



NEW ENGLAND CIVIL ENGINEERING CORP.

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March 21, 2019

Paul Stedman
District Highway Director
Massachusetts Department of Transportation, Highway Division
Attention: Permits
519 Appleton Street
Arlington, MA 02476

Re: Permit to Access State Highway - Route 1A/133, Ipswich, MA

Dear Mr. Stedman,

On behalf of the Town of Ipswich Utilities Department, we hereby submit the attached Application for Permit to Access State Highway for your review and consideration. We have also attached a set of engineering plans, traffic management plans, and a description of planned tree cutting within the project area for your reference.

Project Summary:

The Town of Ipswich Utilities Department maintains drinking water transmission and distribution mains within the Massachusetts Department of Transportation (MDOT) layout for Route 1A/133 (High Street) extending North from the center of town to the Rowley/Ipswich Town Line.

The Town has experienced several water main breaks on the water distribution main on High Street which have resulted in prolonged water service and traffic interruptions. The Town proposes to replace the old 12-inch cast iron water main on High Street from the intersection of Kimball Avenue (approx. MDOT station 12+50, 1911 layout) to the Ipswich Utilities Department, Electric Building (approx. MDOT station 43+75, 1910 layout). The water main will be installed primarily in the southbound shoulder and travel lane. In addition to the trench cut parallel to the travel lane, the project will involve thirty-two service trenches to the limits of the southbound MDOT layout (crossing shoulder and/or unpaved area), thirty-four service trenches to the limits of the northbound MDOT layout (crossing both travel lanes), and nine main line trenches at intersections.

Cross Trench Locations

The location and size of the cross trenches are summarized below:

Copper water service (1-inch) trenches to cross part of southbound travel lane to southbound shoulder at approximate MDOT layout stations: 54+67, 58+13, 60+69, 61+60, 63+59, 64+27, 65+19, 69+80, 71+49, 73+31, 74+89, 75+94, 76+44, 76+95, 77+78, 78+28, 79+09, 80+06, 80+66, 82+34, 87+25, 89+91, 93+04, 100+81, 101+82, 111+29, 111+42, 111+69

Copper water service (1-inch) trenches to cross both travel lanes to northbound shoulder at approximate MDOT layout stations: service crossing both travel lanes at approximate MHD layout station 61+28, 61+75, 62+77, 63+48, 63+50, 63+87, 64+90, 64+99, 66+88, 67+98, 68+65, 69+78, 71+25, 71+38, 72+62, 73+49, 75+53, 78+31, 94+40, 94+44, 95+12, 97+66, 98+90, 100+69, 103+30, 103+35, 104+84, 105+16, 106+79, 109+50, 111+54, and 111+96

Copper water service (2-inch) trench to cross part of southbound travel lane to southbound shoulder at approximate MDOT layout station: 94+83.

Ductile iron water main (4 to 12-inch) trenches to cross part of southbound travel lane and into side streets at approximate MDOT layout stations:

4-inch water main at 94+88, 6-inch water mains at 71+70 and 100+92, 10-inch water main at 105+75.

12-inch water main to Mile Lane at 57+19, 8-inch water main to Rosewood Drive at 69+54, 6-inch water main to Lowes Lane at 93+87, 8-inch water main to Kimball Avenue at 112+51.

Ductile iron water main (4 to 12-inch) trenches to cross both travel lanes to northbound shoulder or side streets at approximate MDOT layout stations:

6-inch water main at 106+00, 8-inch water main at 110+45, 12-inch water mains at 77+22 and 89+28, 12-inch water main to Mitchell Road at 92+37, 6-inch water main to Paradise Road at 57+37, 8-inch water main to Currier Park at 107+98.

Soil Borings:

Soil borings were performed in 2007 for a previous project at approximate MDOT stations: 58+62, 61+17, 63+79, 65+66, 67+07, 68+77, and 71+20. Pavement thickness varied but was commonly 6-inches thick.

Proposed Excavation and Paving:

The depth of proposed water main and services will typically be 4-6 feet deep. The Town plans to backfill with suitable onsite soil materials and compact in accordance with MDOT specifications, with the top 6-inches of soil being replaced with suitable gravel subbase. Details and specifications are attached for reference.

Temporary trench pavement to be binder course installed at 2-inch thickness. Permanent trench pavement to include a 1-foot cutback on each side, combined (intermediate) binder and surface course thickness to match existing pavement thickness up to 6-inch maximum thickness. The Town requests to install two courses of binder pavement in lieu of base and binder courses to take advantage of availability of binder pavement in small batches. Refer to "Temporary Pavement" and "Permanent Pavement" details on Drawing D-1.

The Town requests flexibility to utilize a modified approach for temporary and permanent pavement as depicted on "Permanent Pavement Alternate 1A" and "Permanent Pavement Alternate 1B" details on Drawing D-1. The modified approach would involve installation of compacted gravel subbase and 6-inches of (intermediate) binder pavement in two courses, instead of temporary pavement. After a settlement period, the trenches would be milled to 2-inch depth and include a 1-foot cutback on each side. Surface course to be installed at 2-inch thickness with tack coat applied to milled surface and edges.

Traffic Management Plan:

The minimum requirements for traffic management are provided on Drawing D-3.

Tree Cutting Plan:

Minimum tree cutting and vegetation removal are anticipated as part of this project. In one small section of the project (approx. MDOT station 88+50 to 89+00), several small trees and brush will be removed to allow access to existing water main. The area to be cleared is outside the MDOT layout and is identified and delineated on Drawing C-14.



The Town is ready to put the project out to bid this spring for construction this summer if possible. We are available to meet with MDOT to discuss this project in further detail at your convenience. If you have any questions or require additional information, please do not hesitate to contact me at any time on my cell phone at 978-767-5415 or at my Salem office at 978-741-7401.

Sincerely,

A handwritten signature in blue ink, appearing to read 'W. M. Ross'.

William M. Ross, P.E.
Principal Engineer / Project Manager
New England Civil Engineering Corp.

Cc: Vicki Halmen, Water and Wastewater Manager



Application for Permit to Access State Highway

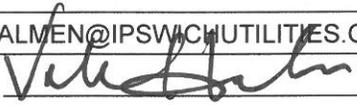
This Access Permit Application, including the attached Access Permit Submittal Checklist, must be completed in full by the Applicant. Instructions for this page are located on page 2. Descriptions of the two types of access permits and related categories are located on page 6. MassDOT will make the final determination regarding Access Permit Application type and category.

1. Town/City: IPSWICH
2. State Highway route number and/or name: ROUTE 1A / 133
3. Locus/Property Address: MDOT STATION 12+50 (1911) TO 43+75 (1910)
4. Description of property and/or facility for which access is sought (attach additional sheets if necessary):
ROUTE 1A / 133 LAYOUT, SHOULDER AND TRAVEL LANE
(SEE ATTACHED)

5. Description of work to be performed within State Highway Layout (attach additional sheets if necessary):
REPLACE WATER MAIN (SEE ATTACHED)

Telecommunications (wireless or wireline) or Renewable Energy (Solar, Wind, etc) – Agreement Process and OREAD* coordination required. (*see pg 2 Instruction)

6. Dig Safe number: TBD

7. Applicant Information ¹ (See footnote below.)
 - Name TOWN OF IPSWICH
UTILITIES DEPARTMENT
 - Mailing Address 272 HIGH STREET
IPSWICH, MA 01938
 - Telephone 978-356-6635
 - Fax _____
 - E-Mail VHALMEN@IPSWICHUTILITIES.ORG
 - Signature 
 - Print Name VICKI HALMEN, WATER DIRECTOR
 - Date MARCH 25, 2019

8. Property Owner
 - Name N/A
 - Mailing address _____
 - Telephone _____
 - Fax _____
 - E-Mail _____
 - Signature _____
 - Print Name _____
 - Date _____

Return completed application, including Submittal Checklist, to the District Highway Director for your town/city. Refer to reverse side for appropriate address.

For office use only. Do not write below this line.

- | | |
|--|--|
| 1. Application number: _____ | 6. Section 61 Finding date: _____ |
| 2. Date received: _____ | 7. Mass. Historic Action (yes or no): _____ |
| 3. Fee amount (non-refundable) : _____ | 8. Plans returned to DHD: _____ |
| 4. Completeness Pre-Review date: _____ | 9. Permit Type/Category: _____ |
| 5. MEPA required (yes or no): _____ | 10. Application complete date: _____ |
| ENF-EOEEA Cert. # _____ | 11. Permit written date: _____ |
| EIR-EOEEA Cert. # _____ | 12. Permit issued date: _____ |
| Other-EOEEA Cert. # _____ | 13. Permit denied: _____ |
| | 14. Permit Recording date at Registry of Deeds _____ |

¹ If an agent is representing an Applicant, the application must include a notarized letter from the Applicant outlining the specified duties and responsibilities of the agent. Where work is proposed on a utility, the utility department must sign the application as the Applicant(s).

Instructions for Completing Application for Permit to Access State Highway

General Instructions

MassDOT's Highway Division is granted authority to issue **State Highway Access Permits** by M.G.L. Chapter 81, Sec. 21. MassDOT adopted 720 CMR 13.00 under the authority of M.G.L. c. 81, § 21 and M.G.L. c.85 §2. 720 CMR 13.00 supersedes the Standard Operating Procedures for Review of State Highway Access Permits dated November 30, 1971, and board vote of September 17, 1991.

ACCESS is generally defined, but not limited to:
Any physical work performed within the State Highway Layout.

This Application governs issuance of the two types of access permit Applications, Non-Vehicular and Vehicular, which are issued under three categories:

- Category I** Minor Vehicle Access Permits
- Category II** Major Vehicular Access Permits
- Category III** Complex Vehicular Access Permits

Please refer to the **MassDOT Highway Access Permit Submittal Checklist** for details regarding permit types and submittals required.

FEES:

A Check payable to **MassDOT** for the appropriate permit application fee must accompany the permit application. Fees are non-refundable.

Fee schedule for access and Utility Payments:

Residential Access Permits	
5 Units or less	\$25.00
From 6 to 49 Units	\$100.00
Greater than 49 Units	\$2000.00

Non-Residential Access Permits	
Less than 25,000 square feet	\$500.00
From 25,000 to 300,000 square feet	\$1000.00
From 300,000 to 750,000 square feet	\$2000.00
Greater than 750,000 square feet	\$3000.00

Non-Municipal Utility Permits not in conjunction With Access Permits:

Annual blanket utility permit	\$500.00
Capital improvements to a utility	\$500.00

Specific Instructions (print or type)

Line 1:
List name of municipality in which access is sought.

Line 2:
List name or number of State Highway Route(s) to which access is sought.

Line 3:
List Locus/Property address.

Line 4:
Describe property and/or facility. If access is sought under Category II above, briefly describe facility for which access is sought,

Example 1: Private single family residence at 100 State Road. Approximate size of proposed building 2,500 s.f. Approximate lot size 0.75 acres.

Example 2: 500,000 s.f. enclosed shopping mall adjacent to State Route I-290 and Route 20. Approx. lot size 67 acres.

Line 5:
Briefly describe the proposed work to be performed within the State Highway Layout.

*Office of Real Estate and Development (**OREAD**)

Example 1: Remove 50 feet of existing granite curb on south side of highway in order to construct driveway access and modify the roadway geometry to accommodate left-hand turn.

Example 2: Excavate 10 foot x 10 foot section of roadway at Station 100+00 in westbound lane in order to install water service to residence at 100 State Street.

Line 6:
A Dig Safe number must be provided if the work will commence within 30 days of the filing of the permit. **NOTE:** A Dig Safe number must be obtained by calling **1-888-DIG-SAFE** (1-888-344-7233). If construction within the State Highway Layout does not commence within the period allowed by Dig Safe, a new number must be obtained prior to beginning construction. (www.digsafe.com)

Line 7:
Individual or business making application must complete the required information, including application date and signature.

Line 8:
Complete this section only if the individual or business making application is other than the property owner of the land for which the permit applies.

Return completed application, submittal checklist and fee to appropriate District Office listed below. Please contact the Permit Engineer at this address if additional information is required.

District One
270 Main Street
Lenox, MA 01240
Tel. (413) 637-5700
Fax. (413) 637-0309

District Four
519 Appleton Street
Arlington, MA 02174
Tel. (781) 641-8300
Fax. (781) 646-5115

District Two
811 North King Street
Northampton, MA 01060
Tel. (413) 582-0599
Fax. (413) 582-0596

District Five
1000 County Street
Taunton, MA 02780
Tel. (508) 824-6633
Fax. (508) 880-6102

District Three
403 Belmont Street
Worcester, MA 01604
Tel. (508) 929-3800
Fax. (508) 799-9763

District Six
185 Kneeland Street
Boston, MA 02111
Tel. (857) 368-6100
Fax. (857) 368-0106

Highway Division Website:
www.massdot.state.ma.us/highway

Access Permit Submittal Checklist

GREY:
DOT
USE
ONLY

This checklist provides the Applicant with a list of required submittals to obtain an Access Permit. However, additional submittals may be required to issue an Access Permit. All Applicants must fill out Part A and one additional part that correlates to the selected application type. To help identify the application type, please see the descriptions on page 6. Check each box that pertains to your application. MassDOT will make the final determination regarding Access Permit Application type and category.

PART A: ALL APPLICANTS MUST FILL OUT

1. APPLICATION TYPE – CHECK ONE

- NON-VEHICULAR:**
 - Non-Vehicular – Fill out Part B
- VEHICULAR**
 - Category I** – Minor Vehicle Access Permits: Fill out Part C-1
 - Category II** – Major Vehicle Access Permits: Fill out Part C-1 and Part C-II
 - Category III** – Complex Vehicle Access Permits: Fill out Part C-1 and Part C-III

2. APPLICATION TYPE (Check all applicable boxes)

- Application Complete
- Permit corresponds to appropriate MassDOT District
- Non-refundable check or money order on correct amount payable to: **MassDOT**
- Evidence certifying property owner(s) consent
- Notarized Applicant Letter outlining agent's duties and responsibilities (if applicable)
- Utility department sign-off as the Applicant(s) (if applicable)

PART B: NON-VEHICULAR PERMITS

- IF NO PHYSICAL MODIFICATION to state highway layout – i.e. parade, road race, traffic counts, etc.**
Required submittals:
 - Map of route
 - Traffic Management Plan (designed in accordance with the Road Flagger & Police Regulations: 701 CMR 7.00)
 - Detour Plan(s) with municipal approval (if applicable)
- IF DRAINAGE:**
 - If requesting connection or discharge to any MassDOT drainage system, contact District Personnel for additional information regarding required submittals.
- IF CONSTRUCTION, RELOCATION OR REPAIR OF UTILITIES:**
Required submittals:
 - EXISTING PROJECT:** reference(s) to the documents and plans already filed with MassDOT for the affected project
 - NEW PROJECT/UTILITY WORK:**
Required submittals:
 - Engineered Plan(s) including method of crossing Highway
 - Traffic Management Plan (if applicable)
(Designed in accordance with the Road Flagger & Police Regulations: 701 CMR 7.00)
 - Detour Plan(s) with municipal approval (if applicable)
 - Tree Cutting or Landscaping Plan (if applicable)
 - Vegetative Plan including plant species and maturity size (if applicable)
 - Blasting Plan (contact District Personnel for additional information)

PART C-I: VEHICULAR PERMITS

CATEGORY I – Minor Vehicular Access Permits

Required submittals:

- Engineering Plans
- ENF - (Environmental Notification Form) Certificate (if applicable)

IF RESIDENTIAL DRIVEWAY:

- Detailed plan/sketch showing the drive location in relation to the property lines, MassDOT baselines, distance from nearest mile marker, and an easily identifiable fixed object (distance from telephone poles, mail boxes, other drives, etc.).
- If severe topographic conditions exist, an engineered plan showing the driveway layout, profile and storm water management may be necessary to show that the edge of the proposed drive is protected during and after construction to prevent sediment and debris from entering upon the State Highway Layout (SHLO).

IF COMMERCIAL DRIVEWAY: (where no MEPA review is required)

Required submittals:

- Two (2) 40 scale plans that include:
 - A. Route Number, Road Name, Property Address
 - B. Property Corners and Bounds
 - C. Lot Line Dimensions, Bearings and Distances
 - D. State Highway Layout Lines (both sides) and Nearest Massachusetts Highway Bounds (if found).
 - E. State Highway Baseline and both edges of roadway including any sidewalks and type of edging, if any, and shoulder information (grass, gravel etc.).
 - F. Any existing drive to be altered or closed shall be indicated. Existing and proposed dimensions should be included for altered drives.
 - G. Information on all proposed drives including radii, widths, handicap ramps, etc. must be shown.
 - H. All existing and proposed buildings, utilities, trees, stonewalls, fences etc., should be labeled and shown in their correct location.
 - I. It is required that all stands, buildings, gasoline pumps and structures of any kind be placed at least 12 feet back from the State Highway Layout Line, since conducting of business within a State Highway Layout is forbidden.
 - J. Complete detail on drainage; all drives should be constructed on a downgrade from the edge of the highway surface or shoulder to the State Highway Layout Line.
 - K. Engineered plans will be required to show that storm flows are not directed into the SHLO, using contour lines, where applicant/owner property elevations are raised from the edge of the highway.
 - L. The plans should identify measures to protect the edge of the proposed drive during and after construction to prevent sediment and debris from entering upon the SHLO.

IF NEW STREET / SUBDIVISION ROAD:

Minor Intersection and Roadway Reconstruction (where no MEPA review is required)

Required submittals:

- All Commercial Driveway requirements (above) apply in addition to the following: Evidence of acceptance, including its line, grade and proposed drainage, by a local planning board, or other City of Town official with such authority.
- A street/road profile from its nearest high point and plan of drainage.

Please be advised:

- It will be required that all such future street approaches be constructed on a downgrade, where possible, from the edge of highway surface or shoulder to the State Highway Layout Line.
- Common driveway criteria may apply and must be shown on plans as mentioned above.

PART C-II: VEHICULAR PERMITS

CATEGORY II – Major Vehicular Access Permits

Required submittals:

- Engineering Plans based on the standards in the Manual On Uniform Traffic Control Devices (MUTCD), MassDOT's Project Development & Design Guide or its successor, MassDOT's Standard Specifications for Highway and Bridges, and any current technical policies or engineering directives Issued by MassDOT. All PS&E design submissions must be both in hard copy (one set) and electronic format. Electronic format includes PDF files transmitted to DHD or designee via USB Flash Drive, CD or posted to a FTP site.
- In cases where a proposed access is to be shared by multiple development sites, the Applicant(s) will provide evidence of the rights of access between the parties involved prior to the issuance of the Access Permit.
- MEPA Certificate
- Section 61 Finding

PART C-III: VEHICULAR PERMITS

CATEGORY III – Complex Vehicular Permits

Required submittals:

- Engineering Plans based on the standards in the Manual On Uniform Traffic Control Devices (MUTCD), MassDOT's Project Development & Design Guide or its successor, MassDOT's Standard Specifications for Highway and Bridges, and any current technical policies or engineering directives Issued by MassDOT. All PS&E design submissions must be both in hard copy (one set) and electronic format. Electronic format includes PDF files transmitted to DHD or designee via USB Flash Drive, CD or posted to a FTP site.
- In cases where a proposed access is to be shared by multiple development sites, the Applicant(s) will provide evidence of the rights of access between the parties involved prior to the issuance of the Access Permit.
- MEPA Certificate
- Section 61 Finding

Recording of Access Permits

Applicants must record any Vehicular Access Permit and plans or any Non-Vehicular Access Permit and plans involving drainage at the appropriate Registry of Deeds. Any Permit issued by MassDOT that requires recording will not be effective until recorded at the appropriate Registry of Deeds and a notice of recording is submitted to the District Highway Director (DHD). Changes may require the re-recording of permits and related documents. In those cases, permits will not be effective until re-recorded at the Registry of Deeds and a notice of recording is submitted to the DHD.

THERE ARE TWO TYPES OF ACCESS PERMIT APPLICATIONS: VEHICULAR, ISSUED UNDER THREE CATEGORIES & NON-VEHICULAR:

1. VEHICULAR ACCESS PERMITS:

Category I – Minor Vehicular Access Permits:

Access Permits for Projects that require entry to the State Highway Layout (SHLO), require little to no non-signalized modifications, and do not significantly alter the operating characteristics of traffic. These Projects ordinarily do not exceed the Massachusetts Environmental Policy Act (MEPA) transportation thresholds beyond the filing of an Environmental Notification Form (ENF).

Category II - Major Vehicular Access Permits:

Access Permits for Projects that require significant non-signalized modifications that may alter the operating characteristics of traffic at residential or commercial driveway intersecting with the SHLO; that require significant non-signalized modifications that may alter the operating characteristics of traffic at or upon any other intersection or roadway under the jurisdiction of MassDOT; that require the installation of a new traffic signal at a residential or commercial driveway intersecting with the SHLO or at any other intersection or roadway under the jurisdiction of MassDOT; or that require modification of structures, equipment, or hardware at an existing traffic signal at a residential or commercial driveway and its intersection with the SHLO or at any other intersection or roadway under the jurisdiction of MassDOT.

Category III – Complex Vehicular Permits

Access Permits for Complex Projects requiring actions similar to major Projects, but which require a new or altered SHLO; that require significant non-signalized and/or signalized modification within the SHLO over an extended distance or at a number of intersections that significantly alters the operating characteristics of traffic along a corridor; or that require the construction of a new, or modifications to an existing, bridge. These Projects generally require MEPA review and may require Federal review.

2. NON-VEHICULAR ACCESS PERMITS:

Access Permits for Projects that require access to the SHLO that do not involve physical modifications such as a parade or road race; construction, relocation or repair of utilities within the SHLO; tree cutting or landscaping within the SHLO; the use of explosives to remove material from within 250 feet of the SHLO; or connection to or discharge to any MassDOT drainage system (in cases where it can be shown that no practical alternative exists).

