to the completion of this item.

5.4 The accepted quantity of water services, valves, valve boxes, fittings, chlorine injection taps, corporation stops, curb stops and hydrant extensions will be paid for at the contract unit price of each

of the kind, type, and size specified complete in place including all necessary excavation and backfill, bedding, materials, concrete, components, pipe, labor, testing, and equipment.

5.4.1. Hydrant extensions shall be paid as fittings according to 4.5.1

5.5 The accepted quantity of hydrant assemblies installed, removed or relocated will be paid for at the contract unit price for each complete in place, or removed including all necessary excavation and backfill, bedding, materials, components, pipe, labor, testing, and equipment.

5.5.1 Payment will be made for Hydrants Removed and Salvaged required under this contract on a per each basis. The price bid for Hydrants Removed and Salvaged includes all labor, materials and equipment necessary for or incidental to the completion of the work to the satisfaction of the Engineer. Any materials damaged by the Contractor shall be replaced at no expense to the Owner.

5.6 The accepted quantity of valve boxes new or adjusted will be paid for at the contract unit price for each complete in place including all necessary excavation, backfill, bedding, materials, concrete, labor, and equipment. Intermediate adjustments for the convenience of the Contractor shall not be paid. Intermediate adjustments directed by the plans or the Engineer shall be complete inclusive of all items defined in this paragraph; otherwise, shall not be payable.

5.7 The accepted quantity pipe removed will be paid for at the contract unit price per linear foot removed including all necessary excavation, labor, materials, backfill and equipment.

5.7.1 All valves, fittings, thrust blocking, and appurtenances removed and salvaged required under this contract shall be subsidiary to pipe and hydrant removal items.

5.7.2 Existing pipe & fittings removed in conjunction with installation of new pipe shall be subsidiary to the new pipe & fitting unit item except where specifically identified as a pay item.

5.7.3 Payment will be made for Gate Valves Removed, Replaced or Salvaged required under this contract on a per each basis. The price bid for Gate Valves Removed and Salvaged includes all labor, materials and equipment necessary for or incidental to the completion of the work to the satisfaction of the Engineer. Any materials damaged by the Contractor shall be replaced at no expense to the Owner.

5.8 In addition to specifically mentioned items for each classification of work the following shall also be considered subsidiary to water system work which is necessary for a complete and operational system: concrete thrust blocks, thrust restraining systems, restoration of existing service connections, MJ glands, abandonment of existing water pipe, connections to existing water mains.

5.9 Water main insulation installed shall be paid at the Contract unit price per square of insulation installed and shall include all necessary backfill, excavation, labor, materials and equipment. No payment will be granted where an item for water main insulation is not part of the Contract.

5.10 Payment for temporary water main required for the project shall be inclusive of all components, installation, excavation, labor, equipment, testing, chlorination, maintenance and repair.

5.10.1 Temporary water main service shall include decommissioning and removal of components once water system improvements have been completed.

Pay items and units (ENGLISH):

611.05204	4" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05206	6" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05208	8" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05210	10" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05212	12" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05214	14" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05216	16" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05220	20" CEMENT LINED DUCTILE IRON WATER PIPE, CL 52	LF
611.05306	6" CEMENT LINED DUCTILE IRON WATER PIPE, CL. 53	LF
611.05308	8" CEMENT LINED DUCTILE IRON WATER PIPE, CL 53	LF
611.22206	6" CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22208	8" CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22210	10" CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22212	12" CEMENT LINED CAST IRON WATER PIPE, CL. 22	LF
611.22310	10" CEMENT LINED CAST IRON WATER PIPE, CL. 23	LF
611.35224	24" CASING PIPE WITH 6" DIA. CL 52 D.I. M.J. CARRIER PIPE	LF
611.50003	3/4" WATER SERVICE CONNECTION	EA
611.5001	1" WATER SERVICE CONNECTION	EA
611.50015	1-1/2" WATER SERVICE CONNECTION	EA
611.5002	2" WATER SERVICE CONNECTION	EA
611.50107	3/4" COPPER WATER PIPE	LF
611.5011	1" COPPER WATER PIPE	LF
611.51007	3/4" CORPORATION STOP	EA
611.5101	1" CORPORATION STOP	EA
611.51015	1-1/2" CORPORATION STOP	EA
611.5102	2" CORPORATION STOP	EA
611.52007	3/4" CURB STOP	EA
611.5201	1" CURB STOP	EA
611.52015	1-1/2" CURB STOP	EA
611.5202	2" CURB STOP	EA
611.6001	1" PLASTIC WATER PIPE (TEMP. SERVICE ONLY)	LF
611.60015	1-1/2" PLASTIC WATER PIPE (TEMP. SERVICE ONLY)	LF
611.6002	2" PLASTIC WATER PIPE (TEMP. SERVICE ONLY)	LF
611.6106	6" PLASTIC PRESSURE WATER PIPE (TEMP. SERVICE ONLY)	LF
611.6903	LAYING 3" PVC PLASTIC WATER PIPE (TEMP. SERVICE ONLY)	EA
611.70004	4" FITTING	EA
611.70006	6" FITTING	EA
611.70008	8" FITTING	EA
611.70010	10" FITTING	EA
611.70012	12" FITTING	EA
611.70014	14" FITTING	EA
611.70016	16" FITTING	EA
611.71GVB	REMOVE AND REPLACE GATE VALVE BOXES	EA
611.71006	6" GATE VALVE	EA
611.71008	8" GATE VALVE	EA

611.71010	10" GATE VALVE	EA
611.71012	12" GATE VALVE	EA
611.71014	14" GATE VALVE	EA
611.71016	16" GATE VALVE	EA
611.71912	12" TAPPING SLEEVE	EA
611.72018	18" BUTTERFLY VALVE	EA
611.74	CHLORINE INJECTION TAP	EA
611.81	HYDRANT ASSEMBLIES	EA
611.811	ADJUSTING/ RELOCATING HYDRANTS	EA
611.812	INSTALLING DRY HYDRANT SYSTEM	U
611.813	RELOCATING DRY HYDRANT SYSTEM	U
611.814	REMOVING HYDRANT	U
611.815	REMOVE AND SALVAGE HYDRANT	EA
611.9	WATER REGULATOR CHAMBER IRON WATER PIPE	U
611.90001	ADJUSTING WATER GATES AND SHUT OFFS (SET BY OTHERS)	EA
611.91	REMOVING AND RELAYING WATER PIPE	LF
611.92	REMOVE AND SALVAGE GATE VALVE	EA
611.93	REMOVE WATER PIPE	EA
611.9406	REMOVE AND REPLACE GATE VALVE (6")	EA
611.951	WATER MAIN INSULATION	SY
611.99	TEMPORARY WATER MAIN AND APPURTENANCES	LUMP
611.93	REMOVE WATER PIPE	LF