TOWN OF WESTFORD, MASSACHUSETTS

GROTON ROAD OVER BLUE BROOK

CULVERT REPLACEMENT

ALTERNATE NO. 1

DECEMBER 2023

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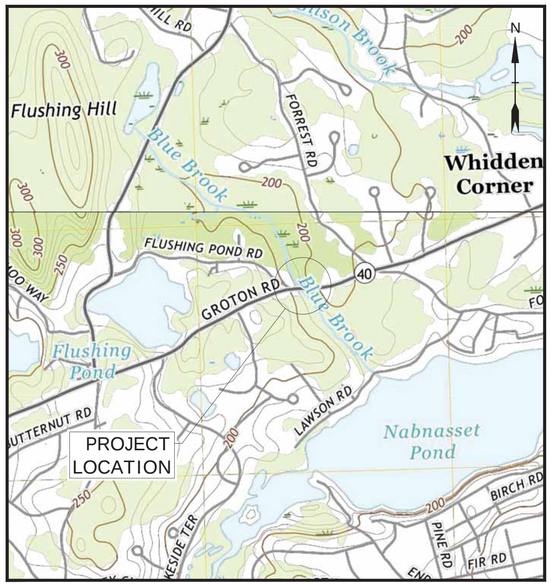

LOCATION MAP
SCALE: 1" = 1000'

PREPARED BY:

Tighe&Bond

DANIEL S. HOLMES, PE, LEED AP

ERIC OHANIAN, PE

PREPARED FOR:
TOWN OF WESTFORD
DEPARTMENT OF PUBLIC WORKS
PAUL STARRATT, PE, TOWN ENGINEER
STEPHEN CRONIN, DIRECTOR OF PUBLIC WORKS

COMPLETE SET 15 SHEETS

Last Saved: 12/6/2023
Plotted On: Dec 06, 2023-11:32am By: SSak
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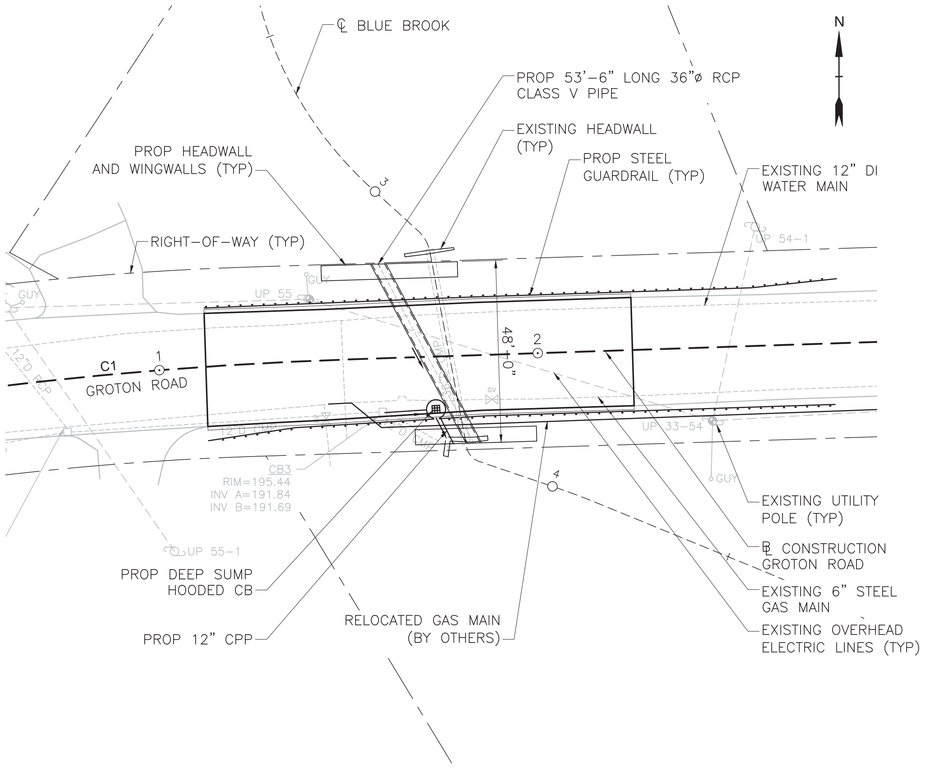
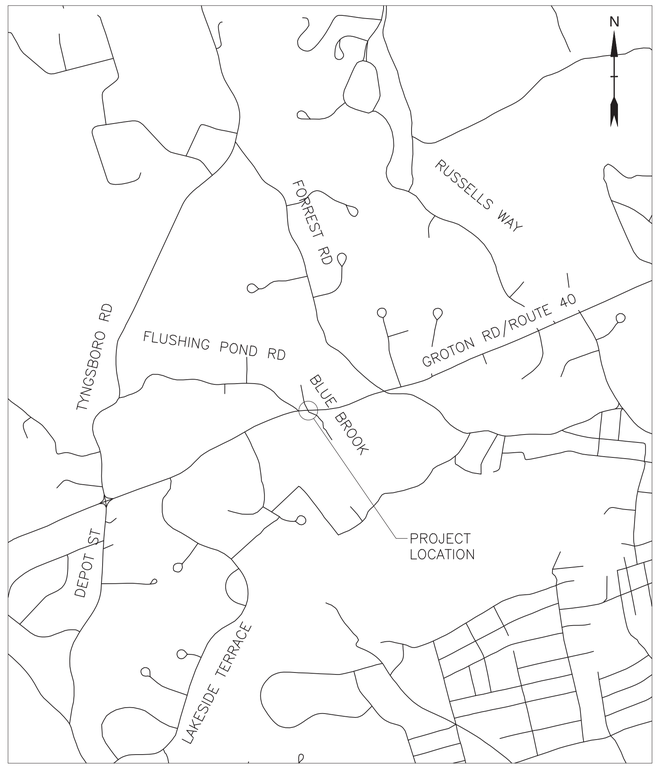


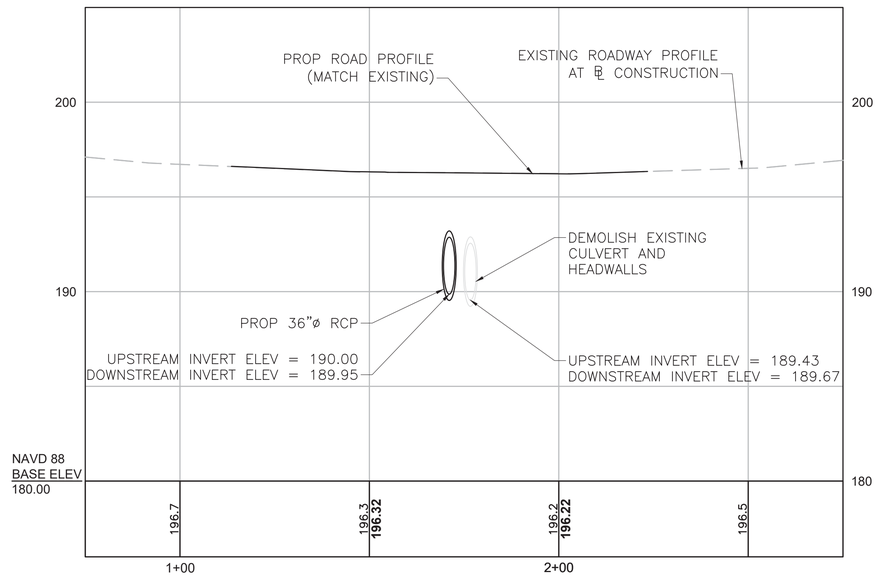
KEY PLAN

SCALE: 1" = 20'



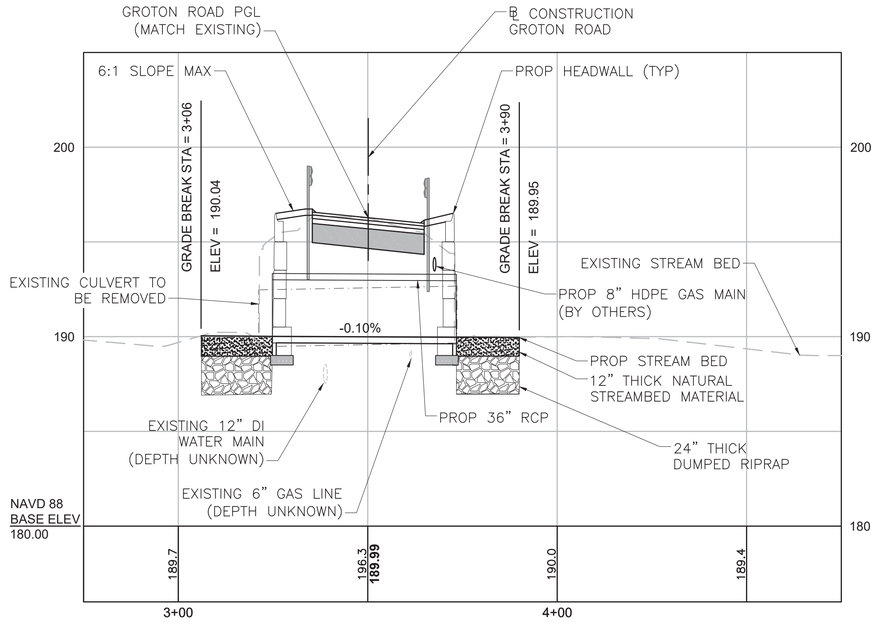
LOCUS

SCALE: 1" = 1000'



GROTON ROAD PROFILE – ℄ PROPOSED ROADWAY

HORIZ.: 1" = 20' VERT.: 1" = 4'



PROFILE ALONG ℄ BLUE BROOK

HORIZ.: 1" = 20' VERT.: 1" = 4'

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

MARK	DATE	DESCRIPTION

PROJECT NO:	W5005-029
DATE:	DECEMBER 2023
FILE:	W5005-029_02_BRIDGE-COVER.dwg
DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

CULVERT KEY PLAN, PROFILES, LOCUS, & INDEX

SCALE: AS SHOWN

SHEET 02 OF 15

Last Saved: 12/6/2023
Plotted On: Dec 06, 2023-11:32am By: SSak
Tighe & Bond - J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_02_BRIDGE-COVER.dwg

BASE PLAN NOTES:

1. THE EXISTING CONDITIONS INFORMATION SHOWN ON THE DRAWINGS IS BASED ON SURVEY DRAWINGS PROVIDED BY LANDTECH CONSULTANTS TITLED: "EXISTING CONDITIONS SURVEY, BLUE BROOK CULVERTS GROTON ROAD/ROUTE 40, (NEAR FLUSHING POND ROAD), WESTFORD, MA" AND DATED AUGUST 10, 2022
2. UTILITY LOCATIONS SHOWN WERE PLOTTED FROM INFORMATION SUPPLIED BY RESPECTIVE UTILITY COMPANIES AND DATA OBTAINED FROM FIELD SURVEYS AND AS BUILT DRAWINGS. THE ACCURACY AND COMPLETENESS OF SUBSURFACE INFORMATION SHOWN ON THESE DRAWINGS IS NOT GUARANTEED.
3. THE HORIZONTAL COORDINATE SYSTEM IS THE NORTH AMERICAN DATUM OF 1983, MASSACHUSETTS STATE PLANE, MAINLAND ZONE, US FEET. VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988.
4. THE EXISTING CONDITIONS SHOWN ARE APPROXIMATE. FIELD VERIFY EXISTING CONDITIONS.
5. THE RIGHT OF WAY SHOWN IS BASED ON THE 1939 COUNTY LAYOUT. THE PROPERTY LINES SHOWN ON THE DRAWINGS ARE APPROXIMATE AND ARE NOT BASED ON DEED OR PLAN RESEARCH. TEMPORARY AND PERMANENT EASEMENTS SHOWN WILL BE SECURED PRIOR TO CONSTRUCTION.
6. THE RESOURCE AREA BOUNDARIES DEPICTED ON THE DRAWINGS WERE DELINEATED BY TIGHE&BOND, INC. ON 12/17/2021.
7. THE PROJECT IS NOT LOCATED WITHIN THE 100-YEAR FLOOD ZONE BASED ON THE FEMA FLOOD INSURANCE STUDY (FIS) FOR MIDDLESEX COUNTY, MA, STUDY NUMBER 25017CV003C EFFECTIVE 7/6/2016 AND FLOOD INSURANCE RATE MAP (FIRM) COMMUNITY PANEL NUMBER 25017C0231E EFFECTIVE 6/4/2010.
8. TEST PITS IDENTIFIED ON SHEET 6 WERE COMPLETED BY THE TOWN OF WESTFORD AND WITNESSED BY TIGHE & BOND, INC. ON 11/14/2022.