CONDITIONS REQUIRING AN ACCESS PERMIT

Vehicular Access Permits are required for:

- New residential or commercial driveways or streets intersecting the SHLO; or,
- Physical modifications to existing residential or commercial driveways or streets at their intersection with the SHLO; or,
- Change in use of an existing residential or commercial driveway onto SHLO that results in a **Substantial Increase in or Impact on Traffic** (as defined below) over the current use; or
- Construction of new or change in use of existing, residential or commercial driveway from properties that abut the SHLO to serve a building or facility, or expansion of a building or facility, that generates a Substantial Increase in or Impact on Traffic.

Substantial Increase in, or Impact on, Traffic as referenced above is defined as:

A Project that meets or exceeds any of the following thresholds:

- (i) Generation of 2,000 or more new ADT on roadways providing access to a single location; or,
- (ii) Generation of 1,000 or more new ADT on roadways providing access to a single location and construction of 150 or more new parking spaces at a single location; or,
- (iii) Construction of 300 or more new parking spaces at a single location; or
- (iv) Creation of a change in the type, pattern, or timing of traffic that is determined by MassDOT to generate a significant impact on traffic flow and safety.

Non-vehicular Access Permits are required for:

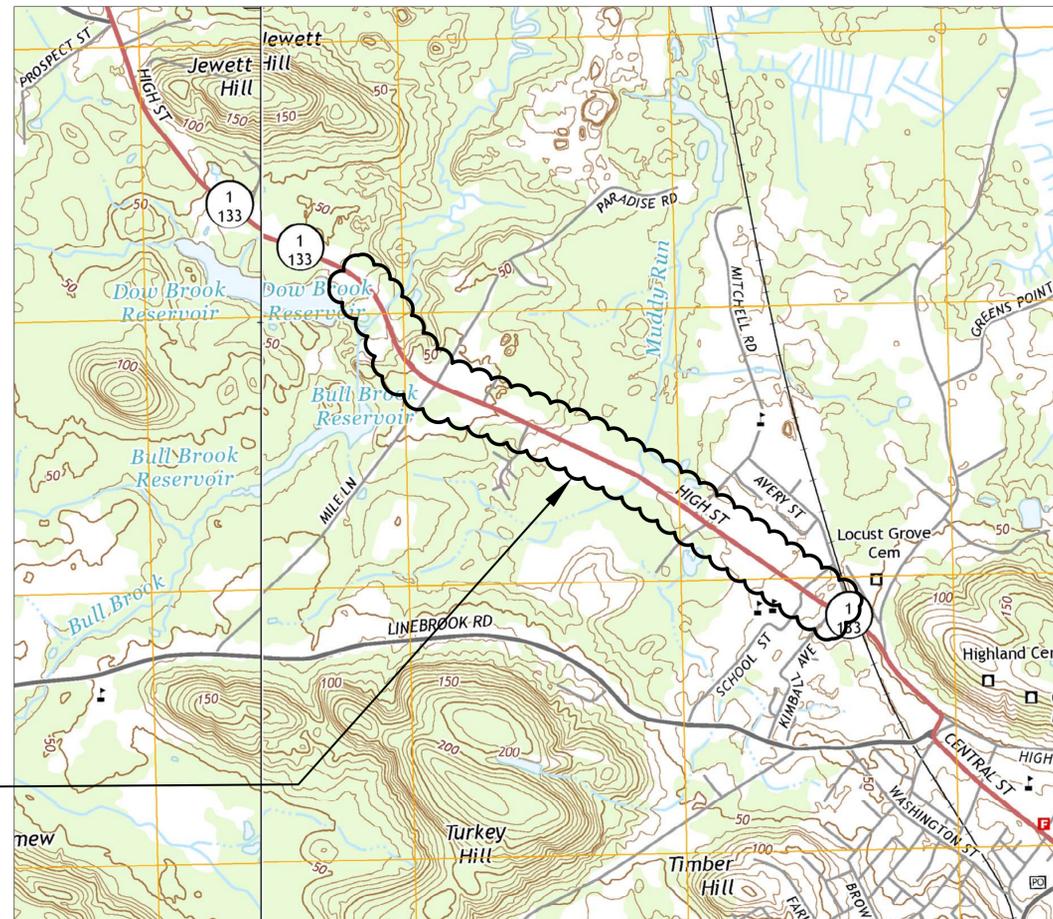
- Access to the SHLO for Projects that do not involve physical modifications; or
- Connection to or discharge to any MassDOT drainage system (in cases where it can be shown that no practical alternative exists); or
- Construction, relocation or repair of utilities within the SHLO; or
- Tree cutting or landscaping within the SHLO; or
- The use of explosives to remove material from within 250 feet of the SHLO.

In cases where a particular Project or activity may seek both vehicular and non-vehicular access, separate and distinct Permit Applications must be filed.

TOWN OF IPSWICH, MASSACHUSETTS

HIGH STREET WATER MAIN REPLACEMENT PROJECT

MARCH 2019



PROJECT LOCATION

LOCUS MAP (NO SCALE)

DRAWING INDEX:

- G-1: COVER**
- G-2: GENERAL NOTES (NOT INCLUDED)**
- G-3: KEY PLAN AND LEGEND**
- C-7 - C-18: UTILITY PLANS**
- D-1 - D-3: DETAILS**

NEW ENGLAND CIVIL ENGINEERING CORP.



NEW ENGLAND
CIVIL ENGINEERING
SALEM, MA

265 Essex Street
Suite #102
Salem, MA 01970

(978) 741-7401



LEGEND

- FIRE HYDRANT
- WATER MAIN WITH PIPE SIZE, MAIN LINE VALVE, AND WATER SERVICE WITH CURB STOP
- SEWER MANHOLE AND SEWER MAIN WITH PIPE SIZE
- STORMWATER MANHOLE AND STORMWATER MAIN WITH PIPE SIZE
- CATCH BASIN (CB)
- GAS MAIN WITH PIPE SIZE & MATERIAL AND GAS VALVE
- UTILITY PIPE WITH CONTINUATION SYMBOL
- TELEPHONE / COMMUNICATION CONDUIT
- ELECTRIC CONDUIT
- ELECTRIC MANHOLE

EXISTING FEATURES

- ROADWAY SIGN
- UTILITY POLE/OVERHEAD WIRE
- LIGHT POST/POLE
- TREE
- VEGETATION BOUNDARY
- PARCEL / PROPERTY LINE
- FENCE
- BUILDING / HOUSE / STRUCTURE

ELEVATION CONTOUR WITH SPOT GRADE ELEVATION (FEET) SHEETS C-1 TO C-6



ELEVATION CONTOUR WITH ELEVATION LABEL (FEET) FOR SHEETS C-7 AND C-8

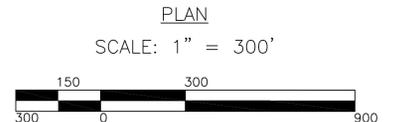


- BIT.
- CONC.
- GRAN.
- PL
- BS
- VC
- AC
- DI
- RET.
- ABD.
- INV.
- DHM
- SMH
- MIN.
- STA

- BITUMINOUS
- CONCRETE
- GRANITE
- PLASTIC
- BARE STEEL
- VITRIFIED CLAY
- ASBESTOS CEMENT
- DUCTILE IRON
- RETAINING
- ABANDONED
- INVERT
- TYPICAL
- DRAIN MANHOLE
- SEWER MANHOLE
- MINIMUM
- STATION

PROPOSED FEATURES

- FIRE HYDRANT
- WATER MAIN, MAIN LINE VALVE, AND WATER SERVICE WITH CURB STOP
- WATER MAIN COUPLING CONNECTING EXISTING MAN TO NEW WATER MAIN
- TEE CONNECTION
- PIPE BEND
- TAPPING SLEEVE AND VALVE ON EXISTING WATER MAIN
- REDUCER
- LINSTOP ON EXISTING WATER MAIN
- EXPLORATORY EXCAVATION (TEST PIT)
- EROSION AND SEDIMENTATION BARRIER
- CAPPED / PLUGGED PIPE



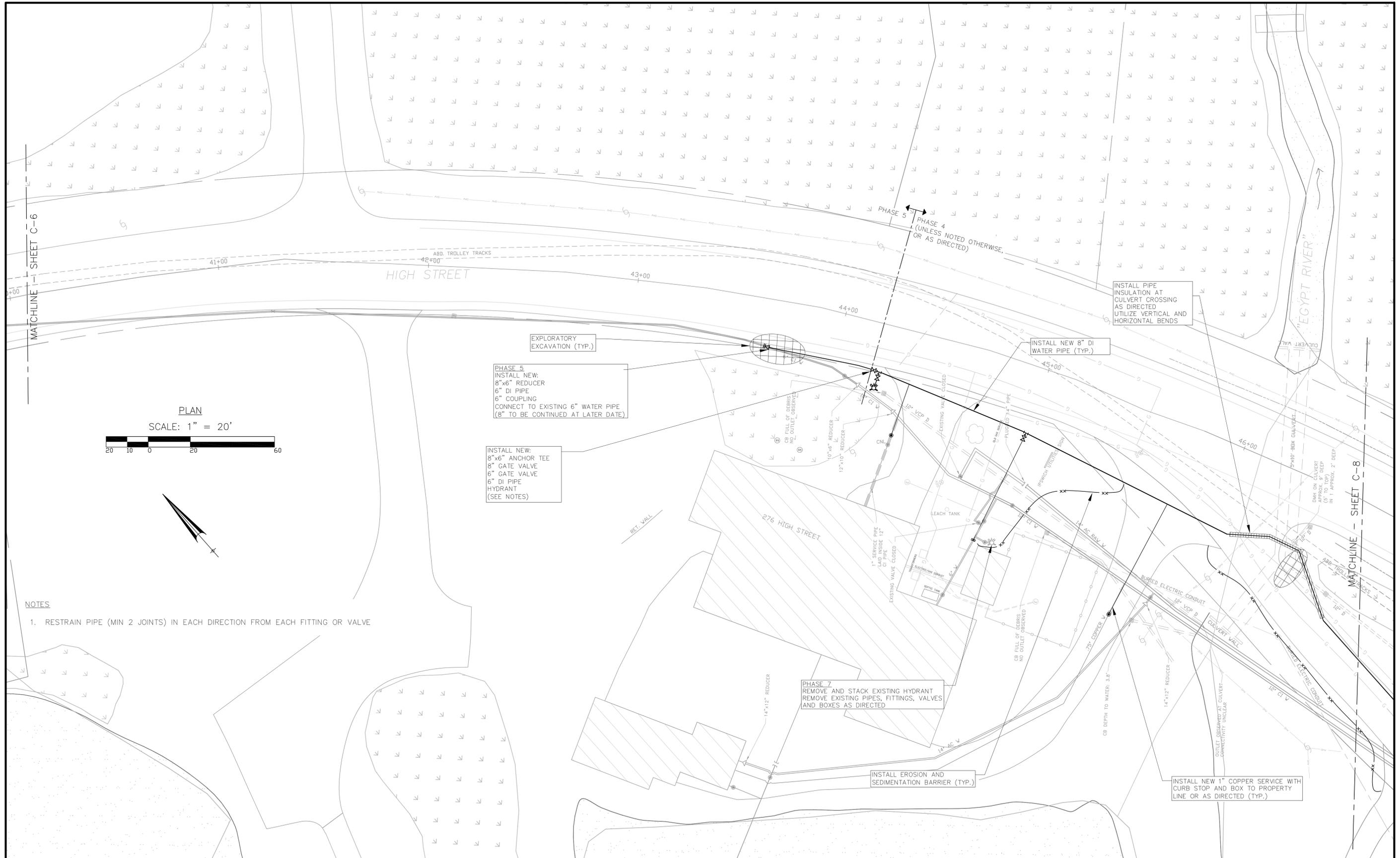
Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
KEY PLAN AND LEGEND	

Scale	1"=20'
Date	3/22/2019
Job	IP-HIGH ST.
Designed by	WMR
Drawn by	DJW
Checked by	WMR
Approved by	WMR
No.	
Description	
Date	
File: W:\Ipswich\High Street Water Main\CAD\Ipswich_Design32219.dwg	



New England Civil Engineering Corp.
265 Essex Street
SALEM, MASSACHUSETTS

Sheet	G-3
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PLAN
SCALE: 1" = 20'



- NOTES
1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

EXPLORATORY EXCAVATION (TYP.)

PHASE 5
INSTALL NEW:
8"x6" REDUCER
6" DI PIPE
6" COUPLING
CONNECT TO EXISTING 6" WATER PIPE
(8" TO BE CONTINUED AT LATER DATE)

INSTALL NEW:
8"x6" ANCHOR TEE
8" GATE VALVE
6" GATE VALVE
6" DI PIPE
HYDRANT
(SEE NOTES)

PHASE 7
REMOVE AND STACK EXISTING HYDRANT
REMOVE EXISTING PIPES, FITTINGS, VALVES
AND BOXES AS DIRECTED

INSTALL EROSION AND SEDIMENTATION BARRIER (TYP.)

INSTALL NEW 8" DI WATER PIPE (TYP.)

INSTALL PIPE INSULATION AT CULVERT CROSSING AS DIRECTED UTILIZE VERTICAL AND HORIZONTAL BENDS

INSTALL NEW 1" COPPER SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED (TYP.)

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 39+08 TO STATION 45+61

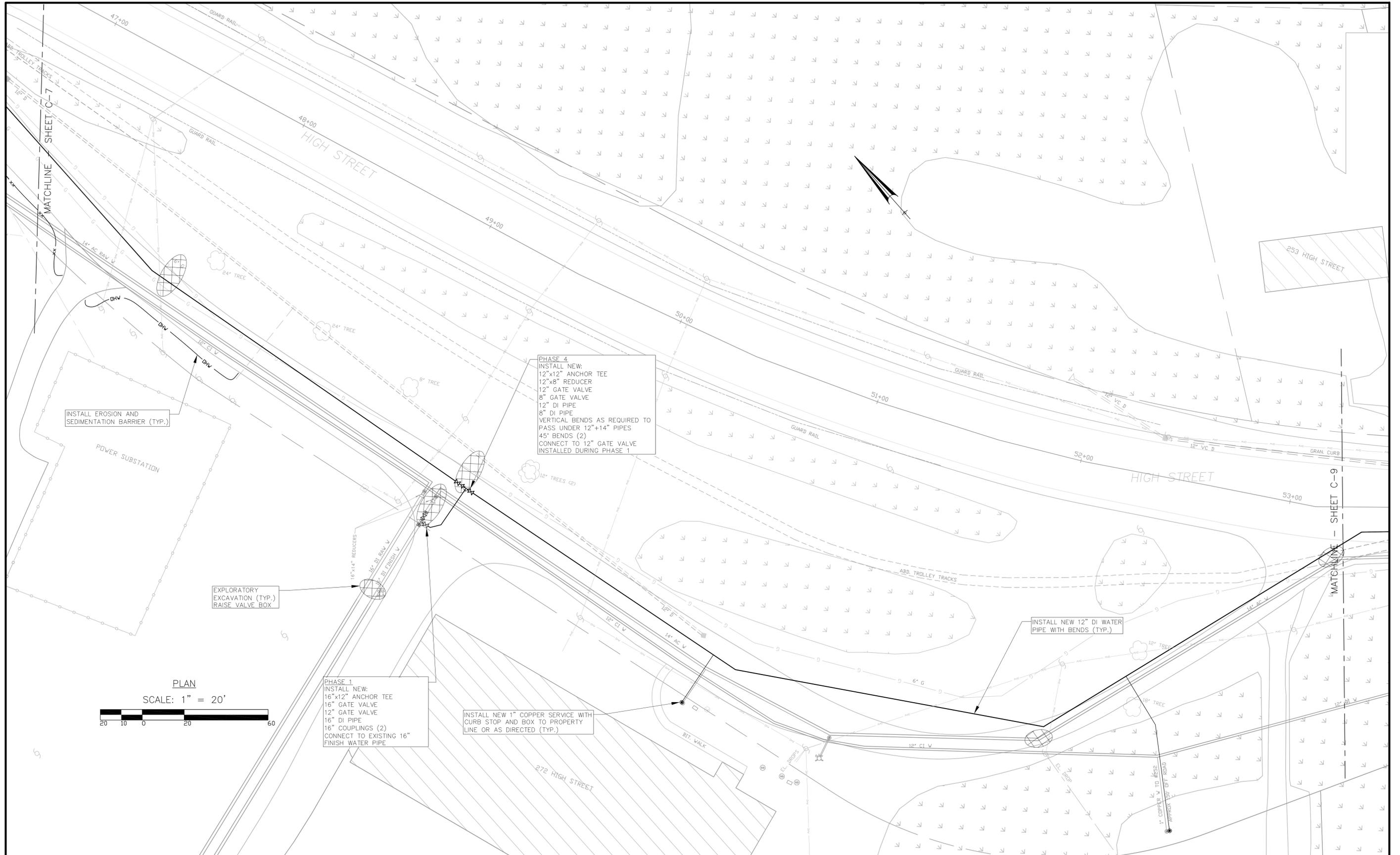
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Drawn by	DJW
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Approved by	WMR
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INSTALL EROSION AND SEDIMENTATION BARRIER (TYP.)

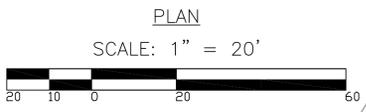
EXPLORATORY EXCAVATION (TYP.) RAISE VALVE BOX

PHASE 4:
 INSTALL NEW:
 12"x12" ANCHOR TEE
 12"x8" REDUCER
 12" GATE VALVE
 8" GATE VALVE
 12" DI PIPE
 8" DI PIPE
 VERTICAL BENDS AS REQUIRED TO PASS UNDER 12"+14" PIPES
 45' BENDS (2)
 CONNECT TO 12" GATE VALVE INSTALLED DURING PHASE 1

PHASE 1:
 INSTALL NEW:
 16"x12" ANCHOR TEE
 16" GATE VALVE
 12" GATE VALVE
 12" DI PIPE
 16" COUPLINGS (2)
 CONNECT TO EXISTING 16" FINISH WATER PIPE

INSTALL NEW 1" COPPER SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED (TYP.)

INSTALL NEW 12" DI WATER PIPE WITH BENDS (TYP.)



Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 45+61 TO STATION 52+33

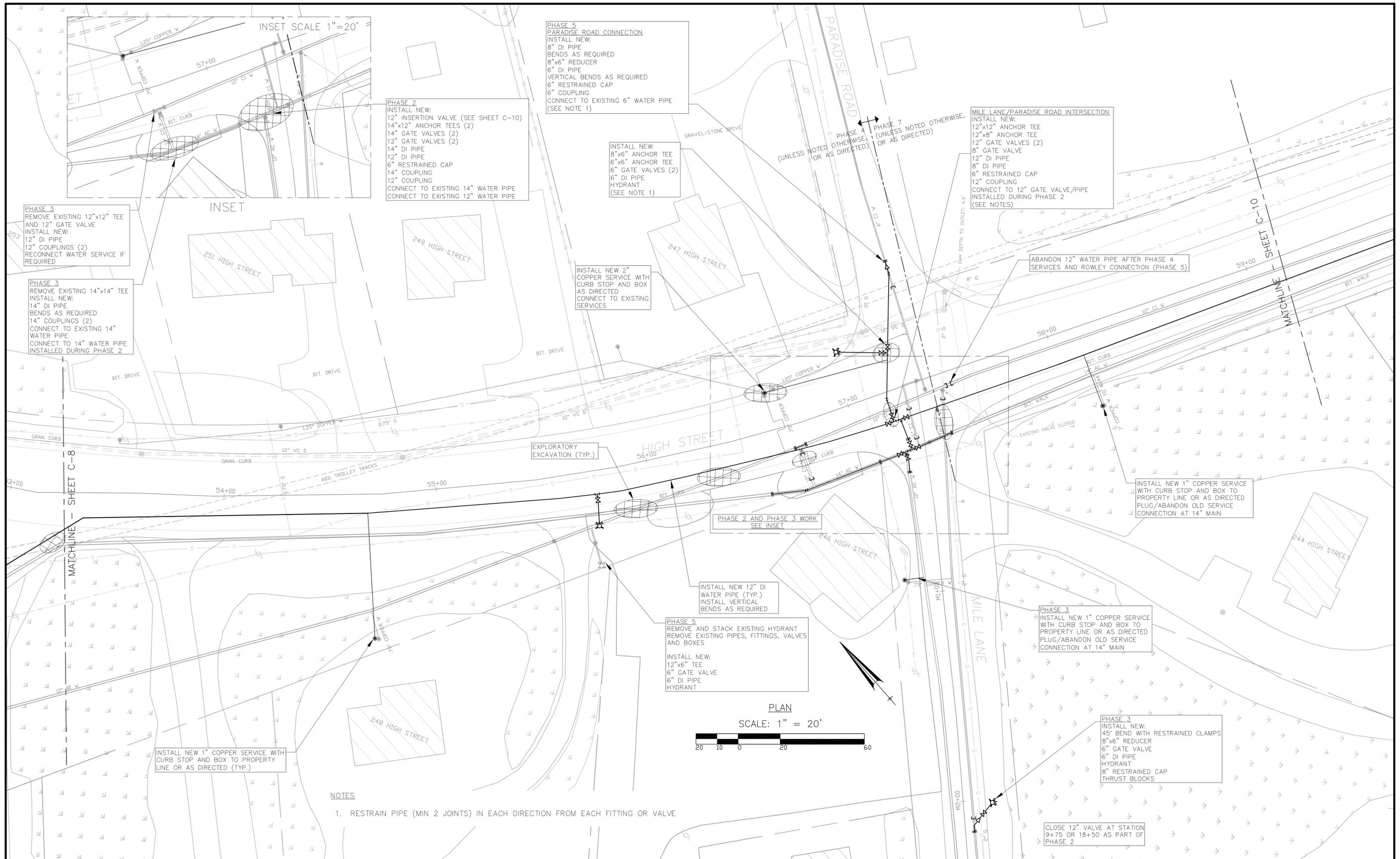
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INSTALL NEW 1" COPPER SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED (TYP.)

NOTES

1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 52+33 TO STATION 58+27

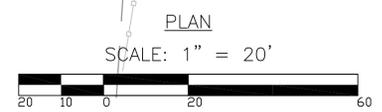
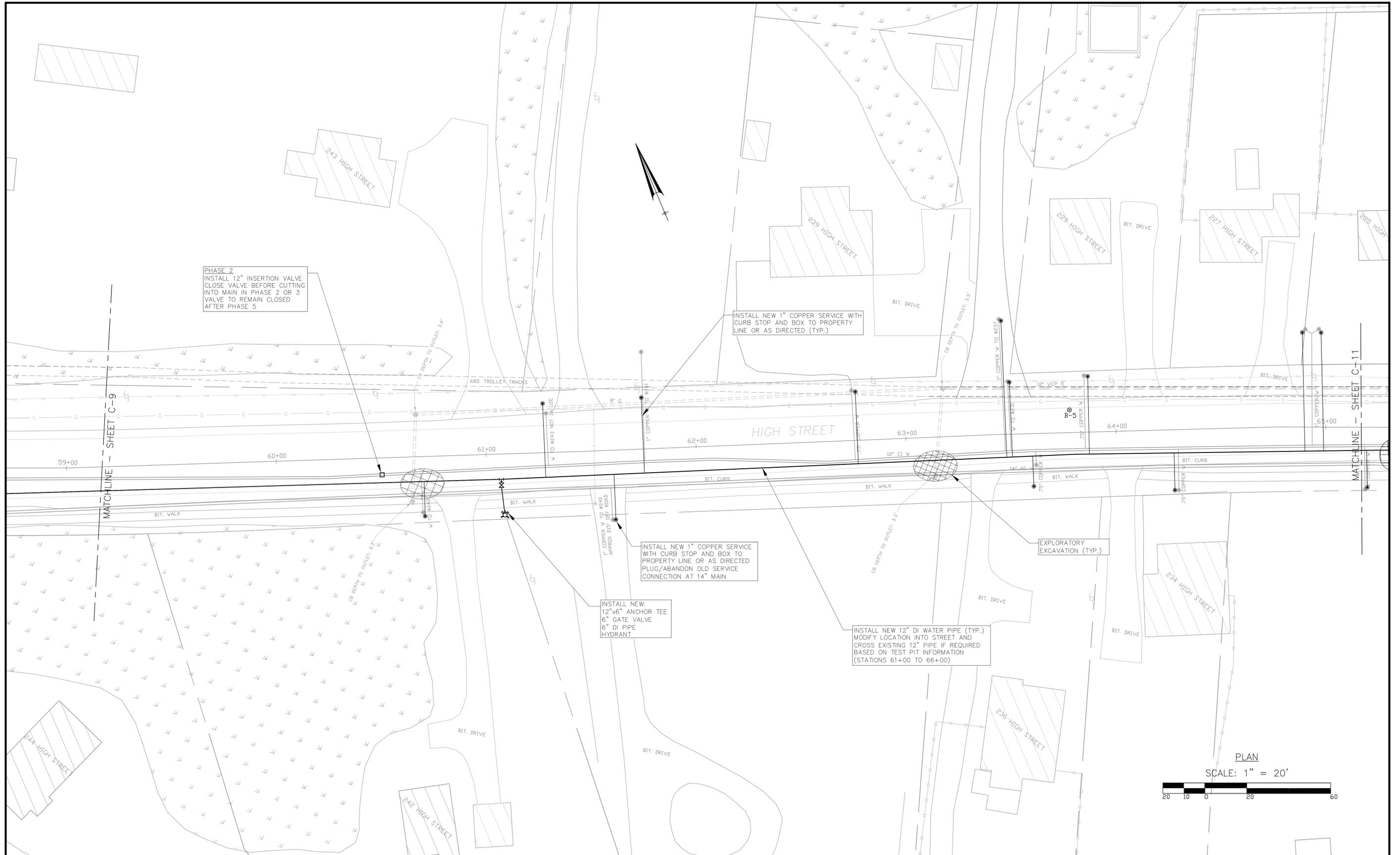
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Job	IP-HIGH ST.
Designed by	WMR
Drawn by	DJW
Checked by	WMR No.
Approved by	WMR

Description	Date



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Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 58+27 TO STATION 64+28

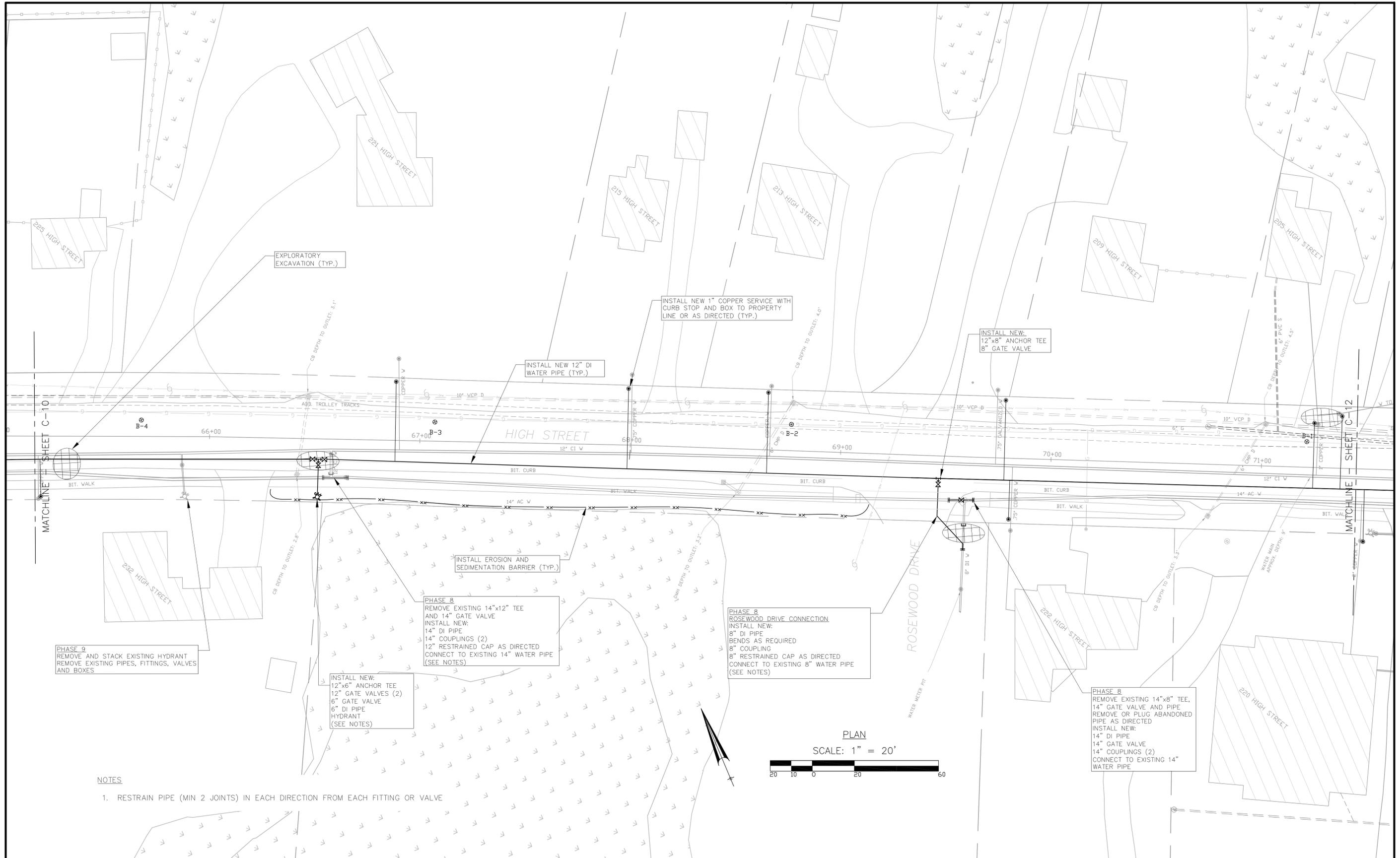
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NOTES

1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 64+28 TO STATION 70+56

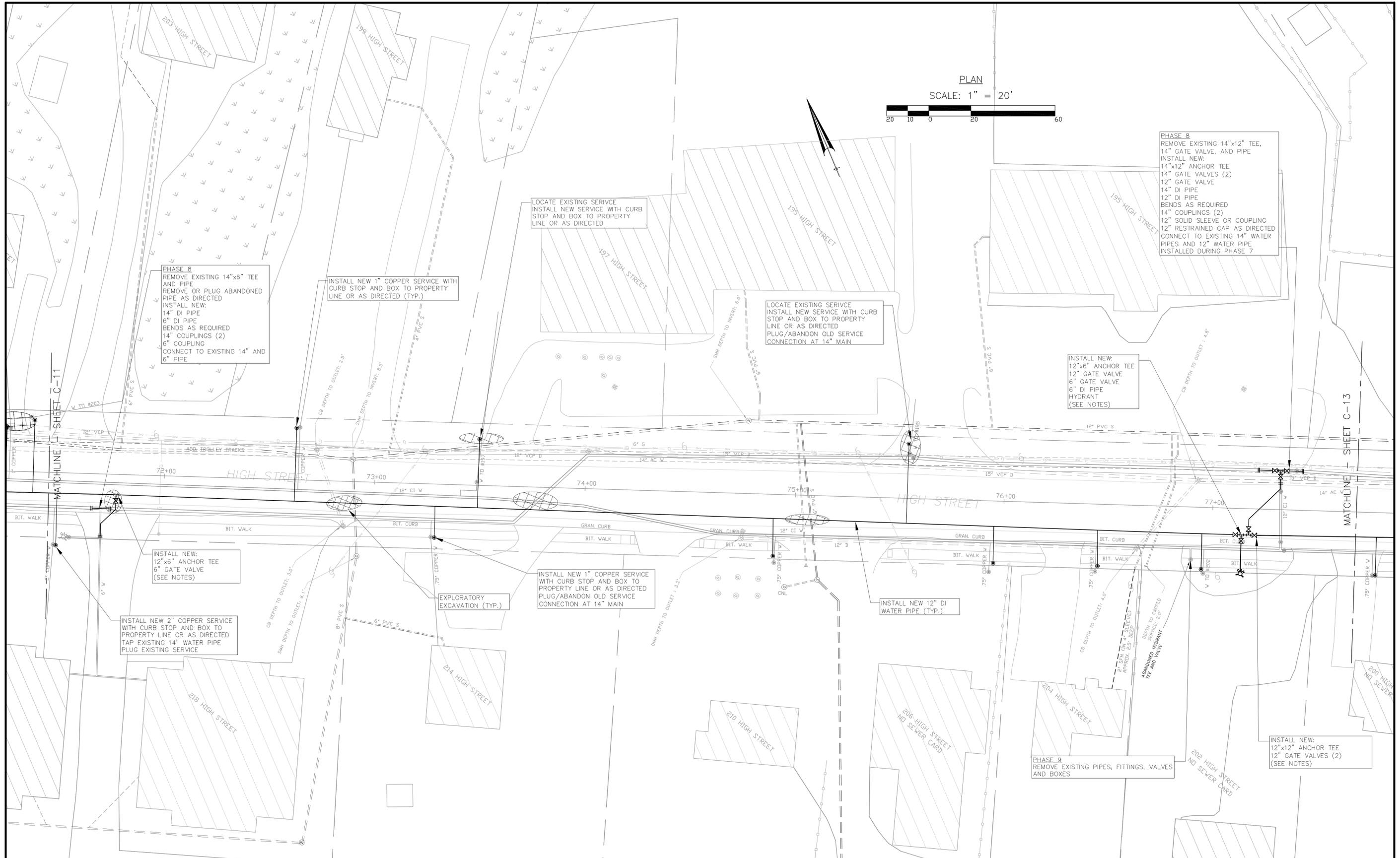
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PLAN
SCALE: 1" = 20'



PHASE 8
REMOVE EXISTING 14"x6" TEE AND PIPE
REMOVE OR PLUG ABANDONED PIPE AS DIRECTED
INSTALL NEW:
14" DI PIPE
6" DI PIPE
BENDS AS REQUIRED
14" COUPLINGS (2)
6" COUPLING
CONNECT TO EXISTING 14" AND 6" PIPE

INSTALL NEW 1" COPPER SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED (TYP.)

LOCATE EXISTING SERVICE
INSTALL NEW SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED

LOCATE EXISTING SERVICE
INSTALL NEW SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED
PLUG/ABANDON OLD SERVICE CONNECTION AT 14" MAIN

PHASE 8
REMOVE EXISTING 14"x12" TEE, 14" GATE VALVE, AND PIPE
INSTALL NEW:
14"x12" ANCHOR TEE
14" GATE VALVES (2)
12" GATE VALVE
14" DI PIPE
12" DI PIPE
BENDS AS REQUIRED
14" COUPLINGS (2)
12" SOLID SLEEVE OR COUPLING
12" RESTRAINED CAP AS DIRECTED
CONNECT TO EXISTING 14" WATER PIPES AND 12" WATER PIPE INSTALLED DURING PHASE 7

INSTALL NEW:
12"x6" ANCHOR TEE
12" GATE VALVE
6" DI PIPE
HYDRANT (SEE NOTES)

INSTALL NEW:
12"x6" ANCHOR TEE
6" GATE VALVE (SEE NOTES)

INSTALL NEW 2" COPPER SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED
TAP EXISTING 14" WATER PIPE
PLUG EXISTING SERVICE

INSTALL NEW 1" COPPER SERVICE WITH CURB STOP AND BOX TO PROPERTY LINE OR AS DIRECTED
PLUG/ABANDON OLD SERVICE CONNECTION AT 14" MAIN

INSTALL NEW 12" DI WATER PIPE (TYP.)

PHASE 9
REMOVE EXISTING PIPES, FITTINGS, VALVES AND BOXES

INSTALL NEW:
12"x12" ANCHOR TEE
12" GATE VALVES (2) (SEE NOTES)

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 70+56 TO STATION 76+78

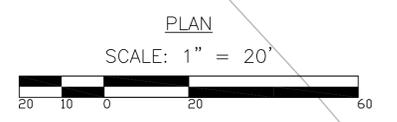
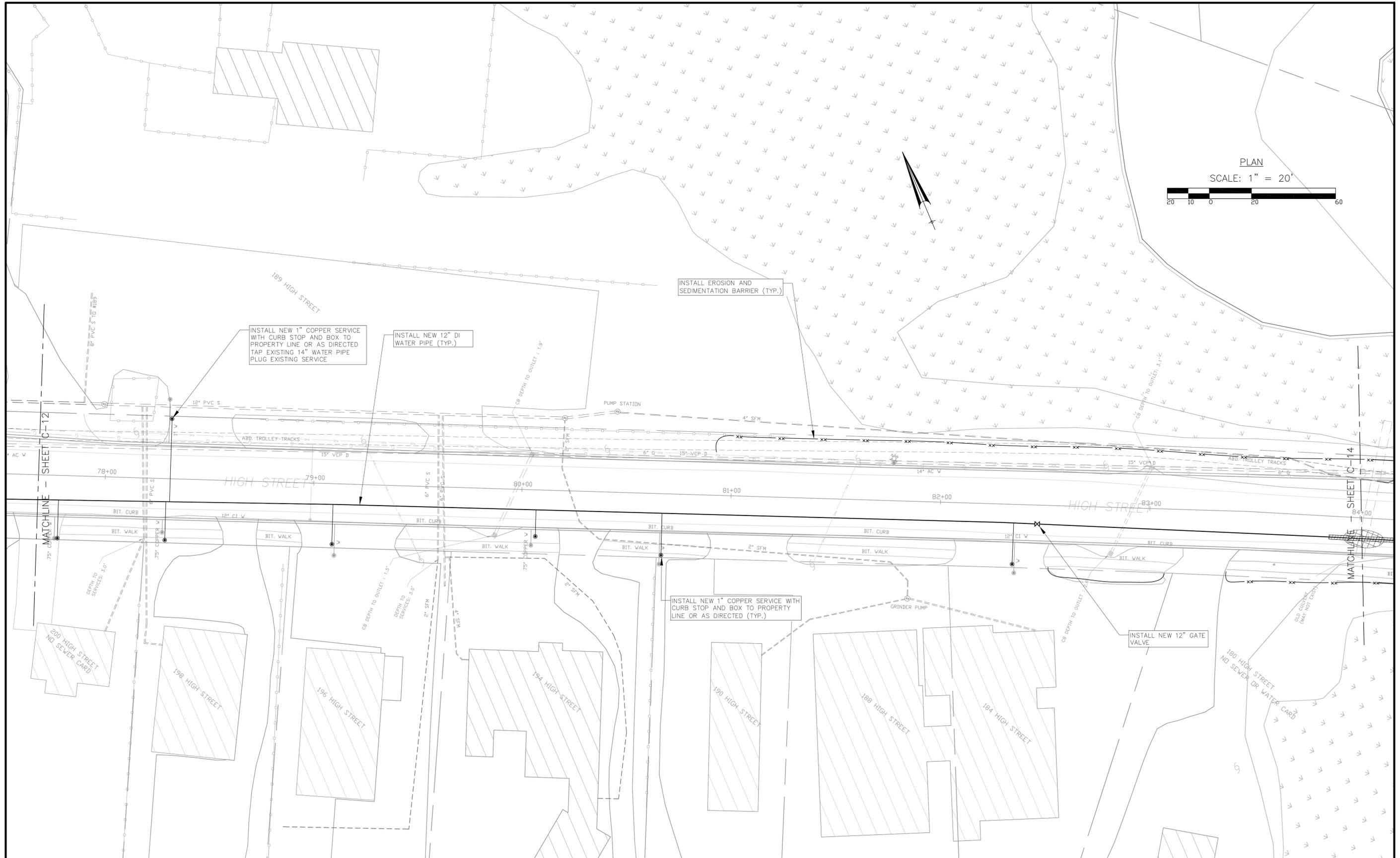
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Designed by	WMR
Drawn by	DJW
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Approved by	WMR
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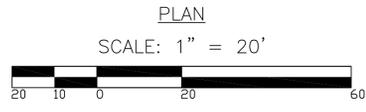
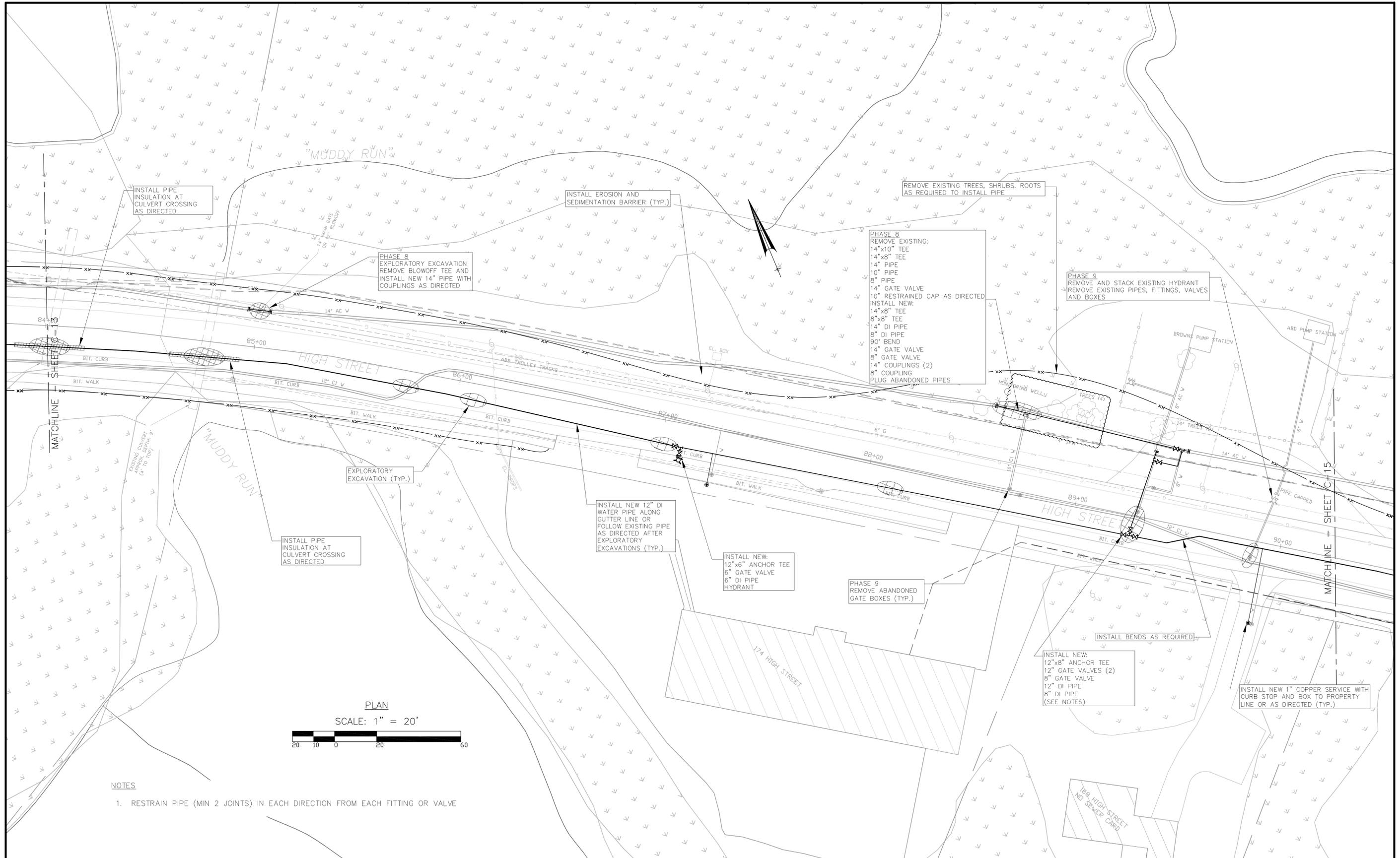
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Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 76+78 TO STATION 83+07

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Designed by	WMR
Drawn by	DJW
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Approved by	WMR
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- NOTES
1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 83+07 TO STATION 89+30