GENERAL NOTES:

1. NOTIFY DIGSAFE AT 1-888-344-7233 AND OTHER UTILITY OWNERS IN THE AREA NOT ON THE DIGSAFE LIST AT LEAST 72 HOURS PRIOR TO ANY DIGGING, TRENCHING, ROCK REMOVAL, DEMOLITION, BORING, BACKFILLING, GRADING, LANDSCAPING, OR ANY OTHER EARTH MOVING OPERATIONS.
2. LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE. IN ADDITION, SOME UTILITIES MAY NOT BE SHOWN. DETERMINE THE EXACT LOCATION OF UTILITIES BY TEST PIT OR OTHER METHODS, AS NECESSARY TO PREVENT DAMAGE TO UTILITIES AND/OR INTERRUPTIONS IN UTILITY SERVICE OR CONSTRUCTION OPERATIONS. PERFORM TEST PIT EXCAVATIONS AND OTHER INVESTIGATIONS TO LOCATE UTILITIES, AND PROVIDE THIS INFORMATION TO THE ENGINEER, PRIOR TO CONSTRUCTING THE PROPOSED IMPROVEMENTS. LOCATE ALL EXISTING UTILITIES TO BE CROSSED BY HAND EXCAVATION.
3. NOT ALL OF THE UTILITY SERVICES TO BUILDINGS ARE SHOWN. THE CONTRACTOR SHALL ANTICIPATE THAT EACH PROPERTY HAS SERVICE CONNECTIONS FOR THE VARIOUS UTILITIES.
4. NOTIFY THE ENGINEER OF ANY UTILITIES IDENTIFIED DURING CONSTRUCTION THAT ARE NOT SHOWN ON THE DRAWINGS OR THAT DIFFER IN SIZE OR MATERIAL.
5. TIGHE & BOND ASSUMES NO RESPONSIBILITY FOR ANY ISSUES, LEGAL OR OTHERWISE, RESULTING FROM CHANGES MADE TO THESE DRAWINGS WITHOUT WRITTEN AUTHORIZATION FROM TIGHE & BOND.
6. EXCAVATE ADDITIONAL TEST PITS TO LOCATE EXISTING UTILITIES AS DIRECTED OR APPROVED BY THE ENGINEER.
7. THE CONTRACTOR IS RESPONSIBLE FOR SITE SAFETY; COORDINATION WITH THE OWNER, ALL SUBCONTRACTORS, WITH OTHER CONTRACTORS WORKING WITHIN THE LIMITS OF WORK, AND THE MEANS AND METHODS OF CONSTRUCTING THE PROPOSED WORK.
8. OBTAIN, PAY FOR AND COMPLY WITH PERMITS, NOTICES AND FEES NECESSARY TO COMPLETE THE WORK. ARRANGE AND PAY FOR NECESSARY INSPECTIONS AND APPROVALS FROM THE JURISDICTIONAL AUTHORITIES.
9. SHORE UTILITY TRENCHES WHERE FIELD CONDITIONS DICTATE AND/OR WHERE REQUIRED BY LOCAL, STATE AND FEDERAL HEALTH AND SAFETY CODES.
10. FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO CONSTRUCTION. IF FIELD CONDITIONS ARE OBSERVED THAT VARY SIGNIFICANTLY FROM THOSE SHOWN ON THE DRAWINGS, IMMEDIATELY NOTIFY THE ENGINEER IN WRITING FOR RESOLUTION OF THE CONFLICTING INFORMATION.
11. PROTECT AND MAINTAIN ALL UTILITIES IN THE AREAS UNDER CONSTRUCTION DURING THE WORK. LEAVE ALL PIPES AND STRUCTURES WITHIN THE LIMITS OF THE CONTRACT IN A CLEAN AND OPERABLE CONDITION AT THE COMPLETION OF THE WORK. TAKE ALL NECESSARY PRECAUTIONS TO PREVENT SAND AND SILT FROM DISTURBED AREAS FROM ENTERING THE DRAINAGE SYSTEM.
12. NOTIFY THE ENGINEER IN WRITING OF ANY CONFLICT, ERROR, AMBIGUITY, OR DISCREPANCY WITH THE PLANS OR BETWEEN THE PLANS AND ANY APPLICABLE LAW, REGULATION, CODE, STANDARD SPECIFICATION, OR MANUFACTURER'S INSTRUCTIONS.
13. THE CONTRACTOR IS RESPONSIBLE FOR SUPPORT OF EXISTING UTILITIES AND REPAIR OR REPLACEMENT COSTS OF UTILITIES DAMAGED DURING CONSTRUCTION, WHETHER ABOVE OR BELOW GRADE. REPLACE DAMAGED UTILITIES IMMEDIATELY AT NO ADDITIONAL COST TO THE OWNER AND AT NO COST TO THE PROPERTY OWNER.
14. TAKE NECESSARY MEASURES AND PROVIDE CONTINUOUS BARRIERS OF SUFFICIENT TYPE, SIZE, AND STRENGTH TO PREVENT ACCESS TO ALL WORK AND STAGING AREAS AT THE COMPLETION OF EACH DAYS WORK.
15. NO OPEN TRENCHES WILL BE ALLOWED OVER NIGHT. THE USE OF ROAD PLATES TO PROTECT THE EXCAVATION WILL BE CONSIDERED UPON REQUEST, BUT BACKFILLING IS PREFERRED.
16. THE CONTRACTOR IS RESPONSIBLE FOR ALL NECESSARY TRAFFIC CONTROL/SAFETY DEVICES TO ENSURE SAFE VEHICULAR AND PEDESTRIAN ACCESS THROUGH THE WORK AREA, OR FOR SAFELY IMPLEMENTING DETOURS AROUND THE WORK AREA. PERFORM TRAFFIC CONTROL IN ACCORDANCE WITH THE APPROVED TRAFFIC CONTROL PLAN.
17. MAINTAIN EMERGENCY ACCESS TO ALL PROPERTIES WITHIN THE PROJECT AREA AT ALL TIMES DURING CONSTRUCTION.
18. WHEN WORKING IN THE ROAD, PROVIDE THE OWNER AND LOCAL FIRE/POLICE/SCHOOL AUTHORITIES A DETAILED PLAN OF APPROACH INDICATING METHODS OF PROPOSED TRAFFIC ROUTING ON A DAILY BASIS. PROVIDE COORDINATION TO ENSURE COMMUNICATION AND COORDINATION BETWEEN THE OWNER, CONTRACTOR AND LOCAL FIRE/POLICE/SCHOOL AUTHORITIES THROUGHOUT THE CONSTRUCTION PERIOD.
19. REMOVE AND DISPOSE OF ALL CONSTRUCTION-RELATED WASTE MATERIALS AND DEBRIS IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL LAWS.
20. THE TERM "DEMOLISH" AND "R&D" USED ON THE DRAWINGS MEANS TO REMOVE AND DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL REQUIREMENTS.
21. THE TERM "ABANDON" USED ON THE DRAWINGS MEANS TO LEAVE IN PLACE AND TAKE APPROPRIATE MEASURES TO DECOMMISSION AS SPECIFIED OR NOTED ON THE DRAWINGS.
22. ALL PROPOSED WORK MAY BE ADJUSTED IN THE FIELD BY THE OWNER'S PROJECT REPRESENTATIVE TO MEET EXISTING CONDITIONS.

SURFACE RESTORATION NOTES:

1. ALL PAVEMENT DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPLACED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AT NO ADDITIONAL COST TO THE OWNER.
2. PROTECT PROJECT FEATURES (E.G., WALLS, FENCES, MAIL BOXES, SIGNS, SIDEWALKS, CURBING, STAIRS, UTILITY POLES, GUY WIRES, WALKWAYS, TREES, ETC.) FROM DAMAGE DURING CONSTRUCTION, INCLUDING PROVIDING TEMPORARY SUPPORTS, WHEN APPROPRIATE.
3. IF REMOVAL OF PROJECT FEATURES IS REQUIRED IN ORDER TO PERFORM THE PROPOSED WORK, REMOVE THOSE SITE FEATURES ONLY UPON APPROVAL OF ENGINEER. REPLACE ALL REMOVED PROJECT FEATURES; NEW ITEMS SHALL BE EQUAL OR BETTER IN QUALITY AND CONDITION TO THE ITEMS REMOVED.
4. EXISTING SURVEY MONUMENTS DISTURBED BY THE CONTRACTOR SHALL BE REPLACED BY A LAND SURVEYOR LICENSED IN THE STATE IN WHICH THE WORK IS PERFORMED AT NO ADDITIONAL COST TO THE OWNER.
5. COORDINATE THE ADJUSTMENT OF EXISTING UTILITY STRUCTURES WITH EACH RESPONSIBLE UTILITY OWNER PRIOR TO RECONSTRUCTION AND/OR PAVING OPERATIONS. RAISE ALL STRUCTURES TO FINISHED GRADES PRIOR TO THE END OF THE CONSTRUCTION SEASON AND PRIOR TO FINISHED PAVING.
6. REPAIR DISTURBED PAVED SURFACES AT THE END OF EACH WORK WEEK, UNLESS OTHERWISE APPROVED/REQUIRED BY THE OWNER.
7. TRANSFER ALL TEMPORARY BENCHMARKS, AS NECESSARY.
8. RESTORE ALL AREAS DISTURBED BY THE CONTRACTOR BEYOND THE PROJECT LIMITS TO ORIGINAL CONDITIONS AT NO ADDITIONAL COST TO THE OWNER.
9. REGRADE ALL UNPAVED AREAS DISTURBED BY THE WORK AS REQUIRED. REPAIR/REPLACE PAVED SURFACES DISTURBED BY THE WORK IN-KIND, UNLESS OTHERWISE NOTED. RESTORE SURFACES TO EXISTING OR PROPOSED CONDITIONS AS INDICATED ON THE DRAWINGS.