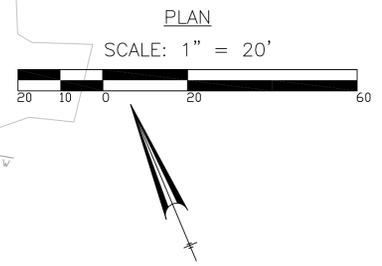
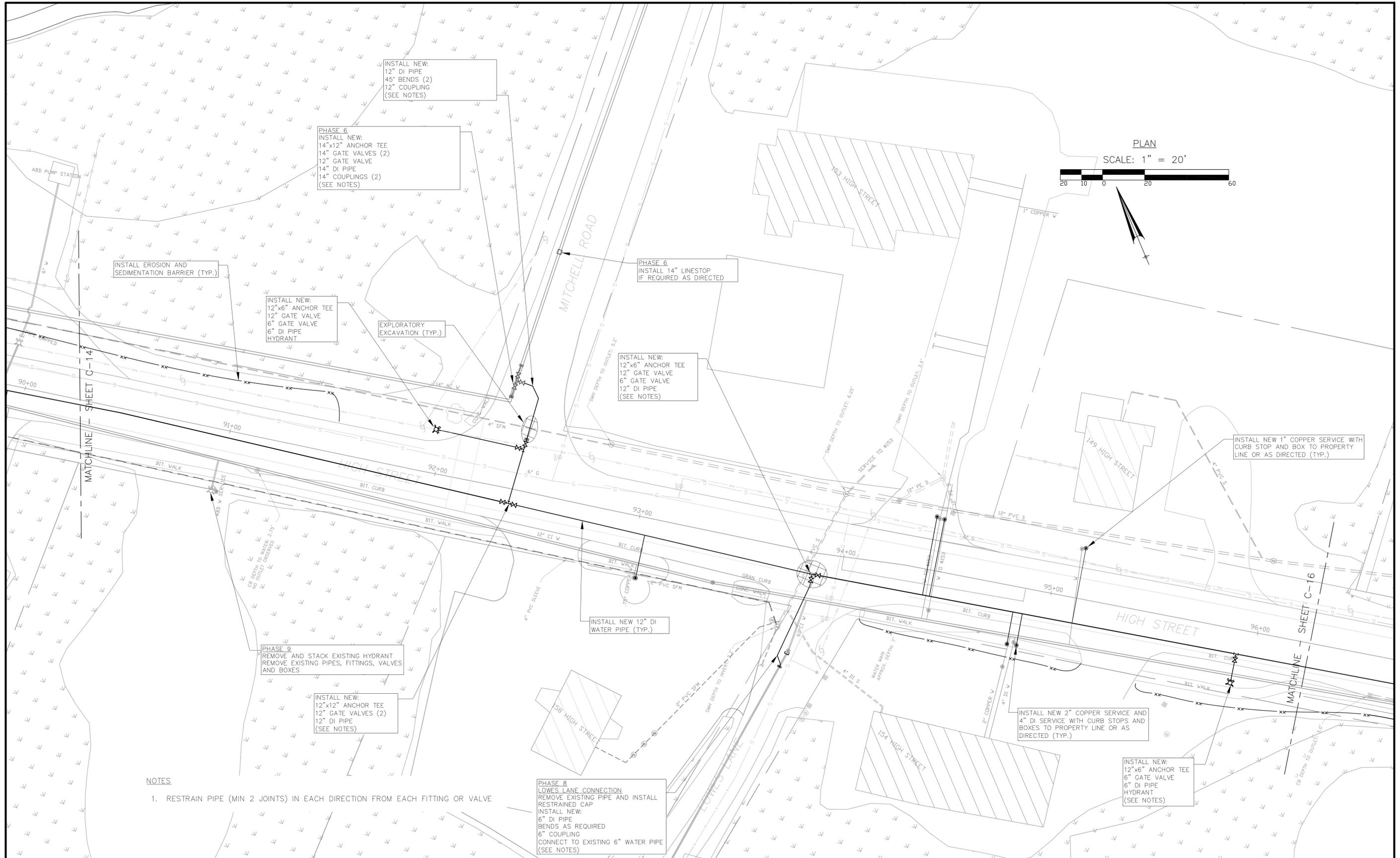
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NOTES

1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

INSTALL NEW:
12" DI PIPE
45' BENDS (2)
12" COUPLING
(SEE NOTES)

PHASE 6
INSTALL NEW:
14"x12" ANCHOR TEE
14" GATE VALVES (2)
12" GATE VALVE
14" DI PIPE
14" COUPLINGS (2)
(SEE NOTES)

INSTALL EROSION AND
SEDIMENTATION BARRIER (TYP.)

INSTALL NEW:
12"x6" ANCHOR TEE
12" GATE VALVE
6" GATE VALVE
6" DI PIPE
HYDRANT

EXPLORATORY
EXCAVATION (TYP.)

PHASE 6
INSTALL 14" LINESSTOP
IF REQUIRED AS DIRECTED

INSTALL NEW:
12"x6" ANCHOR TEE
12" GATE VALVE
6" GATE VALVE
12" DI PIPE
(SEE NOTES)

INSTALL NEW 1" COPPER SERVICE WITH
CURB STOP AND BOX TO PROPERTY
LINE OR AS DIRECTED (TYP.)

PHASE 9
REMOVE AND STACK EXISTING HYDRANT
REMOVE EXISTING PIPES, FITTINGS, VALVES
AND BOXES

INSTALL NEW:
12"x12" ANCHOR TEE
12" GATE VALVES (2)
12" DI PIPE
(SEE NOTES)

INSTALL NEW 12" DI
WATER PIPE (TYP.)

PHASE 8
LOWES LANE CONNECTION
REMOVE EXISTING PIPE AND INSTALL
RESTRAINED CAP
INSTALL NEW:
6" DI PIPE
BENDS AS REQUIRED
6" COUPLING
CONNECT TO EXISTING 6" WATER PIPE
(SEE NOTES)

INSTALL NEW 2" COPPER SERVICE AND
4" DI SERVICE WITH CURB STOPS AND
BOXES TO PROPERTY LINE OR AS
DIRECTED (TYP.)

INSTALL NEW:
12"x6" ANCHOR TEE
6" GATE VALVE
6" DI PIPE
HYDRANT
(SEE NOTES)

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT STATION 89+30 TO STATION 95+25

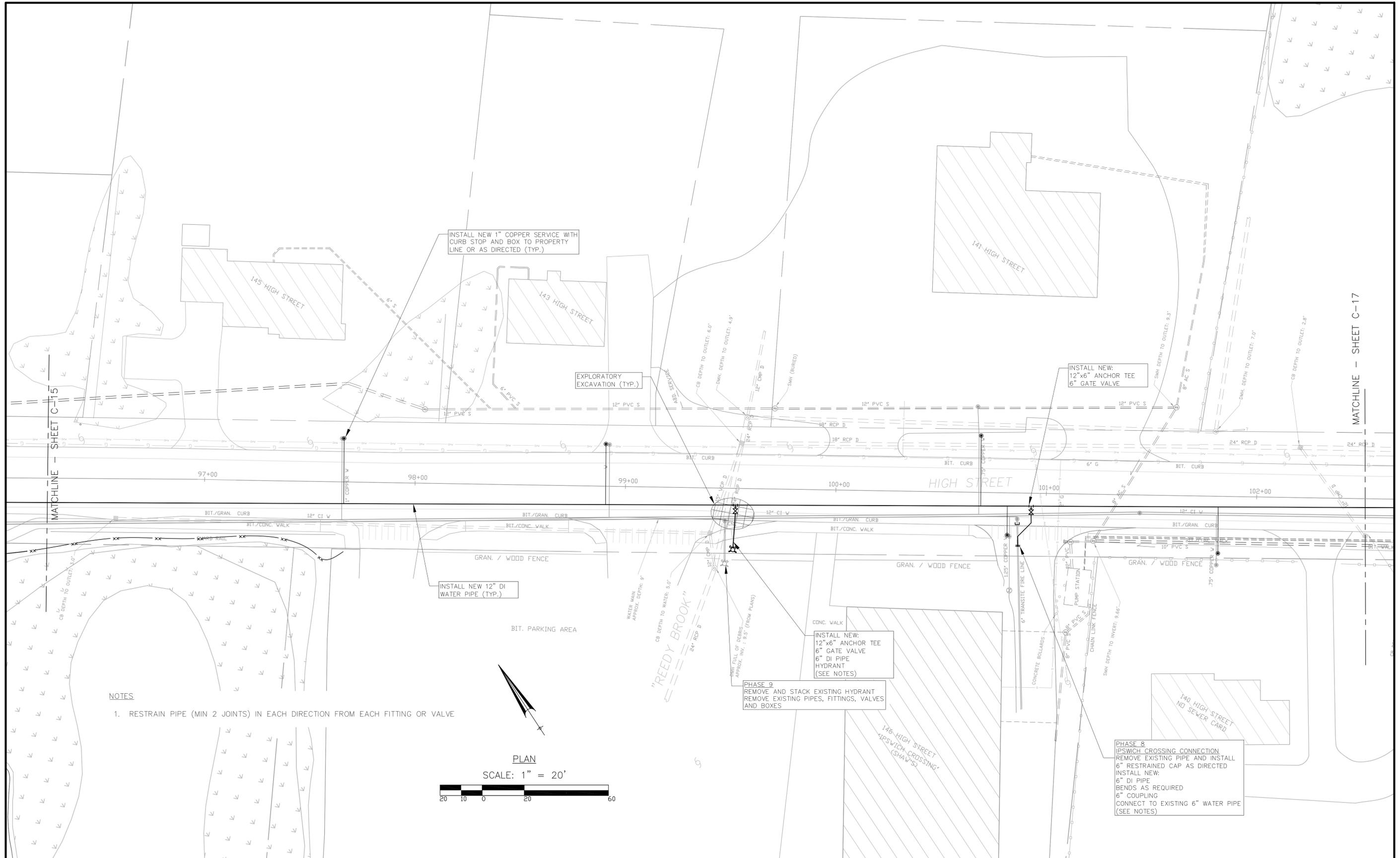
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NOTES

1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

PLAN

SCALE: 1" = 20'



Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 95+25 TO STATION 101+52

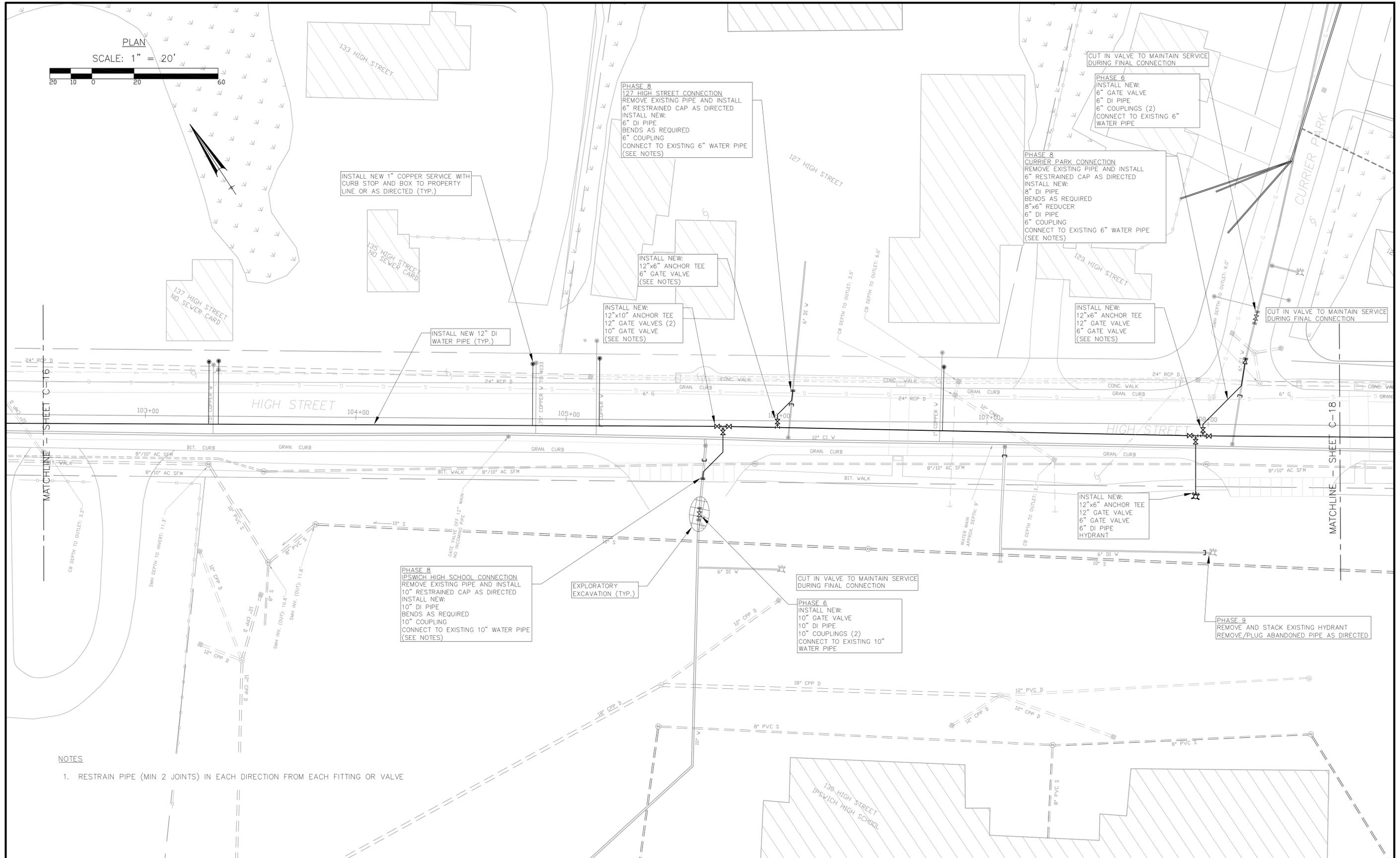
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Date	



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PLAN
SCALE: 1" = 20'



PHASE 8
127 HIGH STREET CONNECTION
REMOVE EXISTING PIPE AND INSTALL
6" RESTRAINED CAP AS DIRECTED
INSTALL NEW:
6" DI PIPE
BENDS AS REQUIRED
6" COUPLING
CONNECT TO EXISTING 6" WATER PIPE
(SEE NOTES)

PHASE 6
INSTALL NEW:
6" GATE VALVE
6" DI PIPE
6" COUPLINGS (2)
CONNECT TO EXISTING 6"
WATER PIPE

PHASE 8
CURRIER PARK CONNECTION
REMOVE EXISTING PIPE AND INSTALL
6" RESTRAINED CAP AS DIRECTED
INSTALL NEW:
8" DI PIPE
BENDS AS REQUIRED
8"x6" REDUCER
6" DI PIPE
6" COUPLING
CONNECT TO EXISTING 6" WATER PIPE
(SEE NOTES)

INSTALL NEW 1" COPPER SERVICE WITH
CURB STOP AND BOX TO PROPERTY
LINE OR AS DIRECTED (TYP.)

INSTALL NEW:
12"x6" ANCHOR TEE
6" GATE VALVE
(SEE NOTES)

INSTALL NEW:
12"x10" ANCHOR TEE
12" GATE VALVE (2)
10" GATE VALVE
(SEE NOTES)

INSTALL NEW:
12"x6" ANCHOR TEE
12" GATE VALVE
6" GATE VALVE
6" DI PIPE
(SEE NOTES)

INSTALL NEW 12" DI
WATER PIPE (TYP.)

PHASE 8
IPSWICH HIGH SCHOOL CONNECTION
REMOVE EXISTING PIPE AND INSTALL
10" RESTRAINED CAP AS DIRECTED
INSTALL NEW:
10" DI PIPE
BENDS AS REQUIRED
10" COUPLING
CONNECT TO EXISTING 10" WATER PIPE
(SEE NOTES)

EXPLORATORY
EXCAVATION (TYP.)

CUT IN VALVE TO MAINTAIN SERVICE
DURING FINAL CONNECTION

PHASE 6
INSTALL NEW:
10" GATE VALVE
10" DI PIPE
10" COUPLINGS (2)
CONNECT TO EXISTING 10"
WATER PIPE

PHASE 9
REMOVE AND STACK EXISTING HYDRANT
REMOVE/PLUG ABANDONED PIPE AS DIRECTED

NOTES
1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 101+52 TO STATION 107+68

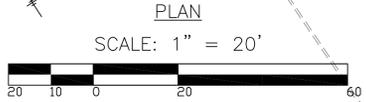
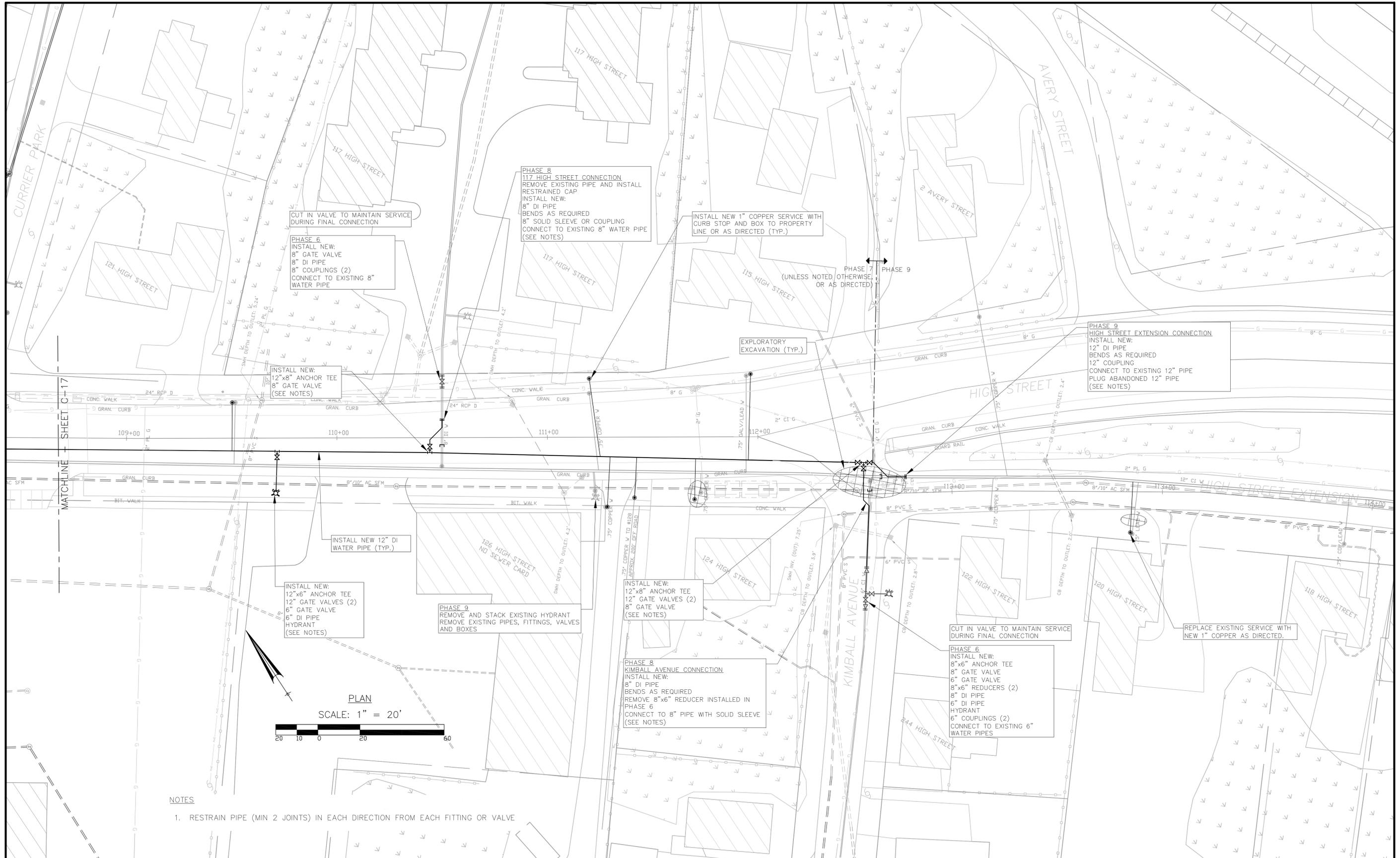
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- NOTES
1. RESTRAIN PIPE (MIN 2 JOINTS) IN EACH DIRECTION FROM EACH FITTING OR VALVE

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	STATION 107+68 TO STATION 113+94

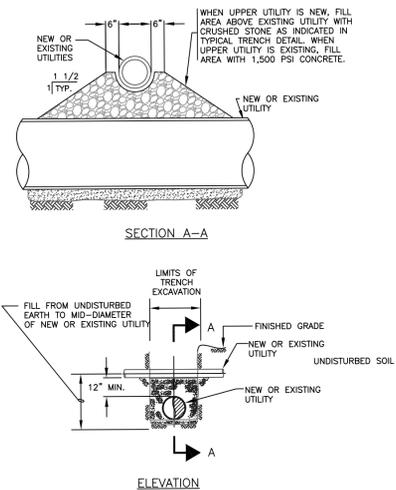
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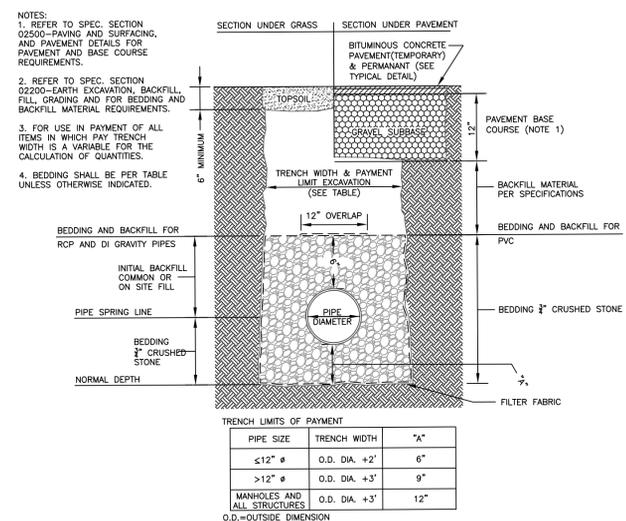
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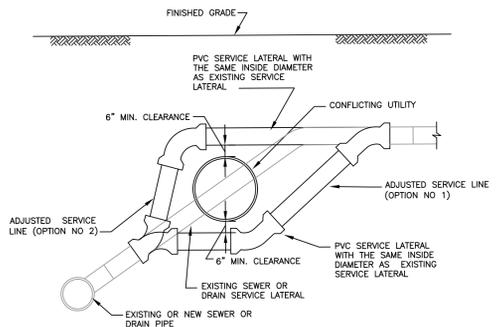
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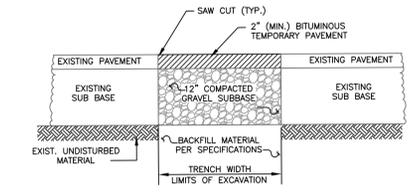
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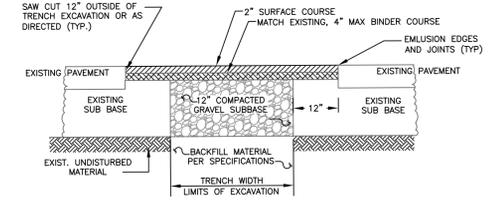
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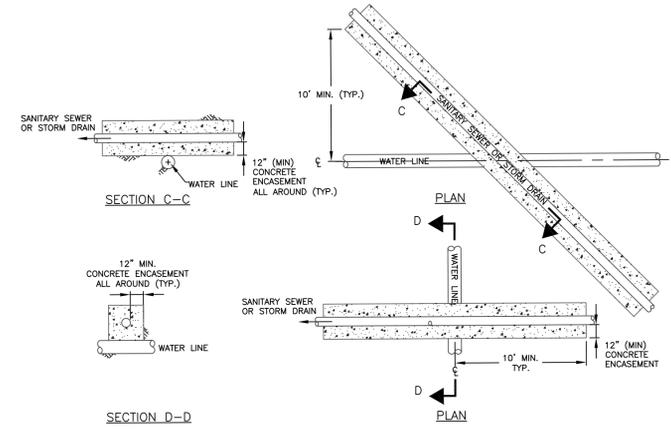
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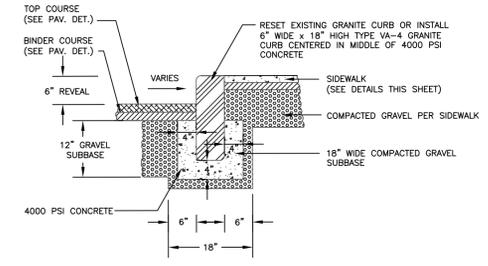
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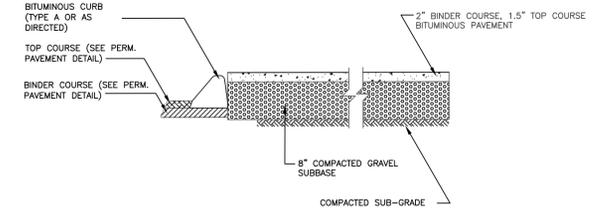
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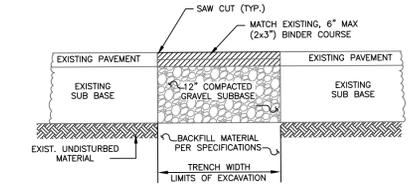
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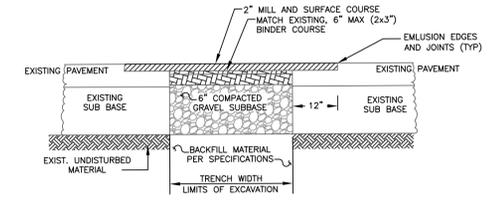
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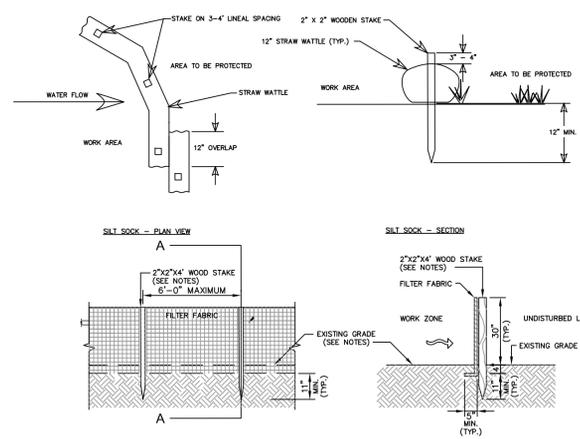
BITUMINOUS CONCRETE CURB
NOT TO SCALE



ALTERNATIVE 1A PERMANENT PAVEMENT DETAIL
NOT TO SCALE



ALTERNATIVE 1B PERMANENT PAVEMENT DETAIL
NOT TO SCALE



- NOTES:
- CONTRACTOR TO INSTALL 12-INCH STRAW WATTLES OR SILT FENCE AS DIRECTED AND APPROVED BY LOCAL CONSERVATION COMMISSION
 - FABRIC FOR FENCES TO BE UV RESISTANT POLYPROPYLENE WITH A MINIMUM WEIGHT OF 2.5 OZ./S.Y. TUBULAR BLACK POLYPROPYLENE FOR STRAW WATTLES SHALL BE PHOTO DEGRADABLE.
 - FABRIC TO BE ATTACHED TO STAKES WITH STAPLES.
 - A MINIMUM OF (2) WOODEN OR METAL STAKES PER HAY BALE. DRIVE STAKES A MINIMUM OF 12" INTO GROUND.
 - STRAW MATERIAL TO BE DISPERSED ON SITE OR HAULED OFFSITE AND DISPOSED AS DETERMINED BY THE ENGINEER.
 - CONTRACTOR TO INSTALL GEOTEXTILE (SILT SACK) IN ALL CATCH BASINS PRIOR TO EXCAVATION.
 - ALL CONSTRUCTION DEWATERING MUST BE TREATED WITH A FILTRATION DEVICE (DIRTING) AND/OR SEDIMENTATION TANK OR APPROVED TREATMENT DEVICE PRIOR TO DISCHARGE UPGRADIENT OF OTHER EROSION AND SEDIMENTATION DEVICES AND CONTROLS.

EROSION & SEDIMENTATION BARRIER
NOT TO SCALE

- GENERAL PAVING NOTES:
- THE CONTRACTOR SHALL MAINTAIN TEMPORARY PAVEMENT FOR A MINIMUM OF 90 DAYS EXCEPT IF TEMPORARY PAVEMENT IS PLACED AFTER OCTOBER 15, THEN IT SHALL BE MAINTAINED UNTIL APRIL 15 OF THE FOLLOWING YEAR.
 - PERMANENT PAVEMENT SHALL BE PLACED BETWEEN APRIL 15 AND OCTOBER 15 OF EACH CALENDAR YEAR UNLESS APPROVED AND DIRECTED BY ENGINEER.
 - THE CONTRACTOR SHALL SAW CUT 12" OUTSIDE OF TRENCH EXCAVATION OR AS DIRECTED. TEMPORARY PAVEMENT SHALL BE REMOVED AND DISPOSED OF. THE GRAVEL SHALL BE FINE GRADED, EMULSION PLACED ON ALL JOINTS, AND PERMANENT PAVEMENT PLACED IN TWO COURSES.
 - CONTRACTOR SHALL MATCH EXISTING ROADWAY GRADES AND EXISTING THICKNESS UNLESS OTHERWISE DIRECTED.
 - REFER TO SPECIFICATION SECTION 02500 PAVING AND SURFACING FOR ADDITIONAL REQUIREMENTS.
 - PERMANENT PAVEMENT DETAIL TO APPLY TO TRENCH PAVEMENT AND FULL WIDTH ROADWAY RECONSTRUCTION AND/OR PAVEMENT.

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	DETAILS

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Approved by	WMR

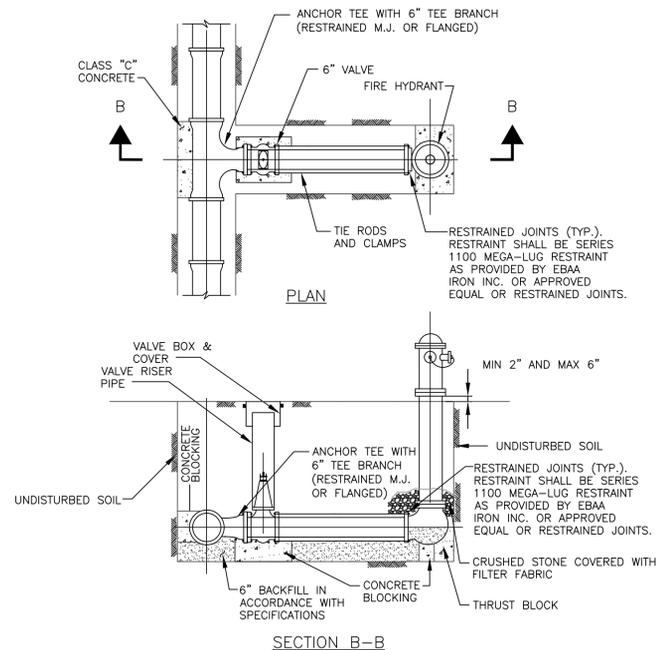
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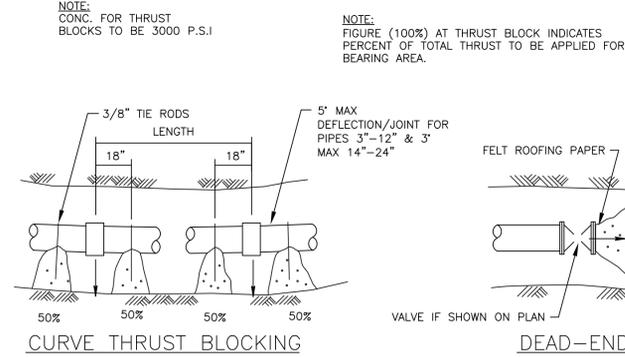
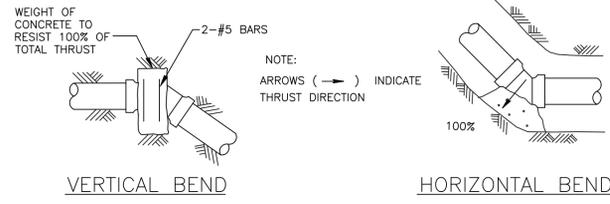
265 Essex Street
SALEM, MASSACHUSETTS

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FIRE HYDRANT DETAIL
NOT TO SCALE

- NOTES:**
1. LOCATE FIRE HYDRANTS AS SHOWN ON DRAWINGS, APPROXIMATELY 3 FEET BEHIND CURB OR PROJECTED FUTURE CURB.
 2. THE FIRE HYDRANT STEAMER NOZZLE SHALL FACE THE STREET.
 3. REFER TO SPECIFICATION SECTION 03300 FOR CONCRETE (3,000 PSI) THRUST BLOCKS.
 4. PROVIDE HYDRANT, VALVE AND TEE JOINTS WITH RESTRAINED MECHANICAL JOINTS.



CONCRETE THRUST BLOCKS FOR DUCTILE IRON PIPE
NOT TO SCALE

PIPE SIZE	THRUST PER PSI OF WATER PRESSURE AT VARIOUS FITTINGS			
	DEAD END OR TEE	90° ELBOW	45° ELBOW	22 1/2° ELBOW
6	39	55	30	15
8	67	94	51	26
10	109	154	84	43
12	155	218	119	61
16	275	383	209	106
18	351	494	269	137

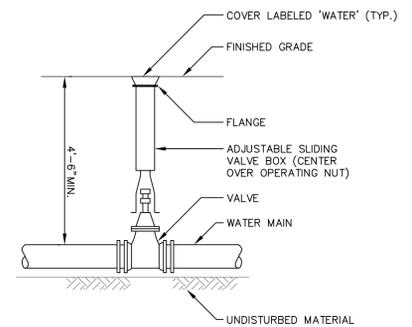
EXAMPLE:
8-INCH 90° ELBOW, PRESSURE=200lb./SQ.IN.
FROM TABLE: THRUST=94 x 200=18,800 lb.
ASSUME BEARING STRENGTH OF SOIL=2000 lb./SQ.FT.

$18,800 / 2000 = 9.4 \text{ SQ.FT.} = \text{AREA OF BEARING REQUIRED FOR THRUST BLOCK}$

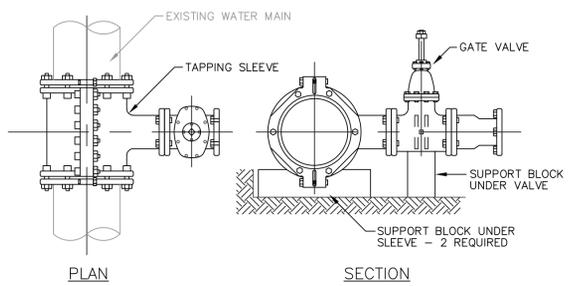
PIPE SIZE-in.	SIDE THRUST PER 100 lb./sq.in. PRESSURE PER DEGREE OF DEFLECTION	
	THRUST-lb	PIPE SIZE-in.
6	72	12
8	122	16
10	197	18

MULTIPLY THRUST BY DEGREE OF DEFLECTION TO OBTAIN TOTAL THRUST

- NOTES:**
1. IN USING THE ABOVE TABLES, USE THE MAXIMUM INTERNAL PRESSURE ANTICIPATED (i.e. HYDROSTATIC TEST PRESSURE, POSSIBLE SURGE PRESSURE DUE TO PUMP SHUT-OFF, ETC).
 2. ASSUME A SOIL BEARING STRENGTH OF 2000 LB. PER SQ. FOOT.
 3. JOINTS SHALL BE PROTECTED BY FELT ROOFING PAPER PRIOR TO PLACING CONCRETE.
 4. REFER TO SPECIFICATION SECTION 03300 - CONCRETE FOR CONCRETE REQUIREMENTS

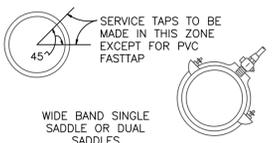


TYPICAL VALVE BOX DETAIL
NOT TO SCALE



NOTES:
SUPPORT BLOCKS TO BE PRESSURE TREATED WOOD OR CONCRETE MASONRY BLOCK.

TAPPING SLEEVE WITH GATE VALVE
NOT TO SCALE

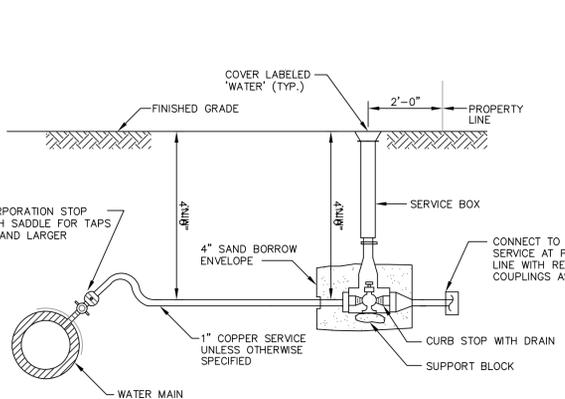


SERVICE CONNECTION
NOT TO SCALE

NOTES:
1. BLOW-OFF & CHLORINATION TAPS ARE MADE IN VERTICAL POSITION

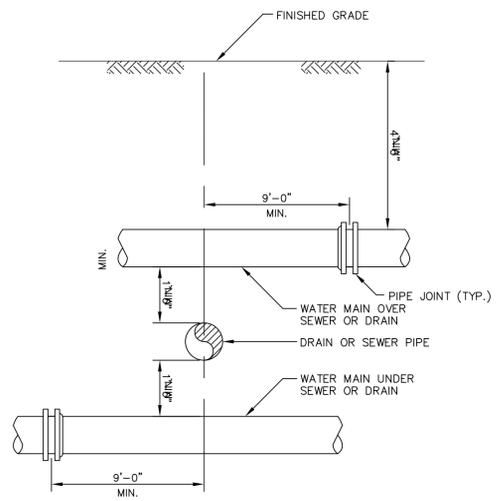
PIPE TAPPING SCHEDULE	
WATER MAIN TYPE AND DIAMETER	SERVICE TAP TYPE
12" OR LESS CAST IRON OR DUCTILE IRON	DSS, WBSS
16" AND UP CAST IRON OR DUCTILE IRON	DWBSS

DSS - DUAL STRAP SADDLES
WBSS - WIDE BAND STRAP SADDLES
DWBSS - DUAL WIDE BAND STRAP SADDLES

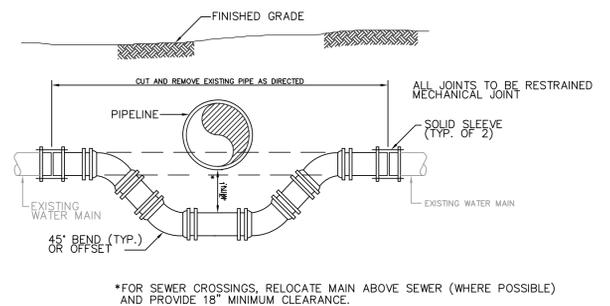


- NOTES:**
1. FLUSH ALL NEW SERVICE LINES PRIOR TO CONNECTING TO EXISTING.
 2. AFTER CONNECTION, CONTRACTOR SHALL ASSIST WATER DEPT. PERSONNEL IN FLUSHING SERVICE LINES UP TO THE METER.
 3. COPPER SERVICE TO BE INSTALLED IN 6-INCH SAND ENVELOPE.
 4. CONNECT TO EXISTING SERVICE. WHERE EXISTING SERVICES DO NOT EXIST, PLUG END OF CURB STOP.
 5. ALL NEW COPPER SERVICES TO BE CONTINUOUS WITHOUT UNIONS OR COUPLINGS BETWEEN CORPORATION AND CURB STOP.

COPPER SERVICE CONNECTION DETAIL
NOT TO SCALE



WATER MAIN CROSSING WITH SEWER OR DRAIN
NOT TO SCALE



*FOR SEWER CROSSINGS, RELOCATE MAIN ABOVE SEWER (WHERE POSSIBLE) AND PROVIDE 18" MINIMUM CLEARANCE.

RELOCATION OF EXISTING WATER MAIN DETAIL
NOT TO SCALE

Figure 6H-6. Shoulder Work with Minor Encroachment (TA-6)

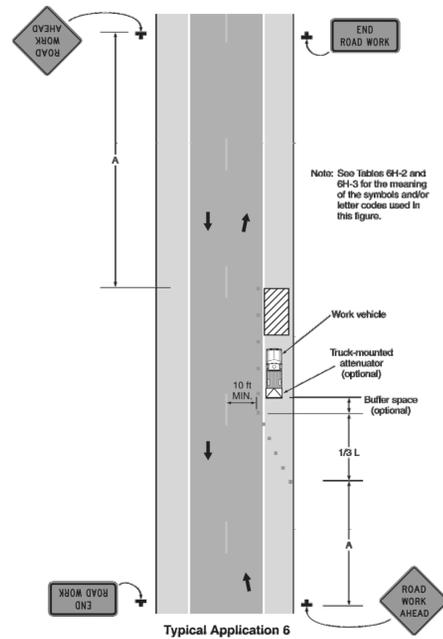


Figure 6H-10. Lane Closure on a Two-Lane Road Using Flaggers (TA-10)

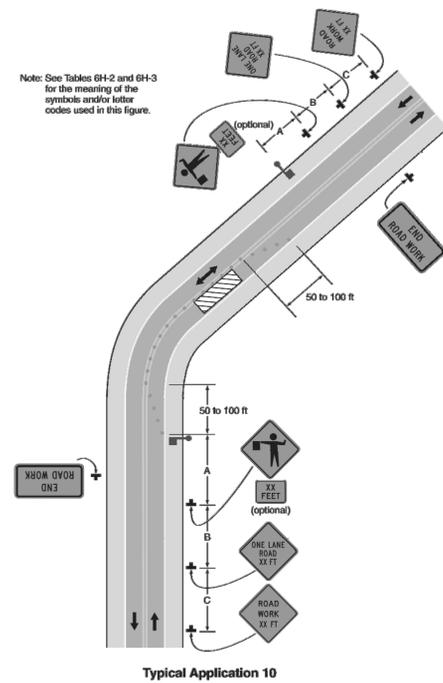


Figure 6H-27. Closure at the Side of an Intersection (TA-27)

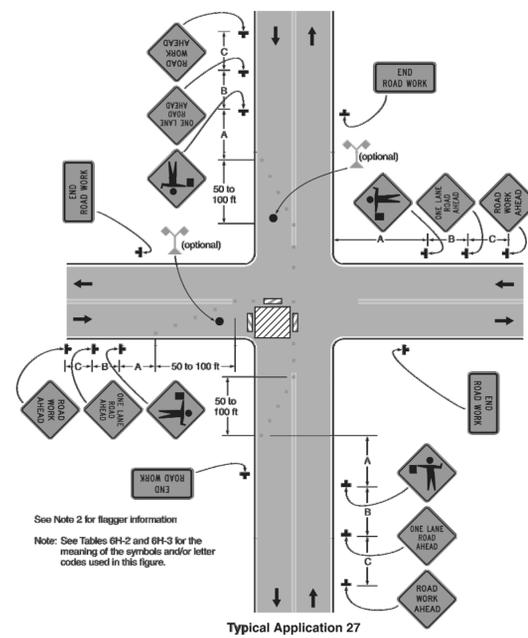
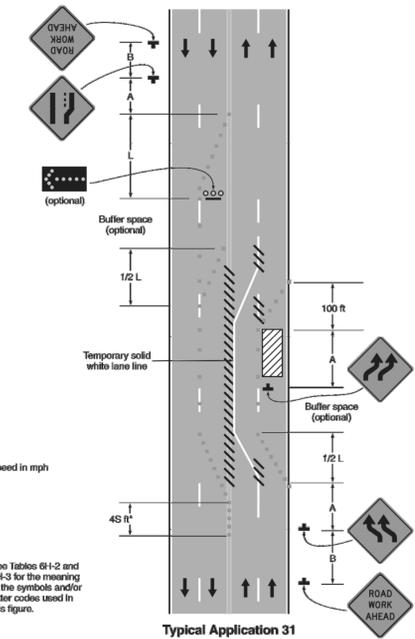


Figure 6H-31. Lane Closures on a Street with Uneven Directional Volumes (TA-31)



NOTES

1. TRAFFIC CONTROL MEASURES SHALL INCLUDE USE OF POLICE DETAILS AS REQUIRED.
2. ALL TEMPORARY TRAFFIC CONTROL WORK SHALL CONFORM TO THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD) AND ALL REVISIONS.
3. ALL SIGN LEGENDS, BORDERS AND MOUNTING SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE MUTCD.
4. TRAFFIC CONTROL SIGNAGE SHALL UTILIZE POLICE OFFICER AHEAD IN LIEU OF FLAGGER AHEAD.
5. TEMPORARY CONSTRUCTION SIGNING AND ALL OTHER TRAFFIC CONTROL DEVICES SHALL BE IN PLACE PRIOR TO THE START OF ANY WORK.
6. TEMPORARY CONSTRUCTION SIGNING, BARRICADES AND ALL OTHER NECESSARY WORK ZONE TRAFFIC CONTROL DEVICES SHALL BE REMOVED FROM THE ROADWAY OR COVERED WHEN THEY ARE NOT REQUIRED FOR CONTROL OF TRAFFIC.
7. DISTANCES ARE A GUIDE AND MAY BE ADJUSTED IN THE FIELD BY THE ENGINEER OR POLICE DETAIL.
8. MAXIMUM SPACING OF TRAFFIC DEVICES IN A TAPER (DRUMS OR CONES) IS EQUAL IN FEET TO THE SPEED LIMIT IN MPH. RATED SPEED LIMIT FOR HIGH STREET IS 40 MILES PER HOUR.
9. LETTER CODES FOR THE APPLICATION DIAGRAMS A,B, AND C ARE 100 FEET. TAPER LENGTH (L) EQUALS W TIMES S SQUARED DIVIDED BY 60; WHERE W EQUALS THE OFFSET IN FEET, AND S EQUALS THE SPEED LIMIT IN MILES PER HOUR. $L = WS^2 / 60$
10. MINIMUM LANE WIDTH IS TO BE 10 FEET UNLESS OTHERWISE SHOWN. MINIMUM LANE WIDTH TO BE MEASURED FROM THE EDGE OF DRUMS OR MEDIAN BARRIER.
11. ALL SIGNS SHALL BE MOUNTED ON THEIR OWN STANDARD SIGN SUPPORTS. BARRELS SHALL BE FITTED WITH REFLECTORS AND BLINKING LIGHTS.
12. ALL TEMPORARY WALKWAYS SHALL MEET ADA/AAB GUIDELINES.
13. ADA COMPLIANT PEDESTRIAN ACCESS SHALL BE MAINTAINED AT ALL TIMES AND SHALL INCLUDE ADDITIONAL SIGNAGE WHERE NEEDED TO DIRECT PEDESTRIAN TRAFFIC AROUND WORK ZONE.