DRAINAGE SYSTEM IMPROVEMENT NOTES:

1. LOCATIONS OF PROPOSED STORM DRAINS AND STRUCTURES ARE APPROXIMATE AND MAY BE ADJUSTED DURING CONSTRUCTION AFTER INVESTIGATIVE WORK. FINAL STORM DRAIN LOCATIONS, AND ASSOCIATED STRUCTURES, WILL BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. ADJUSTMENTS TO THE PROPOSED STORM DRAIN LAYOUTS AND ELEVATIONS SHALL NOT BE CONSIDERED CAUSE FOR ADDITIONAL PAYMENTS. THE CONTRACTOR SHALL NOT MAKE PROPOSED STORM DRAIN LAYOUT AND ELEVATION ADJUSTMENTS WITHOUT APPROVAL FROM THE ENGINEER.
3. MAINTAIN OPERATION OF DRAINAGE SYSTEM DURING CONSTRUCTION. PROVIDE BYPASS PUMPING OF DRAINAGE FLOWS AND/OR TEMPORARY CONNECTIONS, AS NECESSARY.

LEGEND:

EXISTING	PROPOSED	DESCRIPTION
		MAIL BOX
		CONCRETE POST
		BOULDER
		BENCHMARK
WF ##-##		WETLAND FLAG
		SIGN AND POST
		GATE VALVE
		UTILITY POLE
		TREE
		FIRE HYDRANT
		GAS
		OVERHEAD UTILITY
		WATER MAIN
		INTERMEDIATE CONTOURS (MAJOR)
		INTERMEDIATE CONTOURS (MINOR)
		PROPERTY LINE OR APPROXIMATE PROPERTY LINE
		RIGHT-OF-WAY
		EDGE OF PAVEMENT
		CENTERLINE
		GUARDRAIL
		LIMITS OF WORK
		EROSION CONTROL BARRIER
		COFFER DAM
		STONE WALL
		MEAN HIGH WATER/BANK
		BORDER OF VEGETATED WETLAND
		100-FOOT BUFFER ZONE
		200-FOOT RIVERFRONT AREA
		LOCAL 30-FOOT NO DISTURB ZONE
		DEMOLISH
		DUMPED RIPRAP BANK RESTORATION AND STABILIZATION
		COIR LOG BANK RESTORATION AND STABILIZATION
		TEST PIT

ABBREVIATIONS:

BIT	BITUMINOUS
BL	BASELINE
BLSF	BORDERING LAND SUBJECT TO FLOODING
BOT	BOTTOM
CB	CATCH BASIN
CPP	CORRUGATED PLASTIC PIPE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CS	COATED STEEL
CY	CUBIC YARD
D/DIA	DIAMETER
DI	DUCTILE IRON
E	EAST
EL/ELEV	ELEVATION
EOP	EDGE OF PAVEMENT
HMA	HOT MIX ASPHALT
INV	INVERT
LT	LEFT
MAX	MAXIMUM
MIN	MINIMUM
MNS	MONUMENT NOT SET
N	NORTH
N/A	NOT APPLICABLE
OC	ON CENTER
PC	POINT OF CURVATURE
PCF	POUNDS PER CUBIC FOOT
PCMS	PORTABLE CHANGEABLE MESSAGE SIGN
PGL	PROFILE GRADE LINE
PROP	PROPOSED
PROT	PROTECT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
RCP	REINFORCED CONCRETE PIPE
RET	RETAIN
RET UP	RETAIN UTILITY POLE
RT	RIGHT
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
S	SOUTH
SF	SQUARE FOOT
STA	STATION
TYP	TYPICAL
UP	UTILITY POLE

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

MARK	DATE	DESCRIPTION

PROJECT NO:	W5005-029
DATE:	DECEMBER 2023
FILE:	W5005-029_03_GENERAL.dwg
DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

GENERAL NOTES (SHEET 1 OF 2)

SCALE: NO SCALE

SHEET 03 OF 15

DESIGN LOADS AND SPECIFICATIONS:

1. DESIGN LOADING:	HL–93
2. DESIGN METHOD:	LOAD AND RESISTANCE FACTOR DESIGN (LRFD)
3. SPECIFICATIONS:	AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 9TH ED., 2020 AS AMENDED MASSDOT LRFD BRIDGE MANUAL, 2013, AS AMENDED THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 2023, AS AMENDED
4. FOUNDATION DATA:	WINGWALLS: WINGWALLS BEARING ON A MINIMUM 6" CONCRETE LEVELING SLAB WITH DOWELS WITH AN ALLOWABLE BEARING PRESSURE OF 20.0 KSF.
5. REINFORCING STEEL:	AASHTO M31 (ASTM A 615) GRADE 60 EPOXY COATED: ALL BARS AND DOWELS.
6. CONCRETE:	MODULAR BLOCK WINGWALLS: 4000 PSI, 1½", 565 CEMENT CONCRETE LEVELING SLAB: 3000 PSI, 1½", 470 CEMENT CONCRETE

FOUNDATION NOTES:

1. FOUNDATION MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.
2. REINFORCED CONCRETE PIPE AND HEADWALLS SHALL NOT BE PLACED IN WATER OR ON FROZEN SOIL.
3. ALL FOUNDATIONS SHALL BE SUPPORTED FULLY ON SOIL OR BEDROCK. PARTIALLY SUPPORTED FOUNDATIONS ON BEDROCK AND SOIL IS NOT ACCEPTABLE.
4. BOTTOM OF FOUNDATION ELEVATIONS PROVIDED ON DRAWINGS SHALL BE CONSIDERED MINIMUM DEPTHS. REMOVE UNSUITABLE MATERIAL AS REQUIRED.
5. ALL FINISHED EXCAVATIONS SHALL BE VERIFIED AND APPROVED BY THE ENGINEER PRIOR TO CULVERT INSTALLATION.
6. ALL BACKFILL UNDER OR ADJACENT TO ANY PORTION OF THE PIPE AND HEADWALLS SHALL BE PLACED IN ACCORDANCE WITH MASSDOT STANDARD SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, SPECIAL PROVISIONS, AND MANUFACTURERS REQUIREMENTS.
7. NOTIFY THE ENGINEER OF ANY UTILITIES IDENTIFIED DURING CONSTRUCTION THAT ARE NOT SHOWN ON THE DRAWINGS OR THAT DIFFER IN SIZE OR MATERIAL.
8. THE CONTRACTOR IS RESPONSIBLE FOR SITE SAFETY; COORDINATION WITH THE OWNER, ALL SUBCONTRACTORS, WITH OTHER CONTRACTORS WORKING WITHIN THE LIMITS OF WORK, AND THE MEANS AND METHODS OF CONSTRUCTING THE PROPOSED WORK.
9. ANY UNSUITABLE MATERIALS SUCH AS LOOSE OR WEATHERED BEDROCK, BOULDERS, ROOTS, ORGANIC SOILS, OR SILT/CLAY ENCOUNTERED WITHIN THE FOUNDATION BEARING ZONE, DEFINED BY A 1H:1V PLAN EXTENDING DOWNWARD AND OUTWARD FROM 1 FOOT BEYOND THE EDGE OF STRUCTURE, SHALL BE REMOVED AND REPLACED WITH CRUSHED STONE, AS DIRECTED BY THE ENGINEER.

GEOTECHNICAL DESIGN PARAMETERS:

1. MINIMUM EMBEDMENT FOR FROST PROTECTION FOR FOOTINGS FOUNDED ON SOIL = 4 FEET BELOW ADJACENT GROUND SURFACE.
2. ALLOWABLE BEARING PRESSURE FOR FOUNDATIONS ON BEDROCK = 20 KIPS PER SQUARE FOOT.
3. THE WINGWALL DESIGNER SHALL PREPARE CALCULATIONS THAT VERIFY THE APPLIED BEARING PRESSURE IS LESS THAN THE ALLOWABLE BEARING PRESSURE BASED ON THE FINAL WINGWALL FOUNDATION DIMENSIONS AND EMBEDMENT.
3. MAXIMUM ALLOWABLE SETTLEMENT = 0.5 INCHES TOTAL
4. MINIMUM BACKFILL UNIT WEIGHT = 120 POUNDS PER CUBIC FOOT (PCF)
5. MAXIMUM BACKFILL ANGLE OF INTERNAL FRICTION = 37 DEGREE
6. MINIMUM LATERAL EARTH PRESSURES FOR RESTRAINED CULVERT SIDE WALLS:
   a. STATIC =
      - 61 POUNDS PER CUBIC FOOT PER FOOT (PCF/FT) AS AN EQUIVALENT FLUID PRESSURE (ABOVE GROUNDWATER)
      - 94 POUNDS PER CUBIC FOOT PER FOOT (PCF/FT) AS AN EQUIVALENT FLUID PRESSURE (BELOW GROUNDWATER)
   b. SURCHARGE: HORIZONTAL FORCE FROM THE PRESSURE DISTRIBUTION PRODUCED BY THE AASHTO HL–93 VEHICULAR LIVE LOAD, UNIFORMLY DISTRIBUTED OVER THE HEIGHT OF THE WALL
   c. SEISMIC =
      - 42 POUNDS PER CUBIC FOOT PER FOOT (PCF/FT) AS AN EQUIVALENT FLUID PRESSURE (ABOVE GROUNDWATER)
      - 84 POUNDS PER CUBIC FOOT PER FOOT (PCF/FT) AS AN EQUIVALENT FLUID PRESSURE (BELOW GROUNDWATER)
5. MINIMUM LATERAL EARTH PRESSURES FOR UNRESTRAINED WING WALLS:
   a. STATIC =
      - 36 PCF/FT AS AN EQUIVALENT FLUID PRESSURE, 200 PSF/FT MINIMUM (ABOVE GROUNDWATER)
      - 81 PCF/FT AS AN EQUIVALENT FLUID PRESSURE, 200 PSF/FT MINIMUM (BELOW GROUNDWATER)
   b. SURCHARGE: HORIZONTAL FORCE FROM THE PRESSURE DISTRIBUTION PRODUCED BY THE AASHTO HL–93 VEHICULAR LIVE LOAD, UNIFORMLY DISTRIBUTED OVER THE HEIGHT OF THE WALL. THE DESIGN SHALL ACCOUNT FOR SLOPING GROUND SURFACE ABOVE THE WALLS.
   c. SEISMIC =
      - 39 POUNDS PER CUBIC FOOT PER FOOT (PSF/FT) AS AN EQUIVALENT FLUID PRESSURE (ABOVE GROUNDWATER)
      - 83 POUNDS PER CUBIC FOOT PER FOOT (PSF/FT) AS AN EQUIVALENT FLUID PRESSURE (BELOW GROUNDWATER)

CULVERT REMOVAL NOTES:

1. THE CONTRACTOR'S METHOD FOR REMOVAL OF THE EXISTING CULVERT SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND ACCEPTANCE PRIOR TO THE COMMENCEMENT OF ANY REMOVAL OPERATIONS.
2. REMOVAL OF THE EXISTING CULVERT STRUCTURE SHALL INCLUDE THE COMPLETE REMOVAL OF THE PIPE AND STONE HEADWALLS. REFER TO SHEET 6 FOR DEMOLITION PLAN.
3. CONTRACTOR SHALL COORDINATE SALVAGED GRANITE HEADWALL WITH WESTFORD DPW.
4. PRIOR TO THE REMOVAL OF EXISTING CULVERT, THE CONTRACTOR SHALL VERIFY THAT EXISTING UTILITIES HAVE BEEN RELOCATED OR A TEMPORARY BYPASS HAS BEEN INSTALLED.