Client	TOWN OF IPSWICH, MASSACHUSETTS
Project	HIGH STREET WATER MAIN REPLACEMENT PROJECT
	TEMPORARY TRAFFIC CONTROL DETAILS

Scale	1"=20'
Date	3/22/2019
Job	IP-HIGH ST.
Designed by	WMR
Drawn by	DJW
Checked by	WMR No.
Approved by	WMR
	Description
	Date
File: W:\Ipswich\High Street Water Main\CAD\Ipswich_Design32219.dwg	



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265 Essex Street
SALEM, MASSACHUSETTS

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SECTION 02210

EARTH EXCAVATION, BACKFILL, FILL AND GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This Section includes excavations of normal depth in earth and rock for trenches and structures; backfilling such excavations to the extent required; filling; dewatering, blasting, rough grading; constructing embankments; miscellaneous earth excavation and rock excavation; the removal, hauling and stockpiling of suitable excavated material for subsequent use in the work; all rehandling, hauling and placing of stockpiled materials for use in refilling, filling, backfilling, grading and such other operations; the removal and satisfactory disposal off the site of unsuitable material; and appurtenant work, complete, in accordance with the Drawings and Specifications, and as directed.
- B. All excavated materials not utilized for backfill or fill including all surplus or excess excavated materials, boulders, and pavement materials from the required excavations shall be removed and legally disposed off the project site in disposal areas furnished by the Contractor at no additional expense to the Owner.

1.3 SUBMITTALS

- A. General: Shop Drawings, submit the following in accordance with Section 01300 – SUBMITTAL PROCEDURES.
- B. Backfill Materials: Submit a grain size analysis and curve performed in accordance with ASTM D422 for each proposed source of backfill for review by the Engineer. The grain size analysis shall indicate that the backfill material conforms to the gradation requirements specified.
- C. Submit a moisture-density curve indicating the maximum dry density and optimum moisture content as determined by ASTM D1557 for each proposed source of backfill for review of the Engineer.
- D. Blasting Design: Not less than 10 calendar days prior to starting a new phase of the work or any time prior to changing the accepted blast design and procedures, submit in writing to the Engineer the following data of the proposed blasting operations.
 - 1. Location, depth, area, anticipated neat lines and relationship to adjacent structures.
 - 2. Diameter, spacing, burden, depth, pattern and inclination of blast holes.

3. Type, strength, amount in terms of weight and cartridges of explosives to be used in each hole, on each delay and the total for the blast.
 4. The distribution of the charge in the holes and the priming of each hole.
 5. Type, sequence and number of delays, delay pattern; wiring diagram for blast; size and type of hookup lines, and lead lines; type and capacity of firing source; type, size and location of safety switches, lightning gaps.
 6. Scaled range or distance used to calculate the scaled range if the blast will exceed vibration limits.
 7. Stemming of holes and matting or covering of blast area.
- E. Blasting Reports: Complete, maintain and submit to the Engineer permanent blast reports including logs of each blast. Complete reports after each blast to include the following information:
1. Date, time and limits of blast by station.
 2. Amount of explosives used by weight and number of cartridges.
 3. Total number of delays used and number of holes used for each delay period.
 4. On a diagram of the approved blast pattern indicate any holes not drilled, drilled but not loaded, changes in spacing or in pattern of delays or in loading of holes.
 5. Total number of holes, maximum charge per hole and corresponding delay number.
 6. An evaluation of the blast indicating tights, areas of significant overbreak and any recommended adjustments for the next blast.
- F. Filter fabric: Submit the manufacturer's information on the filter fabric to the Engineer for review in accordance with Section 02273 – GEOTEXTILE FABRIC.
- G. Submit the qualifications of the independent geotechnical testing laboratory performing soil testing and inspection services during earthwork operations. The geotechnical testing laboratory must demonstrate to the Engineer's satisfaction, based on evaluation of laboratory submitted criteria conforming to ASTM D3740, that it has the experience and capability to conduct required field and laboratory geotechnical testing. In addition, the laboratory shall be supervised by a Registered Professional Engineer in the State of Massachusetts.
- H. Backfill Materials: Submit a 20 lb. sample, grain size analysis and curve performed in accordance with ASTM D422 and compaction test results (ASTM D1557 Procedure C) for each proposed source of backfill for review by the Engineer at least one week prior to use of the material. The grain size analysis shall indicate that the backfill material

conforms to the gradation requirements specified.

- I. In addition, a certification statement and analytical results shall accompany each physical sample of material to be imported as crushed stone, bedding sand, gravel sub-base, or structural backfill. At a minimum the certification shall state the point of origin and that the material is free of contaminants. The certification shall include representative sample analysis from each point of origin of backfill to be used on the site. The sample(s) shall be analyzed by a certified laboratory for total metals (EPA priority pollutant metals), volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), petroleum hydrocarbons (EPA Method 8100), and Total PCBs and pesticides (EPA Method 8081 and 8082). On-site soils designated as suitable for reuse can be used as backfill without providing the certification required above.
- J. All sampling of soils for chemical testing shall be performed by a person experienced in sample collection and either: 1) a Licensed Site Professional registered in the Commonwealth of Massachusetts; 2) a Professional Engineer registered in the Commonwealth of Massachusetts; 3) a professional Geologist registered in the Commonwealth of Massachusetts; 4) a certified groundwater/ environmental professional; or 5) an authorized representative of the one of the persons listed above. Samples of each material shall be submitted to a chemical analytical laboratory, certified by the Massachusetts Department of Environmental Protection.
- K. Submit additional samples every 1000 cubic yards or anytime consistency of material changes in the opinion of the Engineer and submit associated chemical laboratory data on the imported materials throughout the course of the Work, if requested by the Engineer, to evaluate the consistency of the source or process, at no additional cost to the Owner.
- L. Excavation and Excavation Support Plan: For informational purposes only, and if requested by the Engineer, the Contractor shall submit the following prior to the start of the work, in accordance with Section 01300 – SUBMITTALS.
 1. Submit within a minimum of four (4) weeks prior to construction, the qualifications of the Contractor's excavation support specialist. The excavation support specialist shall have completed at least five (5) successful excavation support projects of equal size and complexity and with equal systems within the last five (5) years.
 2. Submit a detailed temporary excavation support plan stamped and signed by a Registered Professional Engineer at least two weeks prior to start of the construction. Do not submit design calculations. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum.

- a. Proposed temporary excavation support system(s), bracing details, location, layout, depths, extent of different types of support relative to maintaining all existing building foundations adjacent to trench excavations, features, buildings, structures to be constructed, and methods and sequence of installation and removal.
 - b. Certificate of Design: Refer to Section 01300 – SUBMITTALS for form.
 - c. Requirements of dewatering during the construction.
 - d. Minimum lateral distance from the edge of the excavation support system for use of vehicles, construction equipment, and stockpiled construction and excavated materials.
 - e. List of equipment used for installing the excavation support systems.
3. Submit a Construction Contingency Plan specifying the methods and procedures to maintain temporary excavation support system stability if the allowable movement of the adjacent ground and adjacent structures is exceeded.
4. Controlled Density Fill (CDF) Mix Design or Concrete Flowable Fill:
- a. Prior to beginning the work the Contractor shall submit for review, flowable fill mix designs which shall show the proportions and graduations of all materials for each class and type of flowable fill specified herein.
- M. Dewatering Plan: Contractor shall submit the following prior to the start of the work, in accordance with Section 01300 – SUBMITTALS.
- 1. Submit within a minimum of four (4) weeks prior to execution of any dewatering, the qualifications of the Contractor’s dewatering specialist. The dewatering specialist shall have completed at least five (5) successful dewatering projects of equal size and complexity and with equal systems within the last five (5) years.
 - 2. Submit a detailed dewatering plan at least (2) weeks prior to start of any dewatering operation. Do not submit design calculations, but submit working drawings for review by the Engineer. The review will be only for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. The plan shall include the following items as a minimum.
 - a. The proposed type of dewatering plan and details stamped and signed by a Registered Professional Engineer.

- b. Certificate of Design: Refer to Section 01300 for form.
 - c. A list and description of equipment including, but not limited to, pumps, prime movers, and standby equipment, as well as the arrangement and location of system components.
 - d. Detailed description of dewatering, maintenance, and system removal procedures.
 - e. Erosion/sedimentation control measures, and methods of disposal of pumped water.
 - f. Types and sizes of sedimentation basins and filters.
 - g. List of all applicable laws, regulations, rules and codes to which dewatering design conforms.
- 3. Submit a modified dewatering plan within 24 hours, if open pumping from sumps and ditches results in boils, loss of fines or softening of the ground.
 - 4. The Contractor shall be aware that groundwater “underdrains” may exist under all existing sanitary, storm, or combined piping. The contractor shall plan for “underdrains” in their dewatering plan and shall relocate and reconnect “underdrains” as required to complete the work.

1.4 EXCAVATION CLASSIFICATIONS

- A. Earth Excavation or "Excavation" consists of removal of materials encountered to the subgrade elevations indicated and subsequent reuse or disposal of the materials removed. All excavation is classified as earth excavation unless it otherwise meets the classifications provided below for unauthorized excavation, additional excavation, or rock excavation.
- B. Unauthorized Excavation consists of removal of materials beyond indicated subgrade elevations or horizontal dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.
 - 1. Under footings, foundations bases, concrete slabs, retaining walls or other structures, fill unauthorized excavations to the proper elevations with lean concrete. Elsewhere, backfill and compact unauthorized excavations as specified for excavations of the same class, unless otherwise directed by the Engineer.
- C. Additional Excavation:
 - 1. When excavation has reached required subgrade elevations, notify the Engineer who will review subgrade conditions.

2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by the Engineer.
3. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work or as provided for under the unit rates for this classification.

D. Rock Excavation:

1. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42-inch wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10 feet 0-inches in width and pits in excess of 30 feet 0-inches in either length or width are classified as open excavation.
2. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).
3. Determination of rock excavation classification will be made by the Engineer. Typical of materials classified as rock are boulders 1.0 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by Engineer. If the area to be excavated is preblasted prior to the excavation of overburden soils, the Engineer shall be notified at least two days in advance to allow observation of the preblast drilling by the Engineer in order to classify the excavation. Visual observation of the completed excavation may be made by the Engineer to modify the excavation classifications. Removal of rock excavation prior to classification by the Engineer shall be considered as earth excavation unless accepted by the Engineer in writing. Such excavation will be paid on the basis of contract unit rates for this classification.

1.5 EXCAVATION

- A. The Contractor shall perform all excavations of every description and of whatever substances encountered, in a manner as required to allow for placing of temporary earth support, forms, installation of pipe and other work, and to permit access to the Engineer for the purpose of observing the work. Bottoms of trenches and excavations shall be protected

- from frost and shall be firm, dry and in an acceptable condition to receive the work; work shall not be placed on frozen surfaces nor shall work be placed on wet or unstable surfaces.
- B. All excavations made in open cut will be controlled by the conditions existing at the various locations and shall always be confined to the limits as designated by the Engineer. In no case shall earth be excavated or disturbed by machinery so near to the finished subgrade for structures and pipelines as to result in the disturbance of the earth below the subgrade. The final excavation to subgrade should be accomplished with a smooth faced bucket or by hand if directed by the Engineer.
 - C. Stockpiles are to be segregated based on geotechnical properties, visual, olfactory, and field screening results. Similar material shall be stockpiled together. Each stockpile must be clearly separable from adjacent stockpiles.

1.6 TEMPORARY EARTH SUPPORT

A. The Contractor shall design, furnish, place and maintain such temporary excavation support systems as required to maintain lateral support and to prevent danger to persons or damage to pavements, facilities, utilities, or structures, and to prevent injurious caving or erosion or the loss of ground, and to maintain pedestrian and vehicular traffic as directed and required.

B. Common types of excavation support systems include, but not limited to singular or multiple stages comprised of cantilevered or internally braced soldier piles and lagging, steel sheet-pile wall, timber sheet-pile wall, trench box, or combinations thereof.

C. Support systems shall be designed for earth pressures, hydrostatic pressure, equipment, temporary stockpiles, construction loads, and other surcharge loads.

D. In all sheeting, shoring and bracing operations, care shall be taken to prevent injury to persons or damage to structures, roadways, facilities, pipelines, utilities and services. Any injuries to persons shall be the responsibility of the Contractor; and any damage to the work or existing structures occurring as a result of settlement, water or earth pressure, or other causes due to inadequate bracing of other construction operations of the Contractor shall be repaired by the Contractor at no additional cost to the Owner.

E. The Contractor shall bear the entire cost and responsibility of correcting any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance or design of the temporary excavation support systems. The Contractor shall pay for all claims, costs and damages that arise as a result of the work performed at no additional cost to the Owner.

F. Where sheeting is to be used, it shall be driven ahead of excavation operations to the extent practicable so as to avoid the loss of material from behind the sheeting; where voids occur outside of the sheeting, they shall be filled immediately with selected fill, thoroughly compacted.

G. Design the embedment depth below bottom of excavation to minimize lateral and vertical earth movements and provide bottom stability. Toe of braced temporary excavation support systems shall not be less than 3 feet [1.5 m] below the bottom of

excavation.

H. Design temporary excavation support systems to withstand an additional 2 feet [60 cm] of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.

I. The Contractor shall leave in place all sheeting and bracing at the locations and within the limits ordered by the Engineer in writing. The Contractor shall cut off the sheeting at elevations to be determined by the Engineer.

J. The Contractor shall comply with all federal, state, and local safety regulations and requirements.

1.7 DEWATERING SYSTEM

A. The Contractor shall design, furnish, install, operate, maintain and remove at his own expense, a temporary dewatering system to ensure that work is performed under dry and stable conditions, free from groundwater and/or surface runoff. The temporary dewatering system shall be implemented so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. The Contractor shall implement erosion control measures for disposing of discharged water in order to prevent pumped drainage water from causing damage to adjacent property.

B. Any damage resulting from the failure of the dewatering operations of the Contractor, and any damage resulting from the failure of the Contractor to maintain all the areas of work in a suitable dry condition, shall be repaired by the Contractor, at no additional expense to the Owner. The Contractor's pumping and dewatering shall be carried out in such a manner as to prevent damage to the Contract work and so that no loss of ground will result from these operations. If sub-grade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the Engineer, stabilize the sub-grade, and modify system to perform as specified at no additional cost to the Owner. Precautions shall be taken to protect new work from flooding during storms or from other causes. Pumping shall be continuous where directed by the Engineer to protect the work and/or to maintain satisfactory progress.

C. Notify the Engineer immediately if any settlement or movement is detected on structures. If the settlement or movement is deemed by the Engineer to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the Engineer within 24 hours. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the Owner.

D. All pipelines or structures not stable against uplift during construction or prior to completion shall be thoroughly braced and protected. Water from the trenches, excavations and drainage operations shall be disposed to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress. If oil and/or other hazardous materials are encountered after dewatering

begins immediately notify the Engineer.

E. The Contractor shall control the grading in the areas surrounding all excavation so that the surface of the ground shall be properly sloped to prevent water from running into the excavated area. Where required, temporary ditches shall be provided for drainage. Upon completion of the work and when directed, all areas shall be restored by the Contractor in a satisfactory manner and as directed.

1.8 BLASTING

- A. Blasting is not allowed unless it is reviewed and approved by the Owner. If approved by the Owner, the Engineer must approve survey reports prior to blasting beginning.
- B. All blasting operations, including transportation, handling, storage and protection of detonators and explosives shall comply with the requirements of the Department of Labor, Occupational Safety and Health Administration provisions, as well as those of State and local regulations. In the case of conflict of regulations, the most stringent regulations shall apply.
- C. Pre-Blast condition Survey: Prior to start of earth/rock excavation or blasting work, the Contractor shall engage an independent professional engineer who shall conduct a pre-blast condition survey of all existing structures and conditions on the site, adjacent to the site, or in the vicinity of the site. This survey shall extend to such structures, including private wells, or conditions as may be affected by the contractor's construction operations. As a minimum, condition surveys shall be performed on all structures within 200 feet of anticipated blasting areas, and shall include a television inspection of the interior of the existing drainage piping in the construction zone or as designated by the Engineer. The Contractor shall also:
1. Coordinate activities, issue notices, obtain clearances and provide whatever photographic and secretarial assistance is necessary to accomplish the survey.
 2. Give notice in writing, to the owner of the property concerned, and tenants of the property. Advise in notice the dates on which surveys are to be made so that they may have representatives present during the examination. Provide copies of all notices to the Engineer.
 3. The survey shall consist of a description of the interior and exterior conditions of the various structures examined. Descriptions shall locate any cracks, damage, or other defects existing and shall include such information so as to make it possible to determine the effect, if any, of the construction operations on the defect. Where significant cracks, damage, or other defects exist, or for defects too complicated to describe in words, photographs shall be taken and made part of the record.
 4. The survey shall note all public and private wells in the vicinity of the blast area. Condition of wells and flow capacity shall be noted if available.

The Contractor's record of the pre-blast condition survey shall consist of written

documentation and photographs of the conditions identified, or a good quality videotape survey with appropriate audio description of conditions and defects. Prior to start of work, one copy of the Contractor's record of condition survey shall be submitted to the Engineer for review and retention.

Upon completion of all earth/rock excavation and blasting work, the Contractor shall make a television survey of the existing drainage systems within the same limits noted previously in order to determine whether there was any damage. In addition, the Contractor shall make an examination similar to the preconstruction survey of any properties, structures, and conditions where complaints of damage have been received or damage claims have been filed and give notice to all interested parties so that they may be present during the final examination. Records of the final examination shall be distributed the same as the original pre-construction survey.

D. Indemnity: Notwithstanding full compliance with these specifications, approval of blasting plan, and successful limitation to maximum peak particle velocity and airblast overpressure noted below, the contractor shall be solely responsible for any damage, direct or indirect, arising from blasting and shall hold the Owner and Engineer harmless from any costs of defense, arising from such damage, real or alleged.

E. Qualifications:

1. Persons responsible for blasting shall be licensed blasters in the Commonwealth of Massachusetts and shall have had acceptable experience in similar excavations in rock and controlled blasting techniques.
2. The Contractor shall engage the services of a qualified, independent professional engineer, acceptable to the Engineer to conduct a pre-blast condition survey of adjacent structures.
3. Blast monitoring shall be conducted by an independent, qualified professional engineer or seismologist, trained in the use of a seismograph, and records shall be analyzed and results reported by persons familiar with analyzing and reporting the frequency content of a seismograph record.

F. Codes, Permits and Regulations:

1. The Contractor shall comply with all applicable laws, rules, ordinances and regulations of the Federal Government, the Commonwealth of Massachusetts, and the Town of Ipswich, governing the transportation, storage, handling and use of explosives. All labor, materials, equipment and services necessary to make the blasting operations comply with such requirements shall be provided without additional cost to the Owner.
2. The Contractor shall obtain and pay for all permits and licenses required to complete the work of this section.
3. In case of conflict between regulations or between regulation and Specifications,

the Contractor shall comply with the strictest applicable codes, regulations or Specifications.