WINGWALL NOTES:

1. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS, SEALED AND SIGNED BY A CURRENTLY REGISTERED MASSACHUSETTS PROFESSIONAL ENGINEER TO THE ENGINEER FOR REVIEW AND ACCEPTANCE TO ENSURE CONFORMANCE WITH THE CONTRACT DOCUMENTS. DESIGN SHALL ENCOMPASS THE WINGWALLS AND FOUNDATIONS. SHOP DRAWINGS AND CALCULATIONS SHALL BE SUBMITTED PRIOR TO FABRICATION FOR ALL PRECAST CONCRETE ELEMENTS. SHOP DRAWINGS SHALL SHOW JOINT DETAILS AND REINFORCEMENT SIZE AND LOCATION.
2. CHANGES OR MODIFICATIONS DURING THE FABRICATION PROCESS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL AND INCORPORATED INTO THE FINAL AS–BUILT DRAWINGS.
3. DIMENSIONS SHOWN FOR THE WINGWALL ELEMENTS ARE APPROXIMATE AND BASED ON CONCEPTUAL DESIGN. NO ADJUSTMENTS TO PAYMENTS WILL BE MADE AS A RESULT OF PROVIDING WINGWALL UNITS SIZED DIFFERENTLY THAN SHOWN ON THE PLANS. CONTRACTOR TO ADJUST OVERALL CULVERT GEOMETRY AS NEEDED IF WINGWALL SIZES SELECTED BY CONTRACTOR DIFFER. SEE ALSO SPECIAL PROVISIONS SECTION 995.
4. THE QUALITY OF MATERIALS, THE PROCESS OF MANUFACTURE, AND THE FINISHED UNITS SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY THE ENGINEER.
5. EXPOSED CONCRETE SURFACES SHALL BE TREATED WITH WATER REPELLENT (SILANE/SILOXANE).
6. TOP SURFACES OF FOOTING UNITS SHALL BE SET UNIFORMLY TRUE & LEVEL TO A TOLERANCE OF +/– 1/8".
7. DEWATERING IS REQUIRED AT EACH FOUNDATION LOCATION TO CONTROL THE WATER INFLOW AND ADEQUATELY DEWATER THE FOOTING EXCAVATION. SUMP PUMPING AREAS AROUND THE ENTIRE PERIMETER SHALL BE REQUIRED, AT A MINIMUM, TO ADEQUATELY CONTROL THE GROUNDWATER WITHIN THE EXCAVATION AREAS. DEWATERING SHALL BE CONTINUOUS UNTIL THE PIPE AND WINGWALLS ARE BACKFILLED EVENLY ON BOTH SIDES TO THE ELEVATIONS OF THE SURROUNDING WATER TABLE, UNLESS OTHERWISE DIRECTED.
8. ANY PROPOSED DEWATERING SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND ACCEPTANCE.
9. THE CONTRACTOR SHALL SUBMIT DRAWINGS AND DESIGN CALCULATIONS, SEALED AND SIGNED BY A CURRENTLY REGISTERED MASSACHUSETTS PROFESSIONAL ENGINEER TO THE ENGINEER FOR REVIEW AND ACCEPTANCE OF PROPOSED SHORING AND SUPPORT OF EXCAVATION. SHOP DRAWINGS AND CALCULATIONS SHALL BE SUBMITTED PRIOR TO FABRICATION AND INSTALLATION FOR ALL SHORING AND SUPPORT OF EXCAVATION ELEMENTS.
10. WATER PUMPED FROM DEWATERING LOCATIONS SHALL BE FILTERED ADEQUATELY TO REMOVE FINE MATERIALS PRIOR TO RETURNING THE WATER TO THE RIVER/BROOK. ACTUAL LOCATION OF SEDIMENTATION BASIN TO BE DETERMINED BY CONTRACTOR AND APPROVED BY THE ENGINEER AND THE WESTFORD CONSERVATION COMMISSION PRIOR TO INSTALLATION.
11. ANY FOUNDATION MATERIALS WEAKENED AS A RESULT OF INSUFFICIENT CARE WHILE MAINTAINING A DEWATERED CONDITION SHALL BE REMOVED AND REPLACED WITH APPROVAL BY THE ENGINEER AT NO EXPENSE TO THE OWNER.
12. ANY CAST–IN–PLACE CONCRETE SHALL MEET AASHTO COVER REQUIREMENTS.
13. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4", UNLESS OTHERWISE NOTED.
14. FACES OF CONCRETE TO BE BACKFILLED AGAINST SHALL BE COATED WITH DAMP–PROOFING IN ACCORDANCE WITH THE SPECIFICATIONS.

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

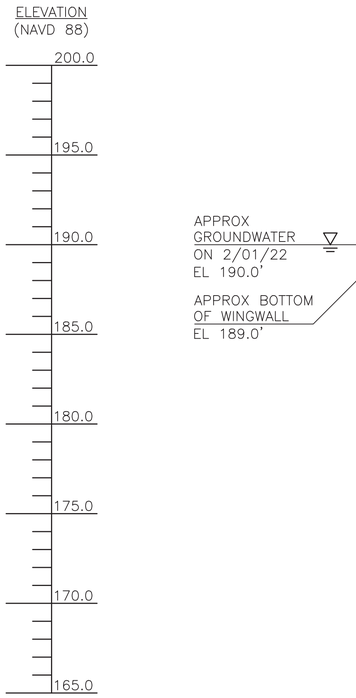
MARK	DATE	DESCRIPTION

PROJECT NO:	W5005-029
DATE:	DECEMBER 2023
FILE:	W5005-029_03_GENERAL.dwg
DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

GENERAL NOTES (SHEET 2 OF 2)

SCALE: NO SCALE

SHEET 04 OF 15



Tighe&Bond — Engineers | Environmental Specialists

Boring No. TB-1 | Page 1 of 1 | File No. 32-5005-029 | Checked by: C. Haker

Project: Blue Brook and Pond Brook Culvert Replacements
Location: Blue Brook and Route 40
Client: Town of Westford, MA

Drilling Co.: Martin GeoEnvironmental
Foreman: J. Martin
T&B Rep.: R. Gaetjens
Date Start: 02/01/22 End: 02/01/22
Location See Exploration Location Plan
GS. Elev. 196± Datum: NAVD88

	Casing	Sampler
Type	HSA	Split Spoon
I.D./O.D.	4-1/4"/ 8"	1-3/8"/2"
Hammer Wt.	-	140#
Hammer Fall	-	30"
Other	B-53 Rig	Auto hammer

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Refer to note 2				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
5		S1/10	0-0.75	-50	0-0.5' Asphalt 0.5-1.25' Very dense, brown, fine to coarse SAND, some Gravel, little Silt	Asphalt	1	No well installed
				50/3"				
		S2/7	2-4	27-6	Loose, brown, fine to coarse SAND, some Gravel, little Silt	FILL		
				2-3				
		S3/11	4-6	2-1	Medium dense, brown, fine to coarse SAND, little Silt, trace organics		2	
				22-21				
10		C1/41	7-12	11	Hard, slightly weathered, slightly fractured, medium grained, Muscovite-Biotite GRANITE, closely fractured, thickly bedded. REC = 41/60 = 68% RQD = 35/60 = 58%	Bedrock		
				2				
				4				
				6				
				5			3	
15					Bottom of exploration at 12'			
20								
25								
30								

Notes: 1) Ground surface elevations from a plan titled "Existing Conditions Survey" prepared by Landtech Consultants dated January 2022.
2) Ground water estimated to be approximately six feet below ground surface based on sample wetness.
3) Boring backfilled with cuttings and surface repaired with coldpatch asphalt upon completion.

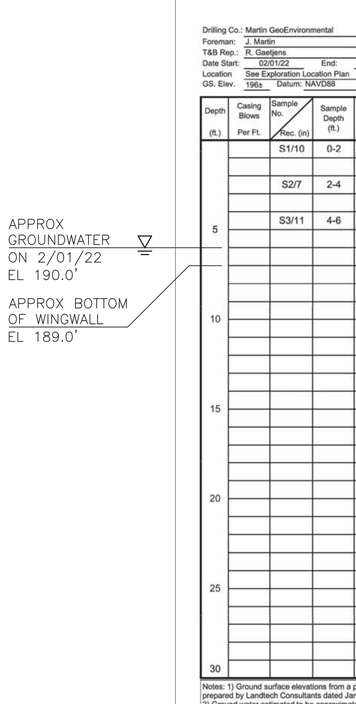
Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

BORING TB–1 (1 OF 1)



Tighe&Bond — Engineers | Environmental Specialists

Boring No. TB-2 | Page 1 of 1 | File No. 32-5005-029 | Checked by: C. Haker

Project: Blue Brook and Pond Brook Culvert Replacements
Location: Blue Brook and Route 40
Client: Town of Westford, MA

Drilling Co.: Martin GeoEnvironmental
Foreman: J. Martin
T&B Rep.: R. Gaetjens
Date Start: 02/01/22 End: 02/01/22
Location See Exploration Location Plan
GS. Elev. 196± Datum: NAVD88

	Casing	Sampler
Type	HSA	Split Spoon
I.D./O.D.	4-1/4"/ 8"	1-3/8"/2"
Hammer Wt.	-	140#
Hammer Fall	-	30"
Other	B-53 Rig	Auto hammer

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Refer to note 2				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
5		S1/10	0-2	-57	0-0.5' Asphalt 0.5-2' Very dense, brown, fine to coarse SAND, some Gravel, little Silt	Asphalt	1	No well installed
				37-28				
		S2/7	2-4	16-22	Dense, brown, fine to coarse SAND, some Gravel, little Silt	FILL		
				17-15				
		S3/11	4-6	7-9	Medium dense, brown, fine to coarse SAND, little Gravel, little Silt, trace Organics		2	
				12-7				
10							3	
15					Bottom of exploration dur to refusal at 8.5'			
20								
25								
30								

Notes: 1) Ground surface elevations from a plan titled "Existing Conditions Survey" prepared by Landtech Consultants dated January 2022.
2) Ground water estimated to be approximately six feet below ground surface based on sample wetness.
3) Boring backfilled with cuttings and surface repaired with coldpatch asphalt upon completion.