G. Blasting Limit Criteria:

1. Peak Particle Velocity Limits

- a. The Contractor shall conduct all blasting activity in such a manner that the maximum peak particle velocity at all structures in the vicinity does not exceed the following:

Distance from Blast to Structure Maximum P.P.V.

< 150 ft.	1.5 in./sec.
150-300 ft.	1.00 in./sec.
> 300 ft.	0.75 in./sec.

2. Airblast Overpressure Limit

- a. The Contractor shall conduct all blasting activity in such a manner that the peak airblast overpressure at tall above-ground, occupied structures in the vicinity of blasting does not exceed 0.014 psi.

H. Blast Vibration Monitoring

- 1. The Contractor shall monitor peak particle velocities and airblast overpressures resulting from each blast at a location adjacent to the nearest structure from the blast.
- 2. All instrumentation proposed for use on the project shall have been calibrated within the previous six (6) months to a standard which is traceable to the National Bureau of Standards. Characteristics of required instrumentation are listed below:
 - a. Measure the three (3) mutually perpendicular components of particle velocity in directions vertical, radial, and perpendicular to the vibration source.
 - b. Measure and display the maximum peak particle velocity component and airblast overpressure, and the frequencies of each. The readings must be displayed and be able to be read in the field, immediately after each blast.
 - c. Furnish a permanent time history record of particle velocity waveforms and airblast overpressure waveforms.

I. Safety Precautions

- 1. Clearing the Danger Area Before Blasting: No blasting shall be permitted until all personnel in the danger area have been removed to a place of safety. A loud,

audible, warning system, devised and implemented by the Contractor, shall be sounded before each blast. The Contractor shall familiarize all personnel on the project, Owner, Police Officers, and Engineer with the implemented system. The danger area shall be patrolled before each blast to make certain that it has been completely cleared, and guards shall be stationed to prevent entry until the area has been cleared by the blaster following the blast.

2. Explosives shall be stored, handled and employed in accordance with federal, state and local regulations.
3. No explosives, caps, detonators or fuses shall be stored on the site during non-working hours.
4. Blasting mats shall be used to cover the top and vertical face of all blasts in order to minimize the possibility of excessive throw of rock. Any damaged mats shall be replaced with mats in good condition before blasting continues. The Engineer shall approve the condition of all mats.
5. The Contractor shall be responsible for determining any other safety requirements unique to blasting operations at these particular sites so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.
6. No requirement of, or omission to require, any precautions under this Contract shall be deemed to limit or impair any responsibility or obligations assumed by the Contractor under or in connection with this contract; and the contractor shall at all times maintain adequate protection to safeguard the public and all persons engaged in the work, and shall take such precautions as will accomplish such end, without undue interference to the public. The Contractor shall be responsible for and pay for any damage to adjacent roadways or structures resulting from work executed under this Section.

J. General Blasting Procedures

1. The time during which explosives may be used is restricted to Monday through Friday between the hours of 8:00 AM and 4:00 PM (prevailing time). The use of explosives is not permitted on weekends (Saturday and Sunday), holidays, on the eve of a holiday nor between the hours of 4:00 PM and 8:00 AM, unless approved in writing by the Engineer. The Contractor shall schedule blasting in order to minimize traffic disruptions.
2. Immediately after blasting, the Contractor shall have sufficient equipment available at the site to clear the pavement of blastrock. The Contractor shall also use, as required, a mechanical sweeper to control dust and small stones.
3. The Contractor shall advise the Engineer at least two working days in advance of the dates on which he proposes to perform blasting operations, giving the approximate hour, for the Engineer's approval. The Contractor will be responsible

for obtaining the necessary permits and police officials required to close local streets during periods of blasting. The Contractor will notify the Engineer by noon of the day prior to any day he plans not to blast where the weekly schedule shows a day of blasting. This does not include changes due to weather or unexpected equipment breakdowns.

4. The maximum time for which traffic may be stopped at any single time shall be fifteen minutes, from the time traffic is stopped by police until all travel lanes are cleared of blast debris, to the satisfaction of the Engineer, and notice is given to the police that traffic may be resumed in both directions. The Contractor shall reduce the size of the blast, change the design and method of the blast, use more mats, or otherwise alter the blasting so that the traffic is not stopped for more than fifteen minutes.
5. Blast hole diameter shall be no greater than 3 inches.
6. No free flowing, pourable or pumpable explosives shall be used. All explosives shall be used. All explosives shall be in cartridges or other semi-rigid container.

PART 2 – PRODUCTS

2.1 DEWATERING MATERIALS

- A. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least on (1) pump for every five (5) used.
- B. Provide and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.
- C. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.

2.2 TEMPORARY EXCAVATION SUPPORT MATERIALS

- A. Structural Steel: All soldier piles, wales, rakers, struts, wedges, plates, waterstop and accessory steel shapes shall conform to ASTM A36.
- B. Steel Sheet Piling: ASTM A328, continuous interlocking type.
- C. Timber lagging Left in Place: Pressured treated per appropriate AWPA standards.
- D. Tieback Tendons: Tieback tendons shall be high strength steel wire strand cables conforming to ASTM A416, or bars conforming to ASTM A722. Splicing of individual cables shall not be permitted.
- E. Raker Ties: ASTM A615 Grade 60.
- F. Cement Grout Materials and Admixtures for Tieback Anchorages: Grout cube strength shall be a minimum 3500 psi at 7 days and 5000 psi at 28 days.

G. Cast-in-Place Concrete: Section 03300.

H. Tamping tools adapted for backfilling voids after removal of the excavation support system.

I. Provide specific trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 subpart P.

2.3 TRENCH DAMS

A. Trench Dam shall be self supporting and provide a watertight seal around the pipe by use of appropriately sized elastomeric PVC flexible coupling. Barriers shall form an impenetrable barrier in the pipe envelope to the flow of water. Baffles constructed of ABS plastic are acceptable. Trench Dams shall be Ripley's Dams of Durham, NH or equal.

2.4 BACKFILL MATERIALS

A. Clean Fill - Analytical Results. The Contractor shall provide certification that imported fill and/or topsoil material to be used as fill, borrow or subbase is free of contaminants. Certification must indicate the point of origin and include laboratory analytical results as specified and include a statement that the material is free of organic, or any other unsuitable contaminants and that metal concentrations are consistent with background levels. No processed concrete, recycled asphalt, brick, coal ash or wood ash shall be present in any fill material. Evidence of such recycled products in the fill shall be rejected and returned to the supplier at no additional cost to the owner.

B. Common Fill: Common fill shall be soil containing no stone greater than 2/3 loose lift thickness. The materials shall be free of trash, ice, snow, tree stumps, roots and other organic and deleterious materials. Common fill shall not contain more than 25 percent by weight of silt and clay. It shall be of such a nature and character that it can be compacted to the specified densities in a reasonable length of time. Topsoil and subsoil shall not be considered common fill.

Common fill shall be used as trench backfill above the crushed stone layer and below the gravel subbase material, and outside limits of structures.

C. Structural Fill: Structural fill shall consist of gravel and sand consisting of hard durable particles, and free from trash, ice and snow, tree stumps, roots and other organic and deleterious or organic matter. Structural fill shall be used as replacement backfill for unsuitable soils below pipes and structures. Structural fill shall conform to the following gradation requirements.

Sieve Size	Percent Finer by Weight
6-inch	100 (1)
3-inch	70-100
1-inch	45-90
No. 4	20-70
No. 10	15-60
No. 40	10-40
No. 200	0-10
<u>(1) Four-inch maximum particle size within 12 inches of slab, footing or pavement grade.</u>	

- D. Crushed Stone: Crushed stone shall consist of durable crushed rock or durable crushed gravel stone, free from ice and snow, sand, clay, loam, or other deleterious or organic material. The crushed stone shall be uniformly blended and shall conform to the following requirements.

Sieve Size	Percent Passing by Weight	
	1-1/2-inch Stone	¾-inch Stone
2-inch	100	
1-1/2-inch	95-100	
1-inch	35-70	100
¾-inch	0-25	90-100
½-inch		10-50
3/8-inch		0-10
No. 4		0-8

Crushed stone (1-1/2-inch) shall be used as the working mat below precast structures, and ¾-inch shall be used for bedding around PVC pipes.

- E. Gravel Subbase: The top layer of backfill in unpaved sections of roads and where directed by the Engineer shall consist of compacted 12-inch thickness of gravel subbase meeting MHD specification section M1.03.1 as indicated below:

Sieve Size	Percent Passing by Weight
3-inch	100
1-1/2-inch	70-100
3/4-inch	50-85
No. 4	30-60
No. 200	0-10

F. Control Density Fill (CDF) / Flowable Fill: Controlled density fill shall consist of a cementitious hard excavatable mixture of aggregate, Portland Cement, Fly Ash and air entrained admixtures. The material shall be of the type specified in the Massachusetts Highway Department 1995 Standard Specifications for Highway and Bridges, Type 2E. Controlled density fill shall be used as trench backfill material at locations where compaction equipment is inaccessible as directed by the Engineer.

PART 3 - EXECUTION

3.1 DEWATERING

A. Execution of any earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed and the geotechnical instrumentation has been installed.

B. Furnished, install, operate, and maintain dewatering, re-infiltration, treatment and discharge systems as indicated or specified and in accordance with the dewatering plan. As no dewatering flows shall be discharged to surface waters either directly or indirectly without appropriate settling, at a minimum, the Contractor shall provide a settling tank with a capacity of 10,000 gallons, so that if pumping rates exceed discharge rates, sufficient storage capacity is available. Delays due to insufficient storage capacity will be at no additional cost to the Owner. The Contractor is responsible to evaluate available data and determine the necessary storage capacity so as not to impede construction activities.

C. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.

D. Dewatering shall lower the groundwater to at least 12-inches below the bottom of excavation.

E. Do not excavate until the dewatering system is operational.

F. Discontinue open pumping from sumps and ditches, if such pumping is resulting in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering

plan and submit to the Engineer at no additional cost to the Owner.

G. Where sub-grade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials at no additional cost to the Owner.

H. Dewatering Discharges:

1. Water to be infiltrated need not be treated. Contractor shall provide infiltration that complies with relevant local, state and federal regulations.

2. Transport pumped or drained water to discharge locations in compliance with applicable permits and without interference to other work; damage to or contamination of pavement, other surfaces, or property; erosion; or siltation.

3. Provide separately controlled pumping lines.

4. Immediately notify the Engineer if groundwater is encountered that is suspected to be contaminated with substances other than those for which the treatment system has been designed. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.

I. Compliance with Dewatering and Related Permits and Regulations

1. Discharging groundwater and allowing for natural infiltration may not be a viable option for controlling groundwater in the project area. Should dewatering activities be required where the Contractor needs to discharge groundwater to a location other than the point of origin, then the Contractor shall be prepared to store, treat and discharge the water in accordance with applicable permits and regulations. Periodic sampling, as may be required to demonstrate treatment effectiveness and compliance with pretreatment standards specified in any local, state or federal discharge permit required shall be the responsibility of the Contractor and its Dewatering Professional. Water that can not be infiltrated is anticipated to be discharged to the local sewer system under a temporary construction dewatering permit to be obtained by the Owner. If neither infiltration nor discharge to the local system is feasible, the Contractor shall be responsible for seeking coverage under the appropriate EPA/NPDES permit. At a minimum, the Contractor shall be prepared to comply with standard local permit conditions including periodic testing of the effluent for Total Toxic Organics (TTO) (VOA), TTO (ABN Extractables), petroleum hydrocarbons (MADEP EPH), pH, total metals, and total suspended solids (TSS); and with standard NPDES permit conditions including periodic testing of the treatment system influent, mid-fluent and effluent for benzene, toluene, ethylbenzene, xylenes, TPH, metals, and TSS. The dewatering Plan shall include a description of procedures and information related to the collection of readings, maintenance of logs and other required documents. At a minimum, provisions of the local Construction Dewatering Permit, EPA NPDES Storm water General Permit for Construction Activities, EPA/DEP NPDES Permit and Plan approval for Construction Site Dewatering and the local Construction Commission Order of Conditions.

2. The Contractor, through its Dewatering System Professional:
- a. Shall furnish all labor, equipment and materials necessary to obtain accurate representative samples of the groundwater and for analysis for the set of analytical parameters specified above and as required by local, state and federal permits and regulations.
 - b. Shall coordinate sampling activities with the Engineer. The Engineer reserves the right to sample treated and untreated dewatering flows at any time.
 - c. Shall take readings from the treatment system in accordance with the dewatering plan.
 - d. Shall collect and initial sample of untreated and treated groundwater at the beginning of dewatering activities within the construction area.
 - e. Shall prepare and keep in proper order all records required by regulatory authorities and permits.
 - f. Shall maintain logs and other records in accordance with the Specifications, regulatory agency and permit requirements, and the Dewatering Plan.
 - g. Shall coordinate analysis of samples by an appropriately certified analytical laboratory in accordance with the Specifications, regulatory agency and permit requirements, and the Dewatering Plan, and ensure that laboratory detection limits meet permit requirements.
 - h. Shall comply with reporting requirements in a timely manner and in the format required by the relevant permit. Reporting in compliance with permit requirements includes, but is not limited to, notification to the appropriate regulators and the Owner and Engineer prior to discharge; submittal of laboratory analytical reports for each sampling event; submittal or reports for each reporting period during which no discharge occurs; notification of non-compliant discharges; notification of termination of discharge; and response to permit-related questions posed by regulators or the Owner and Engineer.
 - i. If water will be discharged under National Pollutant Discharge Elimination System (NPDES) permit, submit notifications and reports to both the Environmental Protection Agency (EPA) and the appropriate regional office of the Massachusetts Department of Environmental Protection (DEP). Comply with pre-discharge notification, discharge reporting, notification of no discharge, and termination of discharge notification requirements; and respond to inquires or correspondence from EPA or DEP regarding permit issues
 - j. If water will be discharged under local permit, submit notifications and reports as required in the permit.
 - k. For monthly or less frequent reporting deadlines, provide the Engineer with

copies of all reports fourteen (14) days prior to the reporting deadline, and submit reports to the appropriate agency(ies) at the same time. Provide copies of other dewatering documents to the Engineer immediately.

3. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.

4. The Contractor shall obtain all federal, state, country, and all local permits and variances to allow transport of materials on public roadway, should such transport be necessary.

5. The Contractor shall dispose of all wastes resulting from construction dewatering activities in accordance with local, federal and state regulations.

6. The Contractor is solely responsible for the implementation of the permit requirements, and is solely responsible for any punitive action resulting from any violation of the permit. The actual permit issued shall become part of this Contract by either addendum or by change of order. If the actual permit is included by change of order, no additional costs for implementing the permit will be considered by the Owner, when the actual permit is issued.

J. Removal

1. Do not remove dewatering system without written approval from the Engineer.
2. Backfill and compact sumps or ditches with crushed stone wrapped with geotextile fabric.
3. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

3.2 EXCAVATION SUPPORT SYSTEM

- A. Installation of the temporary excavation support systems shall not commence until the related earth excavation and dewatering submittals have been reviewed by the Engineer with all Engineer's comments satisfactorily addressed.
- B. Install excavation support systems in accordance with the temporary excavation support plan.
- C. Do not drive sheeting within 100 feet [30 m] of concrete less than seven (7) days old.
- D. Carry out program of temporary excavation support in such a manner as to prevent undermining or disturbing foundations of existing structures of work ongoing or previously completed.

E. Bottom of the trench box excavation support system shall be above the pipe invert prior to installing the pipe.

F. Notify utility owners if existing utilities interfere with the temporary excavation support system. Modify the existing utility with the utility owners permission or have the utility owner make the modifications at no additional cost to the Owner.

G. Sheeting shall be left in place unless otherwise indicated or approved in writing by the Engineer.

H. When indicated or approved by the Engineer, remove the temporary excavation support system without endangering the constructed or adjacent structures, utilities, or property. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with bank-run gravel, clean screened gravel or select borrow by tamping with tools specifically adapted for that purpose.

I. The excavation support system left-in-place shall be cut-off a minimum of 2 feet [60 cm] below the bottom of the next higher foundation level or a minimum of 5 feet [152 cm] below finished grade.

J. Conduct survey of the locations and final cut-off elevations of the excavation support systems left in place.

K. Submit as-built information, prior to backfilling.

3.3 FILLING AND BACKFILLING

A. Subgrade Preparation: After the subgrade has been shaped to line, grade, and cross-section, it shall be thoroughly compacted. This operation shall include any required reshaping and wetting to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with structural fill material from excavation or borrow. The resulting area, and all other low sections, holes, or depressions shall be brought to the required grade with structural fill material and the entire subgrade shaped to line, grade and cross-section and thoroughly compacted.

B. Backfill Material Selection: Unless otherwise specified or directed, material used for filling and backfilling shall meet the requirements specified under Products (Part 2). In general, the material used for backfilling utility trench excavations shall be material removed from the excavations provided that the reuse of these materials result in the required trench compaction and meets the requirements specified for common fill. All backfill placed within the structure limits shall be structural fill unless otherwise specified. In areas where the bottom of the excavation is in fine sand and silt, and is below the groundwater table, the first lift of backfill shall be 12-inches of compacted 3/4-inch crushed stone to provide a working mat and drainage layer.

Place backfill to a maximum loose lift thickness of 12 inches. Maintain backfill material with an uniform moisture content, with no visible wet or dry streaking, between plus 2

percent and minus 3 percent of optimum moisture content. The final filled soil mass shall be as uniform as possible in lift thickness, moisture content, and effort required to compact soil mass.

C. Trench Backfill:

1. The trenches shall be backfilled as soon as practicable with common fill material. All trench backfilling shall be done with special care, in the following manner and as directed by the Engineer.
2. Backfill material for pipe bedding as shown on the drawings shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench to the depths shown on the drawings. The backfill material shall be placed by hand shovels, in layers not more than 4-inches thick in loose depth, and each layer shall be thoroughly and evenly compacted by tamping on each side of the pipe to provide uniform support around the pipe, free from voids.
3. The balance of backfill shall be spread in layers not exceeding 12-inches in loose depth. Each layer shall be thoroughly compacted by mechanical methods and shall contain no rock, stones or boulders larger than 4-inches in their greatest dimension.
4. All trench backfilling shall be done with special care and must be carefully placed so as not to disturb the work at any time; if necessary, a timber grillage or other suitable method shall be used to break the fall of material. The moisture content of the backfill material shall be such that proper compaction will be obtained. Puddling of backfill with water will not be permitted. Backfill within areas to receive topsoil or pavement construction shall be made to grades required to establish the proper subgrade for the placement of topsoil or pavement base courses.
5. In backfilling trenches, each layer of backfill material shall be moistened and compacted to a density at least 95 percent of its maximum density, and in such a manner as to permit the rolling and compaction of the filled trench or excavation with the adjoining earth to provide the required bearing value, so that paving of the excavated and disturbed areas, where required, can proceed immediately after backfilling is completed.
6. Any trenches or excavations improperly backfilled or where settlement occurs shall be reopened, to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional expense to the Owner.
7. During filling and backfilling operations, pipelines will be checked by the Engineer to determine whether any displacement of the pipe has occurred. If the observation of the pipelines shows poor alignment, displaced pipe or any other defects they shall be remedied in a manner satisfactory to the Engineer at no

additional cost to the Owner.

8. The top 12-inches of backfill in paved roads shall be constructed with 12-inches of gravel subbase material. The material shall be placed in two 6-inch lifts; each lift proof rolled and compacted with rollers before placing subsequent lifts.
9. In no case shall frozen materials be used for trench backfill.

D. Backfilling against Structures:

1. Backfilling against masonry or concrete shall not be done until permitted by the Engineer. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed, special leakage tests of the structures shall be made by the Contractor, as required by the Engineer. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material. The best of the backfill material shall be used for backfilling within 2 feet of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.
2. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills. Except as otherwise specified or directed, backfill shall be placed in layers not more than 12-inches in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.
3. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over, or adjacent to, structures, and any damage thereto shall be made good by the Contractor at no additional expense to the Owner.

E. After backfilling trenches and excavations, the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. Any subsequent settling over backfilled areas shall be repaired by the Contractor immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional expense to the Owner.

F. The finished subgrade of the fills and filled excavations upon which topsoil is to be placed, or pavements are to be constructed, shall not be disturbed by traffic of other operations and

shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

- G. Uniformly smooth grading of all areas to be graded, as indicated and as directed, including excavated and filled sections, embankments and adjacent transition areas, and all areas disturbed as a result of the Contractor's operations, shall be accomplished. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

3.4 **COMPACTION**

- A. **Compaction Requirements:** The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM Test D1557, Method C. The compaction requirements are as follows:

Area	ASTM Density Degree of Compaction
Below footings	95%
Below slabs	95%
Pavement base course	95%
Pavement subbase	95%
General fill below pavement subbase	92%
Trench backfill - below pavements	92%
- below landscaped areas	90%
- below structures	95%
Other areas	90%

- B. **Moisture Control:**

1. Fill that is too wet for proper compaction shall be disced, harrowed, or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.
2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

- C. **Unfavorable Conditions:**

1. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture

content and the density of the previously placed fill are as specified.

2. In freezing weather, a layer of fill shall not be left in an uncompacted state at the close of the day's operations. Prior to terminating work for the day, the final layer of compacted fill shall be rolled with a smooth wheeled roller to eliminate ridges of soil left by compaction equipment.

D. Compaction Control:

1. All methods used to determine and verify the proper compaction of backfill shall be in accordance with AASHTO standards specifications for density of soil and soil-aggregate in-place by nuclear methods (shallow depth) (designation T238-86 method B-direct transmission shall be used to determine in-place density) and moisture content of soil and soil aggregate in place by nuclear methods (shallow depth) (designation T239-91). Any corrective work required as a result of such tests, such as additional compaction, or a decrease in the thickness of layers, shall be performed by the Contractor at no additional expense to the Owner. In-place density tests shall be made at the Contractor's expense by the geotechnical testing laboratory.
2. The Engineer's duties do not include supervision or direction of the actual work by the Contractor, his employees or agents. Neither the presence of the Engineer nor any observation and testing performed by him shall excuse the Contractor from defects discovered in his work at that time or subsequent to the testing.
3. In-place density tests shall be performed as a minimum according to the following or as directed by the Engineer:
 - a. Two tests per list under spread footings and slabs.
 - b. A minimum of every 5 cubic yards of backfill in trenches or around structures.