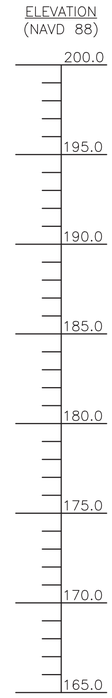
Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

BORING TB–2 (1 OF 1)



BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON SHEET 6 THUS: B–1
2. BORINGS WERE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF DRILLING. FIELD CONDITIONS WILL VARY BASED ON TIME OF YEAR AND RAIN EVENTS.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT TIGHE & BOND'S OFFICE, 53 SOUTHAMPTON ROAD, WESTFIELD, MA 01085. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE DESIGN ENGINEER.
6. ALL BORINGS WERE DRILLED IN FEBRUARY 2022.
7. BORINGS WERE DRILLED BY MARTIN GEO ENVIRONMENTAL LLC. OF BELCHERTOWN, MA.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.
9. THE SURFACE ELEVATION ON EACH BORING LOG IS THE ELEVATION OF THE EXISTING GROUND AT THE TIME THE BORING WAS DRILLED.
10. ENGINEERING JUDGEMENT WAS EXERCISED IN PREPARING THE SUBSURFACE INFORMATION PRESENTED HEREIN. ANALYSIS AND INTERPRETATION OF SUBSURFACE DATA WAS PERFORMED FOR DESIGN AND ESTIMATING PURPOSES. PRESENTATION OF THE INFORMATION IN THE CONTRACT IS INTENDED TO PROVIDE THE CONTRACTOR ACCESS TO THE SAME DATA AVAILABLE TO THE OWNER. THE SUBSURFACE INFORMATION IS PRESENTED IN GOOD FAITH AND IS NOT INTENDED AS A SUBSTITUTE FOR PERSONAL INVESTIGATION, INDEPENDENT INTERPRETATION, INDEPENDENT ANALYSIS OR JUDGEMENT BY THE CONTRACTOR.

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

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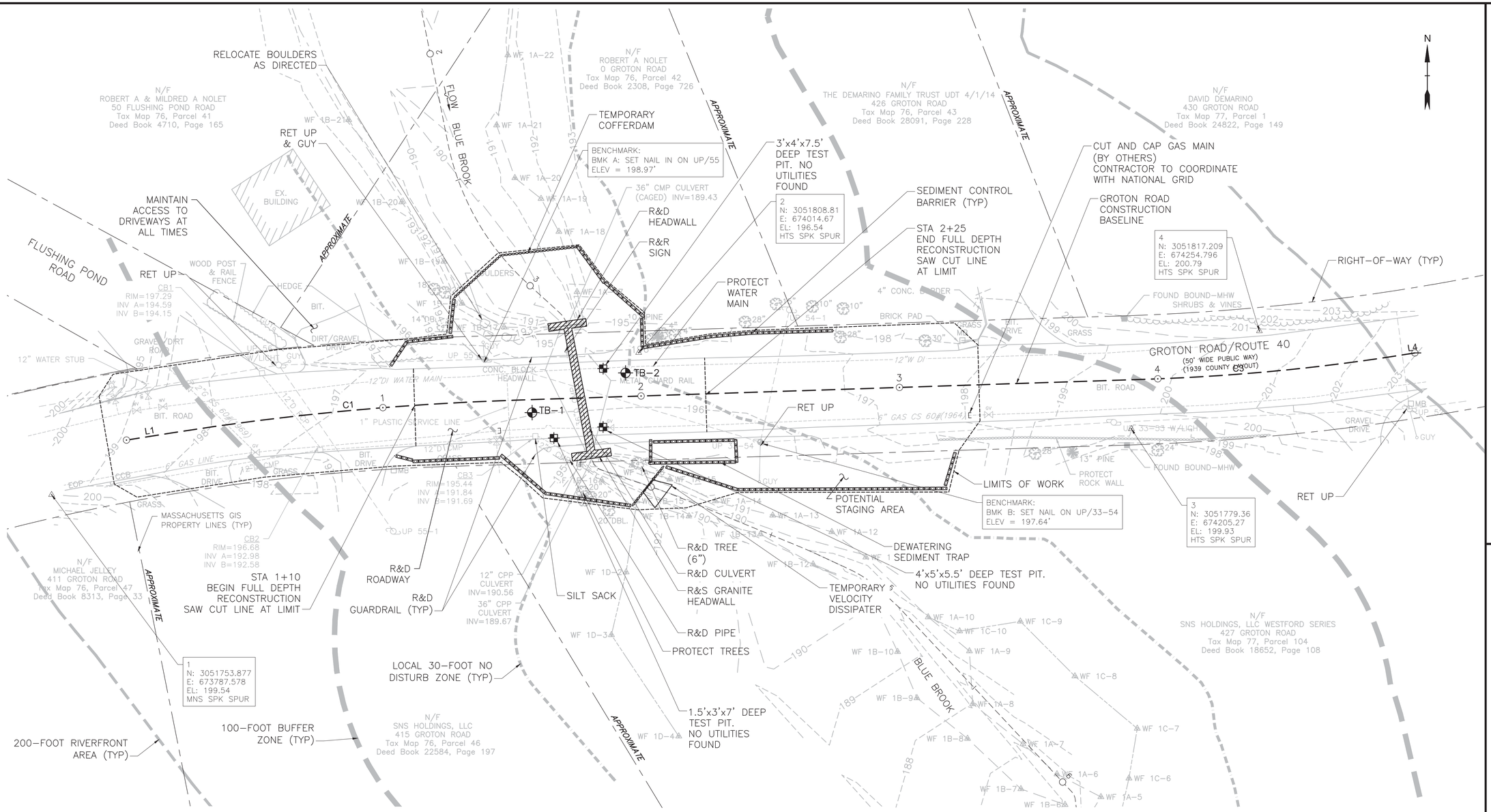
DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

BORING LOGS & BORING NOTES

SCALE: NO SCALE

SHEET 05 OF 15

Last Saved: 12/6/2023
Plotted On: Dec 06, 2023-11:33am By: SSak
Tighe & Bond: J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_03_GENERAL.dwg



GROTON ROAD ALIGNMENT CONSTRUCTION BASELINE DATA								
NUMBER	STARTING STATION	NORTHING	EASTING	CURVE DATA	LINE DATA	ENDING STATION	NORTHING	EASTING
L1	0+00.00	3051775.019	673816.538		N81°00'35"E 18.57'	0+18.57	3051777.921	673834.880
C1	0+18.57	3051777.921	673834.880	R=1066.00' Δ=7°05'24" L=131.91' T=66.04'		1+50.48	3051790.430	673966.112
C3	3+96.17	3051798.577	674211.663	R=800.00' Δ=7°22'16" L=102.92' T=51.53'		4+99.09	3051808.588	674314.024
L4	4+99.09	3051808.588	674314.024		N80°43'43"E 0.91'	5+00.00	3051808.735	674314.924

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APPROVED BY:	DSH

EXISTING CONDITIONS & DEMOLITION PLAN

SCALE: 1" = 20'

SHEET 06 OF 15

Last Saved: 12/6/2023
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PROP PERMANENT EASEMENT TO BE SECURED PRIOR TO CONSTRUCTION

PROP 36" RCP CLASS V PIPE, TYPE 1 INSTALLATION

INLET
STA:1+58.70 OFF:24.90LT
INVERT = 190.00

DUMPED RIPRAP BANK STABILIZATION SEE SHEET 9 FOR DETAILS (TYP)

PROPOSED HEADWALLS SEE SHEET 11 FOR DETAILS (TYP)

PROP TEMPORARY EASEMENT TO BE SECURED PRIOR TO CONSTRUCTION

SEDIMENT CONTROL BARRIER (TYP)

PROPOSED HIGHWAY GUARDRAIL (TYP)

STA 2+25
END FULL DEPTH RECONSTRUCTION
PROVIDE MILLING AND OVERLAY PER BUTT JOINT DETAIL

STA 2+78, 17' LT
GUARDRAIL FLARED END TREATMENT WITH IMPACT HEAD

STA 1+10, 15' LT
GUARDRAIL TRAILING ANCHORAGE

FLUSHING POND ROAD

BLUE BROOK

APPROXIMATE

3:1 (TYP)

GROTON ROAD/ROUTE 40
(50' WIDE PUBLIC WAY)
(1939 COUNTY LAYOUT)

PC4
+96.17

PT
+99.09

RIGHT-OF-WAY (TYP)

STA 2+78, 15' RT
GUARDRAIL TRAILING ANCHORAGE

RELOCATED GAS MAIN
(BY OTHERS)

PROP TEMPORARY EASEMENT TO BE SECURED PRIOR TO CONSTRUCTION

0+00 L1 PC +18.57

PT
+50.48

STA 1+10
BEGIN FULL DEPTH RECONSTRUCTION
PROVIDE MILLING AND OVERLAY PER BUTT JOINT DETAIL

STA 1+10, 18' RT
GUARDRAIL FLARED END TREATMENT WITH IMPACT HEAD

PROP 12" CPP DRAIN
CONNECT TO EXISTING CB
MATCH EXISTING INVERTS

PROP CB
RIM=195.83
INV IN=191.50 (12" CPP)
INV OUT=191.45 (12" CPP)

COIR LOG BANK STABILIZATION SEE SHEET 9 FOR DETAILS (TYP)

PROP PERMANENT EASEMENT TO BE SECURED PRIOR TO CONSTRUCTION

100-FOOT BUFFER ZONE (TYP)

3:1 (TYP)

OUTLET
STA:1+82.36 OFF:23.16RT
INVERT = 189.95

EXPOSE GAS MAIN PRIOR TO DRIVING POSTS FOR GUARDRAIL

200-FOOT RIVERFRONT AREA (TYP)

LOCAL 30-FOOT NO DISTURB ZONE (TYP)

0+50

SCALE: 1" = 20'

N

Tighe&Bond

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Westford, Massachusetts

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DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

SITE PLAN

SCALE: 1" = 20'

SHEET 07 OF 15

Last Saved: 12/6/2023
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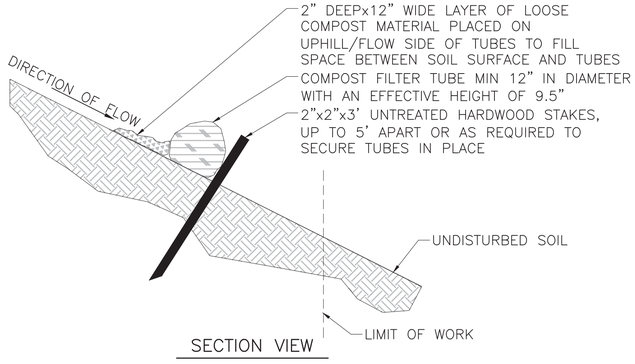
Tighe & Bond: J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_04_CIVIL.dwg

EROSION CONTROL NOTES:

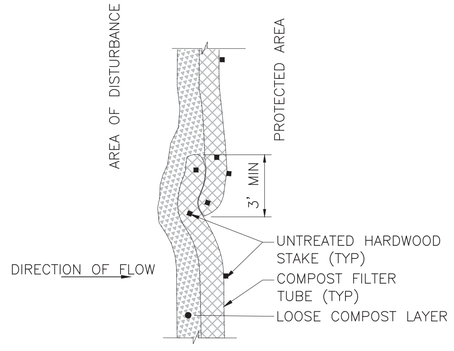
1. ALL EROSION CONTROL MEASURES SHOWN, SPECIFIED AND REQUIRED BY THE ENGINEER SHALL BE INSTALLED PRIOR TO ANY CONSTRUCTION OR IMMEDIATELY UPON REQUEST. MAINTAIN ALL SUCH CONTROL MEASURES UNTIL FINAL SURFACE TREATMENTS ARE IN PLACE AND/OR UNTIL PERMANENT VEGETATION IS ESTABLISHED.
2. A PRE–CONSTRUCTION MEETING WITH THE WESTFORD CONSERVATION COMMISSION AND THE ENGINEER IS REQUIRED. THE EROSION CONTROL MEASURES ARE TO BE REVIEWED BY THE COMMISSION PRIOR TO COMMENCEMENT OF CONSTRUCTION.
3. MAINTAIN AN ADDITIONAL SUPPLY OF EROSION CONTROL MEASURES THROUGHOUT THE CONSTRUCTION PERIOD.
4. PRIOR TO STARTING WORK, CLEARLY STAKE WORK LIMIT LINE(S). DO NOT DISTURB VEGETATION AND TOPSOIL BEYOND THE NEW LIMIT LINE. COORDINATE WITH THE ENGINEER THE LOCATIONS FOR THE TEMPORARY STOCKPILING OF TOPSOIL DURING CONSTRUCTION.
5. SIDE SLOPES, AND DISTURBED VEGETATED AREAS, SHALL BE A MAXIMUM GRADE OF 2:1 COMPACTED, STABILIZED, LOAMED AND SEEDED AS SHOWN ON DRAWINGS. SIDE SLOPES SHALL BE IMMEDIATELY FINE GRADED AND SEEDED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.
6. SILT TRAPPED AT BARRIERS SHALL BE REMOVED AND DISPOSED OF IN UPLAND AREAS OUTSIDE BUFFER ZONES. MATERIALS DEPOSITED IN ANY TEMPORARY SETTLING BASIN SHALL BE REMOVED AT THE COMPLETION OF THE PROJECT. ALL DISTURBED AREAS SHALL BE RESTORED.
7. INSTALL EROSION CONTROLS AT THE EDGE OF NEW WORK. EROSION CONTROLS SHALL ACT AS LIMIT OF WORK LINE TO HELP ENSURE THAT EQUIPMENT DOES NOT DISTURB ADJACENT PROPERTIES.
8. ADDITIONAL EROSION CONTROLS MAY BE REQUIRED TO LIMIT SEDIMENTS FROM DISCHARGING TO ADJACENT PROPERTIES OR WATERWAYS.
9. PROPERLY STABILIZE AND PROTECT TEMPORARY STOCKPILES OF MATERIALS RELATED TO THE CONSTRUCTION ACTIVITIES TO LIMIT MOVEMENT OF MATERIAL ONTO ADJACENT PARCELS, OR INTO THE STREAM.
10. STABILIZE THE AREAS OF CONSTRUCTION ACTIVITIES AT THE CLOSE OF EACH CONSTRUCTION DAY. CHECK EROSION CONTROLS AT THIS TIME AND MAINTAIN OR REINFORCE IF NECESSARY
11. PROTECT NEW WORK FROM FLOODING. PROPERLY SLOPE GRADING IN THE AREAS SURROUNDING ALL EXCAVATIONS TO LIMIT WATER FROM RUNNING INTO THE EXCAVATED AREA OR TO ADJACENT PROPERTIES. UPON COMPLETION OF THE WORK, RESTORE ALL AREAS IN A SATISFACTORY MANNER.
12. ALL SILT–LADEN WATER MUST BE SETTLED OR FILTERED TO REMOVE ALL SEDIMENTS PRIOR TO RELEASE TO AN UPLAND AREA, IN A SEDIMENTATION OR FILTER BAG LOCATED DOWN GRADIENT.
13. DEWATER AS NECESSARY TO KEEP CONSTRUCTION AREAS FREE OF WATER, DISCHARGE WATER FROM DEWATERING TO APPROPRIATE UPLAND LOCATION AND WITHOUT SEDIMENT (SEE DEWATERING REQUIREMENTS).
14. AT THE END OF EACH WORK DAY, ANY SEDIMENTS TRACKED ONTO PUBLIC RIGHTS–OF–WAY BEYOND THE PROJECT LIMITS SHALL BE REMOVED.

COMPOST FILTER TUBE NOTES:

1. PROVIDE A MINIMUM TUBE DIAMETER OF 12" FOR SLOPES UP TO 50' IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATION WITH LONGER SLOPES OR STEEPER SLOPES.
2. INSTALL TUBES ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. DO NOT INSTALL IN PERENNIAL, EPHEMERAL OR INTERMITTENT STREAMS.
4. CONFIGURE TUBES AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN–OFF.
5. TUBES FOR COMPOST FILTERS SHALL BE JUTE MESH OR APPROVED BIODEGRADABLE MATERIAL. ADDITIONAL TUBES SHALL BE USED AT THE DIRECTION OF THE ENGINEER.
6. TAMP TUBES IN PLACE TO ENSURE GOOD CONTACT WITH SOIL SURFACE. IT IS NOT NECESSARY TO TRENCH TUBES INTO EXISTING GRADE.
7. WHEN STAKING IS NOT POSSIBLE, SUCH AS WHEN TUBES MUST BE PLACED ON PAVEMENT, HEAVY CONCRETE OR CINDER BLOCKS CAN BE USED BEHIND TUBES UP TO 5' APART OR AS REQUIRED TO SECURE TUBES IN PLACE.
8. PROVIDE 3' MINIMUM OVERLAP AT ENDS OF TUBES TO JOIN IN A CONTINUOUS BARRIER AND MINIMIZE UNIMPEDED FLOW.
9. STAKE JOINING TUBES SNUGLY AGAINST EACH OTHER TO PREVENT UNFILTERED FLOW BETWEEN THEM.
10. SECURE ENDS OF TUBES WITH STAKES SPACED 18" APART THROUGH TOPS OF TUBES.



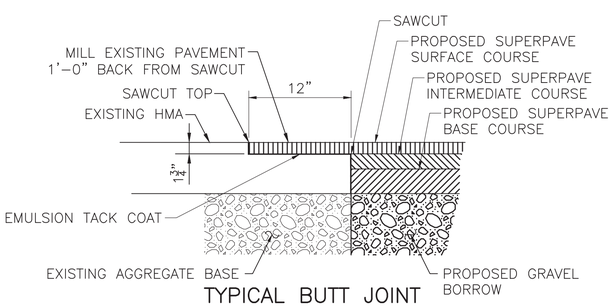
SECTION VIEW



PLAN VIEW – JOINT DETAIL

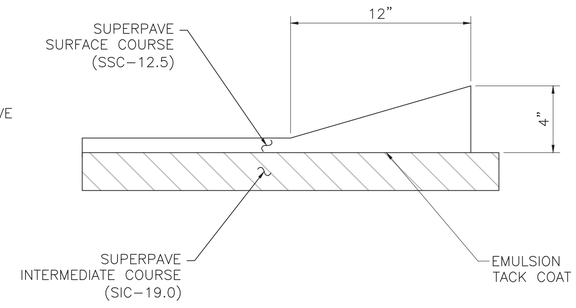
COMPOST FILTER TUBES

NOT TO SCALE



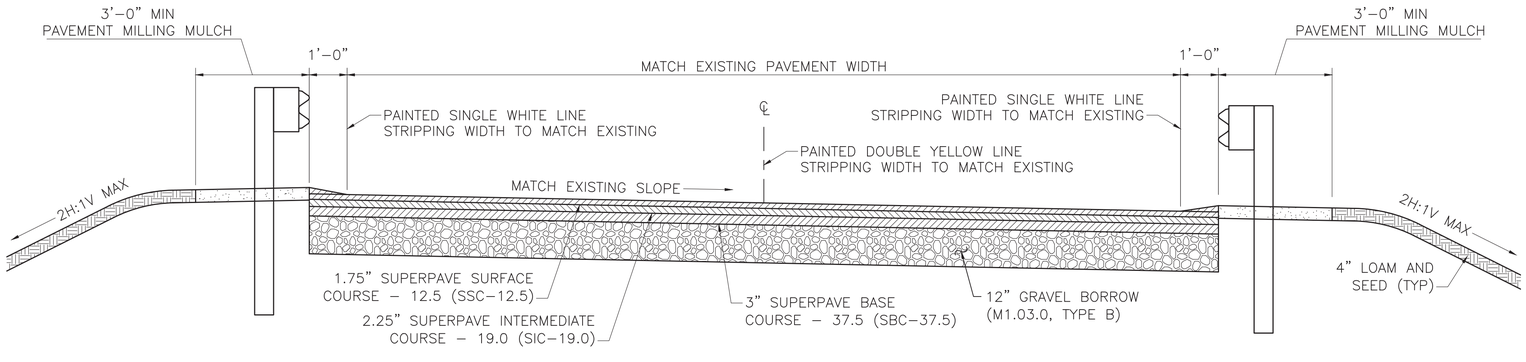
TYPICAL BUTT JOINT TO EXISTING PAVEMENT

NOT TO SCALE



HMA BERM

NOT TO SCALE



GROTON ROAD TYPICAL SECTION

SCALE: ½" = 1'–0"

STA 1+10 TO 2+25

NOTES:

1. PROVIDE REFLECTORIZED PAVEMENT MARKINGS TO MATCH EXISTING. REPLACE STRIPPING IN KIND.

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CONSTRUCTION DETAILS (SHEET 1 OF 3)

SCALE: NO SCALE

SHEET 08 OF 15

Last Saved:12/6/2023
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Tighe & Bond: J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_04_CIVIL.dwg

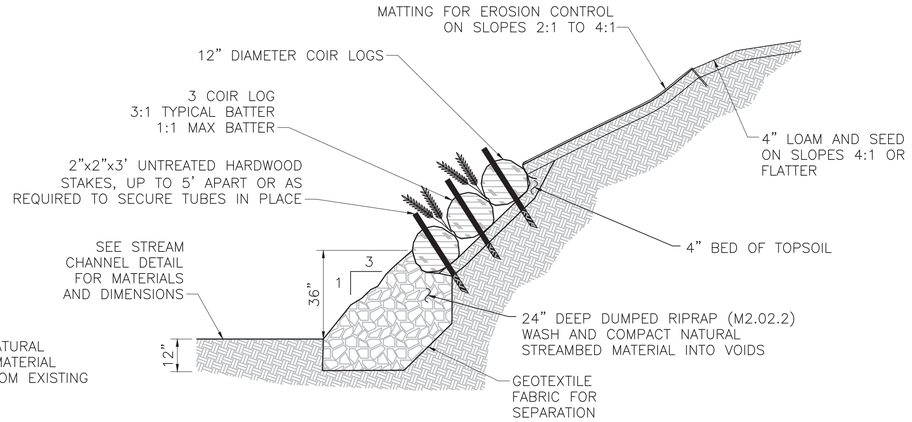
IN–SITU WETLAND RESTORATION NOTES:

1. STABILIZATION OF DISTURBED AREAS OR NEW SOIL SHALL BE IMPLEMENTED WITHIN 14 DAYS AFTER GRADING OR CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED. APPROPRIATE VEGETATIVE SOIL STABILIZATION IS TO BE USED TO MINIMIZE EROSION. TEMPORARY OR PERMANENT VEGETATIVE COVER IS TO BE ESTABLISHED IN ACCORDANCE WITH THE PROJECT PLANS AND SPECIFICATIONS, USING HYDRO–SEEDING, BROADCASTING, OR OTHER APPROVED TECHNIQUES.
2. TREES AND SHRUBS SHOULD BE PLANTED FIRST AND THEN SEEDING WITH THE SPECIFIED SEED MIX (TABLE 1).
3. TREES AND SHRUB SPECIES PLANTING SUBSTITUTIONS MAY BE REQUIRED BASED ON THE AVAILABILITY OF NATIVE MATERIAL. SUBSTITUTIONS SHALL BE APPROVED BY A WETLAND SCIENTIST OR ENGINEER OVERSEEING THE RESTORATION.
4. MAINTAIN VEGETATED SURFACES, INCLUDING WATER, AND RE–SEEDING UNTIL ESTABLISHED CONDITIONS ARE MET AND UNTIL THE END OF THE CONTRACTUAL MAINTENANCE PERIOD.
5. SEED MIX SPECIFIED IN TABLE 1 SHALL BE APPLIED BASED ON THE APPLICATION RATE SPECIFIED BY THE SUPPLIER.
6. THE IN–SITU WETLAND RESTORATION AREAS SHALL BE MULCHED WITH WEED FREE STRAW FOLLOWING SEEDING.
7. AREAS WHERE WETLAND TOPSOIL IS SIGNIFICANTLY DISTURBED OR REMOVED ENTIRELY, WETLAND TOPSOIL FOR WETLAND REPLACEMENT AREAS SHALL CONSIST OF A MIXTURE OF EQUAL VOLUMES OF CLEAN, WEED AND SEED FREE ORGANIC AND MINERAL MATERIALS. WELL–DECOMPOSED CLEAN LEAF COMPOST SHALL BE USED AS A SOIL AMENDMENT TO ACHIEVE THE ORGANIC STANDARD. WOOD CHIPS, PEAT MOSS, AND PEAT MOSS BY–PRODUCTS SHALL NOT BE USED AS AS ORGANIC AMENDMENTS. SUPPLEMENTAL TOPSOIL IN WETLAND REPLACEMENT AREAS SHALL HAVE A MINIMUM ORGANIC CARBON CONTENT OF 4–12% (7 TO 21% ORGANIC MATTER) ON A DRY WEIGHT BASIS. MATCH EXISTING GRADE.

TABLE 1
Seed Mix[1] for Application to Bank and Wetland Restoration Areas and for Wetland Replacement

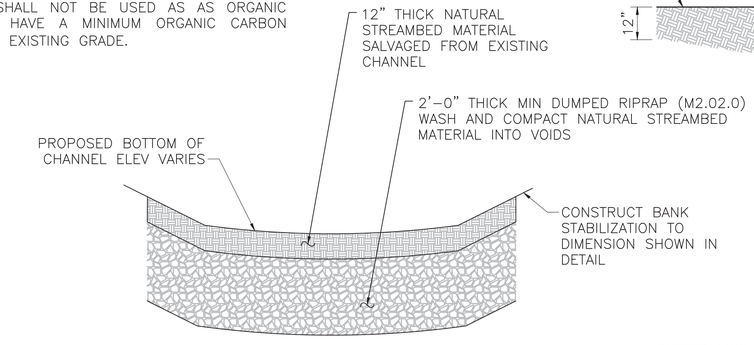
Common Name	Botanical Name[2]	Indicator Status[1]
Fox Sedge	*Carex vulpinoidea*	OBL
Blunt Broom Sedge	*Carex scoparia*	FACW
Lurid Sedge	*Carex lurida*	OBL
Hop Sedge	*Carex lupulina*	OBL
Fowl Bluegrass	*Poa palustris*	FACW
Beggar Ticks	*Bidens frondosa*	FACW
Green Bulrush	*Scirpus atrovirens*	OBL
Swamp Milkweed	*Asclepias incarnata*	OBL
Fringed Sedge	*Carex crinita*	OBL
New York Ironweed	*Vernonia noveboracensis*	FACW
Soft Rush	*Juncus effusus*	OBL
Starved/Calico Aster	*Aster lateriflorus (Symphyotrichum lateriflorum)*	FAC
Blue Flag	*Iris versicolor*	OBL
American Mannagrass	*Glyceria grandis*	OBL
Square Stemmed Monkey Flower	*Mimulus ringens*	OBL
Spotted Joe Pye Weed	*Eupatorium maculatum (Eutrochium maculatum)*	OBL

[1] New England Wetmix (Wetland Seed Mix) Species Composition (New England Wetland Plants, Inc.)
[2] This list was adapted from the New England Wetland Plants, Inc. information sheet as of October 10, 2020.
[3] Indicator status is based on the USDA NRCS Plants Database.



BANK STABILIZATION

NOT TO SCALE



STREAM CHANNEL

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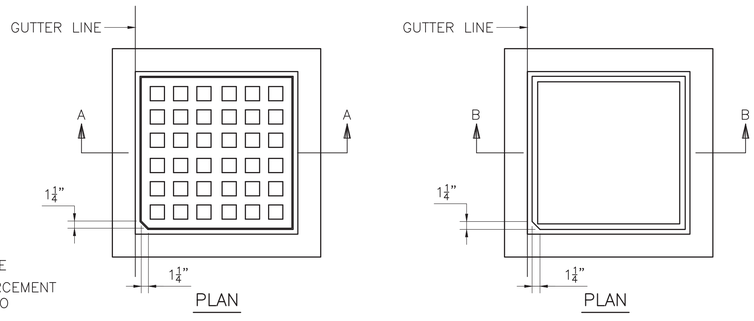
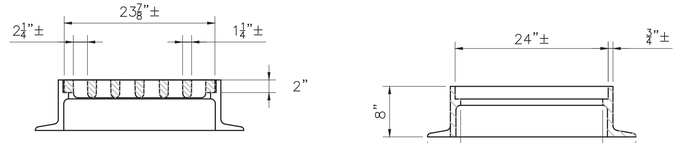
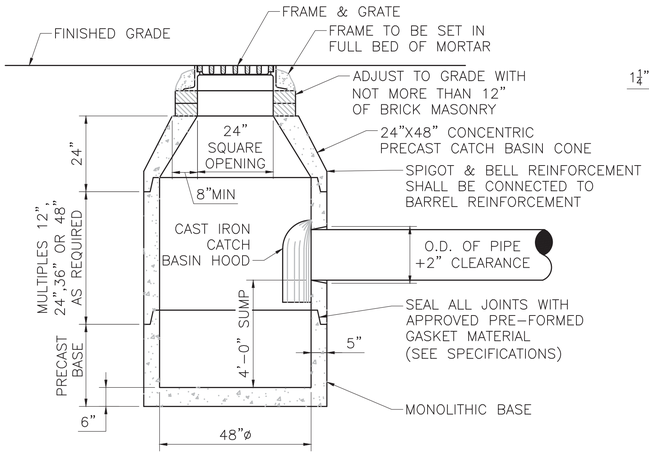






NOTES:

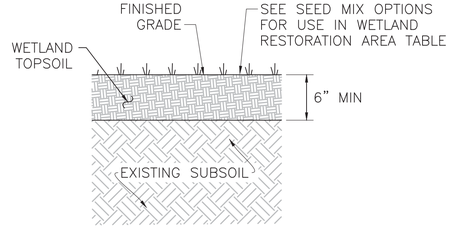
1. SEAL JOINT BETWEEN PIPE AND CATCH BASIN WITH GROUT.

NOTES:

1. MINIMUM WEIGHT OF GRATE – 190 LBS.
2. MATERIAL – CAST IRON, SEE SPECIFICATIONS.

NOTES:

1. MINIMUM FRAME WEIGHT: 4 FLANGE – 295± LBS
2. MATERIAL – CAST IRON, SEE SPECIFICATIONS.
3. FOR ADDITIONAL INFORMATION SEE MHD 201.6.0



WETLAND TOPSOIL FOR INLAND WETLAND REPLACEMENT AREA

NOT TO SCALE

PRECAST CONCRETE CATCH BASIN

NOT TO SCALE

CATCH BASIN GRATE

NOT TO SCALE

CATCH BASIN FRAME

NOT TO SCALE

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

MARK	DATE	DESCRIPTION

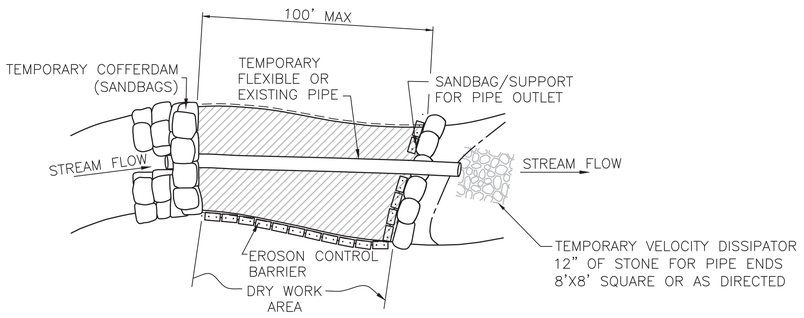
PROJECT NO:	W5005-029
DATE:	DECEMBER 2023
FILE:	W5005-029_04_CIVIL.dwg
DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

CONSTRUCTION DETAILS (SHEET 2 OF 3)

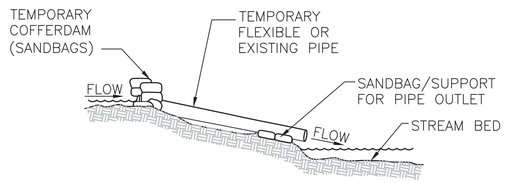
SCALE: NO SCALE

SHEET 09 OF 15

Last Saved: 12/6/2023
Plotted On: Dec 06, 2023-11:33am By: SSak
Tighe & Bond J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_04_CIVIL.dwg



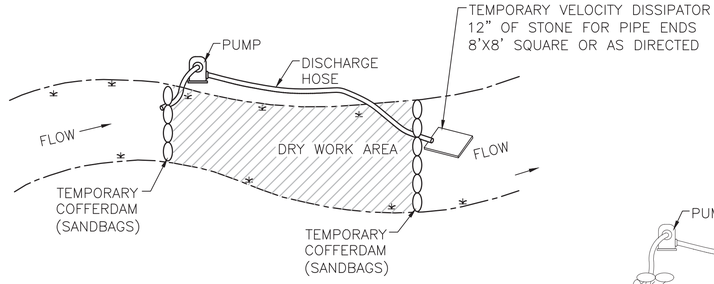
PLAN VIEW – COFFERDAM



ELEVATION VIEW

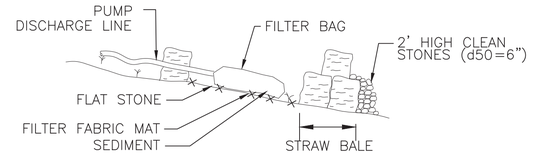
STREAM BYPASS DETAIL (PIPE)