3.5 FINE GRADING

- A. Subgrade: Before surface or subbase is spread, the subgrade shall be shaped to a true surface conforming to the Drawings and as directed by the Engineer. All depressions and high spots shall be filled with gravel subbase material or removed and such areas again compacted until the surface is smooth and properly compacted. A tolerance of 1/2-inch above or below the finished subgrade will be allowed provided that this 1/2-inch above or below grade is not maintained for a distance longer than 50 feet and that the required crown is maintained in the subgrade. Any portion which is not accessible to a roller shall be thoroughly compacted by other mechanical methods.

END OF SECTION 02210

SECTION 02500

PAVING AND SURFACING

PART 1 – GENERAL

1.1 SUMMARY

- A. This section specifies following: installation of pavement on all roadway and parking areas; trench pavement; pavement reclamation for subbase; cold planning; fine grading and compacting; and adjustment of castings as indicated and specified.
- B. Pavement and surfacing shall be constructed in courses as shown on the plans and as directed in accordance with these specifications and in close conformity with the lines, grades, compacted thickness and typical cross section shown on the plans.
- C. The Contractor shall take all reasonable measures to assure proper drainage on the final surface of the roadway. Pavement that does not drain properly due to poor workmanship shall not be accepted by the Owner and shall be replaced by the Contractor at no additional cost to the Owner.
- D. Reference is made herein to the Commonwealth of Massachusetts, Department of Public Works, Massachusetts Highway Department, Standard Specifications for Highways and Bridges, latest edition, hereinafter referred to as the “Massachusetts Highway Department”. All references to method of measurement, basis of payment, and payment items in the Standard specifications are hereby deleted. References made to particular sections or paragraphs in the Standard Specifications shall include all related articles mentioned therein.

1.2 RELATED WORK

- A. Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
- B. Section 02524 – CURBS, WALKS AND DRIVEWAYS
- C. Section 02590 – BRICK MASONRY
- D. Section 03300 – CAST-IN-PLACE CONCRETE

1.3 SUBMITTALS

- A. Submit the following in accordance with the General Conditions of Contract and Section 01300 – SUBMITTALS:
- B. Shop Drawings:
 - 1. Manufacturer product data, specifications and certificates for all materials including but not limited to:
 - a. Bituminous Concrete base, binder and top, including design mix for roadway and parking area pavement.
 - b. Gravel Subbase – Submit in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING
 - c. Brick and Mortar – Submit in accordance with Section 02590 – BRICK MASONRY
 - 2. Infrared pavement sealing equipment specifications.
- C. The Contractor shall submit grain size analysis and moisture density curve performed in accordance with ASTM D422 of the reclaimed pavement material to be reused as subbase. The analysis shall be completed in order to compaction test the reclaimed pavement to be used a subbase. The grain size analysis shall indicate that the material conforms to the gradation requirements specified.
 - 1. Submit additional grain size analysis, moisture density curve and certifications for every 1000 cubic yards (every 200 cubic yards for moisture density curves) of material or anytime consistency of material changes in the opinion of the Engineer. Submit associated chemical laboratory data on the imported materials throughout the course of the Work, if requested by the Engineer, to evaluate the consistency of the source or process, at no additional cost to the Owner.
- D. Submit compaction testing results for all pavement layers and subbase.
- E. Submit temperature testing results for all in-place pavement layers, pavement at time of delivery to the site, ambient air and subbase.
- F. Submit Qualifications of the Contractor’s Independent Testing Laboratory as specified in Paragraph 1.4.B, three (3) weeks prior to any testing.

1.4 QUALITY CONTROL

- A. The Engineer may require the Contractor to remove at his/her own expense, any defective mix not conforming to the specified job mix formula within the stipulated tolerances. Samples of the actual mixture in use will be taken as many times daily as necessary and the mixtures shall be maintained uniform for the project. The Engineer may suspend further approval for use of the Plant mixtures if the mixtures do not conform to the specified requirements.
- B. Materials shall not be placed when underlying surface is muddy, frozen, or has frost, snow, or water thereon.
- C. The Contractor shall repair or remove and replace unacceptable paving as directed by Engineer, and at no additional cost to the Owner.
- D. Independent Testing Laboratory: The Contractor shall employ an independent testing laboratory to perform the following tests:
 - 1. Particle size, gradation analyses and compaction testing for subbase. in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
 - 2. Particle size, gradation analyses and compaction testing for reclaimed subbase in accordance with the Standard Specifications.
 - 3. Compaction testing of all in place pavement courses. The density of the bituminous concrete pavement will be determined by using Nuclear Density Gauge Test - Method ASTM D2950.
 - 4. Temperature testing of all in place pavement courses, temperature testing of pavement at time of delivery, temperature of subbase and temperature of ambient air.
 - 5. Core samples of installed pavement to verify the thickness meets requirements.
- E. Grade Control:
 - 1. The Contractor shall employ at his own expense a Registered Land Surveyor to establish, maintain and ensure that the grades and thicknesses for road reconstruction is completed to the specified tolerances and design.
 - 2. The Contractor shall maintain the subbase grade within 0.5 inches plus or minus of the existing or design grades.

- F. Thickness Tolerances: The Contractor shall test in-place bituminous concrete courses for compliance with requirements for thickness. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:
1. Top Course: 1/4-inch, plus or minus.
 2. Binder Course: 1/4-inch, plus or minus.
 3. Base Course: 1/4-inch, plus or minus
- E. Bituminous Concrete Temperature Requirements: The Contractor shall supply an approved Dial Type Asphalt Thermometer (Range 0° F to 500° F) for each paving machine in operation on the project. The thermometer shall remain the property of the Contractor upon completion of the project.
1. Refer to Section 1.5 below for delivery temperature requirements.
 2. Temperature of bituminous concrete at the time of placement shall be in accordance with the table in Standard Specifications Section 460.61.
- F. Weather and Date Limitations:
1. Apply prime and tack coats when ambient temperature is above 50 deg.F and when temperature has not been below 35 deg.F for 12 hours immediately prior to application. Do not apply when subbase is wet or contains an excess of moisture.
 2. Binder for temporary pavement may be placed when air temperature is above 30 deg.F and rising.
 3. Permanent bituminous concrete shall only be installed when atmospheric temperature is above 40 deg.F.
 4. The Contractor shall not install permanent pavement between the dates of November 15th and April 1st unless written approval has been obtained from the Engineer.
- G. Compaction Testing:
1. All bituminous mixtures shall be compacted to at least 95% of the density achieved on the laboratory testing of the design mix for the project. Density will be checked by the Nuclear Density Gage Method, ASTM D2950. Testing shall be completed by Contractor at no expense to Owner for every 200 square yards of surface area placed.

2. All subbase shall be compacted and testing in accordance with 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
3. All reclaimed subbase shall be compacted and tested in with the MHD Standard Specifications Section 403.64.

H. Core Samples: Core Samples to verify in place pavement thickness to be taken as directed; at least one core sample for every 200 square yards of surface area placed.

1.5 DELIVERY, STORAGE AND HANDLING

Batch ticket information shall be submitted to the Engineer upon placement of bituminous concrete.

Transportation and delivery of bituminous concrete shall be in accordance with the MHD Standard Specifications Section 460.61.

1. The temperature of the mix upon delivery to the project site shall be in accordance with the table in Section 460.61

1.6 DEFINITIONS

- A. Temporary Pavement: Temporary pavement shall mean temporary with regards to the duration of the contract. All temporary pavement shall be removed prior to the placement of permanent pavement. Bituminous concrete for temporary pavement shall meet the material requirements for Bituminous Concrete Binder Course as specified below.
- B. Full Depth Road Reconstruction: Full depth road reconstruction shall mean excavation and replacement of all existing pavement courses; including cobble, brick, cement concrete and bituminous concrete; and subbase to depth of subgrade.

1.7 REGULATIONS (Not Used)

1.8 GUARANTEE

- A. The Contractor shall maintain the surfacing for one year from the date of substantial completion and shall promptly fill with similar material in compliance with the specifications, any depressions and holes that may occur so as to keep the surfacing in a safe and satisfactory condition for traffic.
- B. The Contractor shall infrared seal the joints of all repairs made to the surfacing due to improper installation during the one-year guarantee period at no additional cost to the Owner.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Gravel Subbase: Shall conform to MHD Standard Specifications M1.03.1.
- B. Bituminous Concrete Binder Course: Shall conform to the MHD Standard Specifications, M3.11.00 through M3.11.09, Class I Bituminous Concrete Pavement, Type I-1 – Binder Course.
- C. Bituminous Concrete Top Course: Shall conform to the MHD Standard Specifications, M3.11.00 through M3.11.09, Class I Bituminous Concrete Pavement, Type I-1 – Top Course.
- D. Bituminous Concrete Base Course: Shall conform to the MHD Standard Specifications, M3.11.00 through M3.11.09, Class I Bituminous Concrete Pavement, Type I-1 – Base Course.
- E. Bituminous Concrete for Sidewalk: Shall conform to the MHD Standard Specifications, M3.11.00 Class I Bituminous Concrete Pavement.
- F. Bituminous Concrete for Driveways: Shall conform to the MHD Standard Specifications, M3.11.00 through M3.11.09, Class I Bituminous Concrete Pavement, Type I-1 – Top Course.
- G. Tack coat shall be RS-1 emulsion.
- H. Asphalt emulsion shall conform to Standard Specification MHD Section M3 – M3.03.0 and shall be AC-20 conforming to AASHTO M226.
- I. Bituminous Concrete for Berms and Curbs: Shall conform to the MHD Standard Specifications, M3.11.00 through M3.11.09, Class I Bituminous Concrete Pavement, Type I-1 – Dense Mix.
- J. Hot Poured Rubberized Joint Sealer: Shall conform to the MHD Standard Specifications, M.3.05.0. The sealer shall meet the requirements of Federal Specification Number SS-S-1401.

- K. Reclaimed Pavement Subbase: Shall conform to the MHD Standard Specifications, M.1.11.0. Gradation requirements are included below:

Sieve Designation	Percent Passing
3-inch	100
1½-inch	70 - 100
¾ - inch	50 - 85
No. 4	30 - 60
No. 50	8 - 24
No. 200	0 - 10

- L. Crack sealer: Crack sealer shall be asphalt slurry mixture type SS-1, SS-1h and shall be maintained at a significant fluidity to be able to flow into the hairline cracks

PART 3 – EXECUTION

3.1 SUBGRADE PREPARATION

- A. Bring subgrade to required grade as necessary prior to placing subbase material.
- B. As directed by the Engineer, over-excavate on-site fill material and any unacceptable materials below the subgrade. Utilize excavating equipment equipped with a toothless or smooth edged, excavating bucket to expose the on-site fill material and unacceptable materials to avoid disturbance of the bearing surface.
- A. Backfill the overexcavation with crushed stone and compact as indicated in Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING and in accordance with MHD Standard Specifications.
- D. Proof roll the subgrade prior to placing subbase.

3.2 PLACEMENT AND PREPARATION OF SUBBASE

- A. Do not begin placement of subbase and paving work until deficient subgrade areas have been corrected and are ready to receive paving.
- B. Subbase under roadway shall be installed and compacted in accordance with Section 02210 – EARTH EXCAVATION, BACKFILL, FILL AND GRADING.
- C. The subbase and reclaimed subbase shall be fine graded and compacted for road reconstruction and where indicated in accordance with MHD Standard

Specification Section 170.61.

- D. The subbase shall be spread in layers not more than 8 - inches thick except the last layer of gravel shall be 4-inches thick, compacted measure. All layers shall be compacted to not less than 95 percent of the maximum dry density of the material as determined by ASTM D1557 Method C at optimum moisture content.

3.3 CLASS I BITUMINOUS CONCRETE BASE COURSE

A. Base course shall be furnished and installed in accordance with MHD Standard Specification Section 420.

B. Base course shall be placed to a total thickness of 4 inches.

3.4 CLASS I BITUMINOUS CONCRETE FOR TEMPORARY PAVEMENT

A. SPREADING, FINISHING AND COMPACTING

1. Temporary Binder course shall be spread to a finished thickness of 2 inches. A smooth even surface shall be produced.
2. Binder course shall be compacted with a vibratory plate compactor or roller to produce a smooth even surface.
3. Binder course placement for temporary paving shall be installed on a weekly basis or as otherwise indicated by the Owner and Engineer. Cold patch for temporary pavement shall not be allowed.
4. Binder course placed as temporary paving shall be maintained until removed prior to final paving.

3.5 CLASS I BITUMINOUS CONCRETE BINDER AND TOP COURSE

A. EXISTING PAVEMENT EDGES AND JOINTS

1. Binder (Intermediate) course shall be spread to a finished thickness of 4 inches.
2. Top (Surface) course shall be spread to a finished thickness of 2 inches.
3. The edges of existing pavement which are to remain shall be saw cut to an even, straight edge. Trench edges shall be cut back one foot from edge of the trench on each side.
4. Air blast clean edges.

5. All joints at the junction of existing pavement (including recently placed mixtures) and binder course shall be sealed with an asphalt emulsion and covered with sand.
6. All joints at the junction of existing pavements (including recently placed mixtures) and the top course pavement shall be sealed with hot rubberized sealer. The use of hot rubberized sealer may be omitted at the Engineers discretion if the temperature of the existing mixture at the joint is above 203°F.
7. Construct joints to have same texture, density and smoothness as other sections of bituminous concrete course.
8. Overlap joints so that there is a least a one foot overlap between each course.
9. A keyway shall be provided at the limits of the full depth road reconstruction between the new roadway and the existing roadway as shown on the pavement joint detail.

B. TACK COAT

1. All contact surfaces shall be cleaned of all foreign matter and loose material and shall be dry before the tack coat is placed.
2. Supply tack coat at a rate of 0.05 to 0.10 gallons per square yard over the binder course. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile.
3. The tack coat truck shall have pneumatic tires of such width and number that the load produced on the surface shall not exceed 12 kg/mm of tire width, and it shall be designed, equipped, and operated so that at an even heated emulsion may be applied uniformly on variable widths of surface at readily controlled rates from 0.05 to 0.30 gallons per square yard as directed by the Engineer.
4. The tack coat shall be applied within a pressure range of 0.17 to 0.52MPa. Distributor equipment shall include a tachometer, pressure gauges, volume-measuring devices, and a thermometer for reading the temperature of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.
5. The contact surfaces of manhole, catch basin and gate box frames and covers and other appurtenant structures in pavement shall be painted

thoroughly with tack coat just before mixture is placed against them.

C. SPREADING AND FINISHING

1. Spreading and finishing of bituminous concrete binder and top course shall be completed in accordance with MHD Standard Specification Section 460.63.
2. The temperature of the bituminous concrete at the time of placement shall be in accordance with the table in MHD Standard Specification Section 460.61
3. Place pavement in strips not less than 2-feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete binder course for a section before placing top course.
4. Hand Spreading: Hand spreading will be permitted only for particular locations in the work which because irregularities, inaccessibility or other unavoidable obstacles do not allow mechanical spreading and finishing.
5. Immediately after placement of the new pavement, all joints between the existing and new pavement shall be sealed with RS-1 and sanded.

D. COMPACTION

1. Compaction of bituminous concrete shall be completed in accordance with MHD Standard Specification Section 460.64.
2. Begin rolling when mixture will bear roller weight without excessive displacement.
3. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
4. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
5. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been

thoroughly compacted.

6. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

E. CUTTING AND PATCHING

1. Remove and replace paving areas mixed with foreign materials and defective areas. Saw cut-out such areas and fill with fresh, hot bituminous concrete. Compact by rolling to match the surrounding surface density and smoothness.
2. All saw cut joints in surface coarse shall be sealed by infrared methods.

F. PROTECTION

1. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked by wheel traffic.

3.6 CRACK SEALING

- A. Prior to sealing a crack all compressible material shall be removed by high-pressure air or routing. If grass or vegetation is present in the crack the Contractor shall inject a liquid herbicide to prevent future growth.
- B. For larger cracks, sealing shall be with modified asphalts (e.g. hot rubberized asphalt sealer).
- C. For small hairline cracks, sealing shall be with the asphalt slurry mixture. The crack sealer shall be squeegeed over the surface and forced in the cracks.
- D. Sealing of all cracks shall be considered to be complete upon review and approval by the Engineer.

3.7 RAISING AND ADJUSTING CASTINGS

- A. Prior to installation of top layer of permanent paving, all existing catch basin castings, manhole castings, and valve boxes shall be raised, if necessary, to the proper grade by the Contractor.
- B. Castings owned by private utilities may be raised by the responsible utility. The Contractor shall be responsible for coordinating this work.

- C. Bituminous concrete courses shall be sawcut a minimum of 12” from outside edge of frame or for enough room to allow compaction by a vibratory plate compactor.
- D. Adjust casting with masonry work in accordance Section 02590 – BRICK MASONRY to grade. Adjustments shall be a maximum of 12” in height.
- E. The method of adjusting these castings shall be as follows: Cut around catch basin or manhole castings a minimum of 8 inches from casting. Excavate and if required rebuild up to 10 inches of masonry below the bottom of the casting. Backfill with suitable material and compact to bottom of casting conforming to Section 03300. Place high, early strength cement or bituminous concrete collar, as directed by the Engineer, to approximately 1½ inches below the raised casting grade. Masonry work shall conform to Sections 02252 and 02604, Manholes, and Catch Basins respectively.
- F. The method of raising valve boxes shall be as follows: Cut around valve box a minimum of 8 inches from valve box. Excavate as required and raise the valve box. Pour high early strength cement or bituminous concrete collar, as directed, to approximately 1½ inches below the top of the valve box.
- G. Castings which need to be raised or adjusted to complete final top course full-width paving shall be done immediately prior to paving.

3.8 BITUMINOUS CONCRETE EXCAVATION BY COLD PLANER

- A. Keyways: The Contractor shall saw cut the limits of the cold plane excavation at the connection to existing pavement. A 1’ wide by 4” deep key will be cold planed along the limits of the connection to existing pavement.
- B. Equipment: The Cold Planer shall be equipped with an elevating device capable of loading planed material directly into dump trucks while operative. The Cold Planer shall further have all necessary safety devices such as reflectors, headlights, taillights, flashing lights, and back-up signals so as to operate safely in traffic both in the day or at night. The Cold Planer shall be designed and built for planing flexible pavements and possess the ability to plane cement concrete patches when encountered in bituminous pavement. The Cold Planer shall be self-propelled and have the means for planing without tearing or gouging the underlying surface. The Cold Planer shall be adjustable as to crown and depth and shall meet the standards of the Air Quality Act for noise and air pollution.
- C. Variable lacing patterns shall be provided to permit a rough grooved surface as directed. A 2-inch (5cm) cut is required in one (1) pass. The minimum width of pavement planed in each pass shall be 6-feet (1.8m), except in areas to be trimmed and edged.

- E. The milled or planed surface shall conform generally to the existing grade and cross slope. The surface shall not be torn, gouged, shoved, broken or excessively grooved. It shall be free of imperfections in workmanship that prevent resurfacing after this operation. Excess material shall be swept and removed so that the surface is acceptable to traffic.
- F. The Contractor shall install bituminous concrete binder to the depth of the existing pavement at any areas, which as discovered after cold planning have no existing bituminous concrete.
- G. The Contractor shall maintain the cold planned road until the time of overlay by repairing any pot holes or damaged subbase with bituminous concrete binder at no additional cost to the Owner. The edges of existing base subbase shall be saw cut and tax coated.
 - 1. Cold patch for repair shall be used only after the approval of the Engineer and at no additional cost to the Owner. The Contractor shall remove all cold patch installed complete and replace with permanent bituminous concrete binder prior to completing the overlay at no additional cost to the Owner.
- H. The Contractor shall adjust all castings which do not match the existing pavement grade and slope, including coordinating with private utilities to adjust castings not owned by the City.

3.9 RECLAIMED BASE COURSE

- A. Equipment: Pulverization will be by means of a traveling pulvi-miller or equivalent machine capable of ripping through existing asphalt at depths up to 12” with one pass. The machine shall be self-propelled and be equipped with an adjustable grading blade, thus leaving its path generally smooth for traffic equipment. Road planers or cold milling machines, which are designed to mill or shred the existing bituminous concrete pavement rather than to crush or fracture it, are not considered capable of achieving specification gradation. The required and necessary scraping action of the milling shall provide an increase in the percentage of fine aggregate.
- B. Existing bituminous concrete and gravel base must be ripped and mixed so as to form a homogeneous mass of uniformly processed base material, which will bond together when compacted.
- C. The Contractor shall protect all existing casting, curb work and structures. All existing pavement on side streets, driveways and limits of work shall be saw cut and protected from damage.
- D. The pavement area to be reclaimed shall be swept with a power sweeper to

remove all sand, dirt, organic matter, and other unsuitable materials.

- E. The Contractor shall reclaim only that area of pavement that can be processed and compacted by the end of the same working day. Reclaimed areas shall be acceptable for vehicular traffic at the end of each working day.
- F. The total thickness of the existing pavement and the uppermost portion of the subbase layer shall be recycled to the depth shown on the plans.
- G. If gradation deficiencies exist the appropriate crushed stone aggregate size shall be blended with recycled material to produce a uniform mixture meeting gradation requirements.
- H. Dense graded crushed stone shall be added for volume purposes if required.

3.10 INFRARED PAVING

- A. Equipment: The infrared heating system shall be capable of heating the existing bituminous concrete for rework up to a depth of 2" without flaming or altering the binding effect of the asphalt.
- B. The heated asphalt shall be removed and new hot mix asphalt shall be added to match the existing grades.
- C. The infrared paving repair shall be compacted in accordance with this section.
- D. Joints shall be sealed with asphalt emulsion

END OF SECTION 02500