NOT TO SCALE

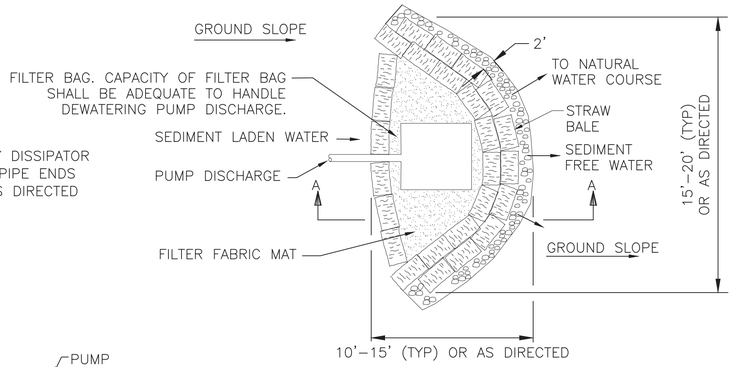


STREAM BYPASS DETAIL (PUMPED)

NOT TO SCALE

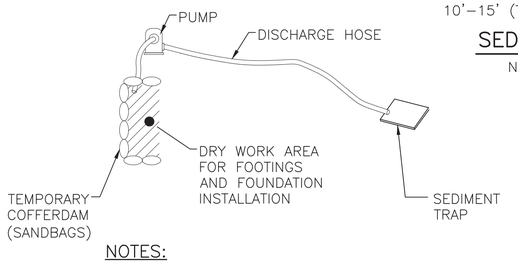


SECTION A–A



SEDIMENT TRAP

NOT TO SCALE



NOTES:

1. DEWATERING EQUIPMENT SHALL REMAIN WITHIN THE PERMANENTLY IMPACTED AREAS.
2. DISCHARGE HOSE SHALL NOT CROSS THE STREAM AT ANY LOCATION

COFFERDAM AND DEWATERING

NOT TO SCALE

WATER CONTROL SEQUENCING:

1. INSTALL A TEMPORARY COFFERDAM UPSTREAM OF THE EXISTING CULVERT PRIOR TO REMOVAL OF THE EXISTING CULVERT. PROVIDE BYPASS FLUME PIPE OR PUMP. SIZE AND PROVIDE A FLUME PIPE OR PUMP WITH ADEQUATE CAPACITY TO ACCOMMODATE STREAM FLOWS AS INDICATED IN THE WATER CONTROL NOTES. SUBMIT AN EMERGENCY CONTINGENCY PLAN FOR A STORM EVENT GREATER THAN THE 2–YEAR STORM.
2. REMOVE AND DISPOSE EXISTING CULVERTS, EXCAVATE AND DEWATER FOR BRIDGE INSTALLATION, PLACE CRUSHED STONE TO GRADE, INSTALL BRIDGE AND PLACE STREAM BED MATERIAL THROUGH BRIDGE, FOLLOWED BY SITE RESTORATION. AT NO POINT SHOULD THE STREAM FLOW OVER NEWLY EXCAVATED EARTH OR OVER AREAS THAT DO NOT HAVE THE FINISHED SURFACE TREATMENT.
3. CULVERT SHALL THEN BE INSTALLED AND STREAM DIVERSION MAY BE REMOVED AFTER ALL SURFACES HAVE BEEN PROTECTED.

WATER CONTROL NOTES:

1. THE ISOLATED WORK AREA WITHIN THE COFFERDAMS MAY BE DEWATERED AS NEEDED TO PERFORM WORK IN THE DRY. ALL WORK MUST BE PERFORMED IN THE DRY. ANY DEWATERING ACTIVITIES SHALL BE PERFORMED USING A DISCHARGE HOSE, FILTER BAG, AND SEDIMENT TRAP (SHOWN ON THIS SHEET).
2. PRIOR TO BEGINNING ANY CONSTRUCTION IN THE STREAM, SUBMIT TO THE OWNER A WORK SEQUENCE INDICATING ANTICIPATED COFFERDAM LOCATIONS, OR ALTERNATE SYSTEM. WORK SHALL ONLY BE PERFORMED DURING LOW FLOW CONDITIONS.
3. THE COFFERDAM WORK MAY BE MODIFIED TO ADDRESS THE CONTRACTOR'S SEQUENCE OF CONSTRUCTION, WITH THE APPROVAL OF THE OWNER.
4. TEMPORARY COFFERDAMS (SAND BAG, JERSEY BARRIER, WATER FILLED BARRIER OR EQUIVALENT; USE OF UNCONSOLIDATED MATERIALS STRICTLY PROHIBITED) WILL BE INSTALLED TO MAINTAIN A DRY WORK AREA DURING CONSTRUCTION ACTIVITIES AND TO LIMIT SEDIMENTATION AS A RESULT OF THE PROPOSED WORK. THE WORK AREA LOCATED WITHIN THE COFFERDAMS SHALL BE DEWATERED. THE COFFERDAMS WILL BE LOCATED WITHIN THE STREAM TO ALLOW INSTALLATION OF BRIDGE FOOTINGS AND FOUNDATIONS AND IN OTHER LOCATIONS WHERE DEWATERING NEAR THE STREAM IS REQUIRED.
5. WATER CONTROLS SHOULD BE DESIGNED FOR A 2–YEAR STORM (PEAK FLOW 16.6 CFS). PRIOR TO COMMENCING WORK SUBMIT TO THE ENGINEER DRAWINGS AND CALCULATIONS, STAMPED BY A PROFESSIONAL ENGINEER IN THE STATE OF MASSACHUSETTS, INDICATING THE CONTRACTOR'S METHOD FOR CONTROL OF WATER. THE SUBMITTAL SHALL INCLUDE PROPOSED IMPACT AREAS, RESTORATION METHODS, FLOW RATES, DEWATERING METHODS AND A DETAILED SCHEDULE FOR THE CONTROL OF WATER.

DEWATERING REQUIREMENTS:

PREPARE A DEWATERING PLAN TO ADDRESS THE FOLLOWING CONCERNS AND ADHERE TO THE FOLLOWING REQUIREMENTS:

1. IF THE WATER TABLE IS INTERCEPTED DURING EXCAVATION, WATER COLLECTED IN THE TRENCH SHALL BE PUMPED OUT SO THAT THE WORK CAN BE PERFORMED "IN THE DRY." PROVIDE ADEQUATELY SIZED DEWATERING EQUIPMENT WITH 100% BACKUP AND SEDIMENTATION/EROSION CONTROL STRUCTURES AS DETAILED ON THE CONTRACT DRAWINGS TO ENSURE CONSTRUCTION "IN THE DRY" AND ADEQUATELY PROTECT ADJACENT WETLAND AREAS AND WATERWAYS.
2. ALL GROUNDWATER REMOVED (PUMPED) FROM THE TRENCH EXCAVATION AND DISCHARGED SHALL BE A "CLEAN DISCHARGE." PROVIDE WHATEVER DEVICES ARE REQUIRED TO ACHIEVE THE "CLEAN DISCHARGE." IF THE OWNER'S REPRESENTATIVE DETERMINES THE PUMPED DISCHARGE IS CLEAN (LESS THAN 50 NTU), THE FLOW CAN BE DIRECTED TO AN UPLAND AREA. IF THE OWNER'S REPRESENTATIVE DETERMINES THAT THE FLOW IS NOT CLEAN, DIRECT THAT FLOW TO ONE OR MORE FILTRATION DEVICES FOR THE PURPOSE OF SUBSTANTIALLY REMOVING SUSPENDED SOLIDS FROM THE WATER. THE FILTRATION DEVICES SHALL BE AS SHOWN ON THE DRAWINGS OR APPROVED ALTERNATES SUGGESTED BY THE CONTRACTOR, OR AS REQUIRED BY THE LOCAL PERMITS.
3. OBTAIN ALL NECESSARY STATE AND LOCAL PERMITS RELATING TO DEWATERING ACTIVITIES.
4. DEWATERING DISCHARGE LOCATIONS ARE TO BE REVIEWED AND APPROVED BY THE OWNER'S REPRESENTATIVE.
5. ANY PROPOSED DEWATERING AND SHORING PROCEDURES SHALL BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW AND ACCEPTANCE. THE DEWATERING/WATER CONTROL AND SHORING/TEMPORARY EARTH SUPPORT SHALL BE DESIGNED AND STAMPED BY A REGISTERED PROFESSIONAL ENGINEER IN THE COMMONWEALTH OF MASSACHUSETTS.

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

MARK	DATE	DESCRIPTION

PROJECT NO:	W5005-029
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DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

CONSTRUCTION DETAILS (SHEET 3 OF 3)

SCALE: NO SCALE

SHEET 10 OF 15

Last Saved: 12/6/2023
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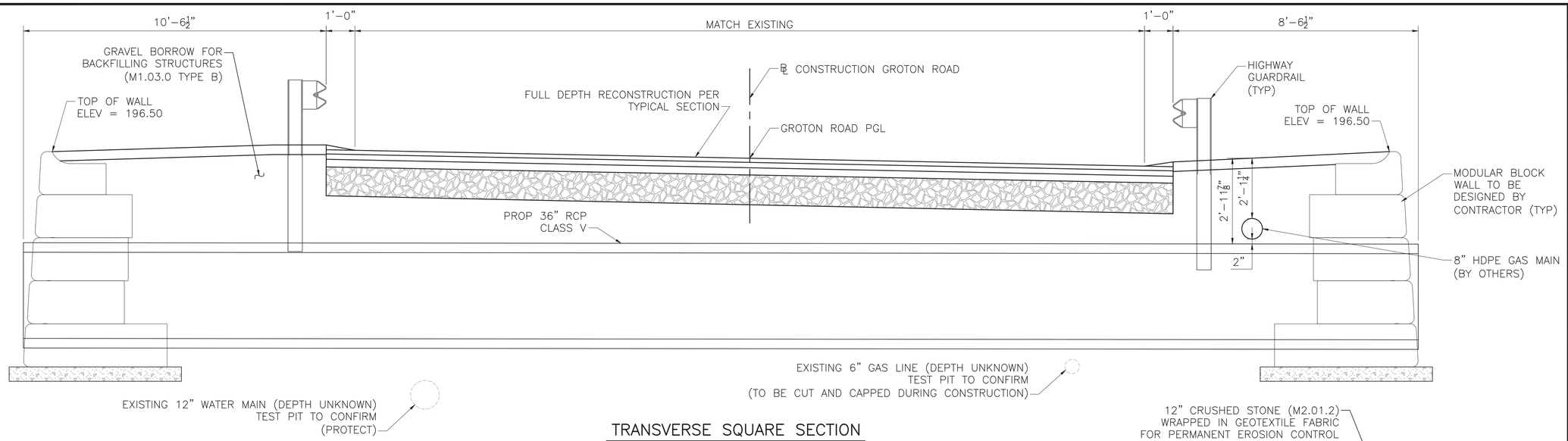
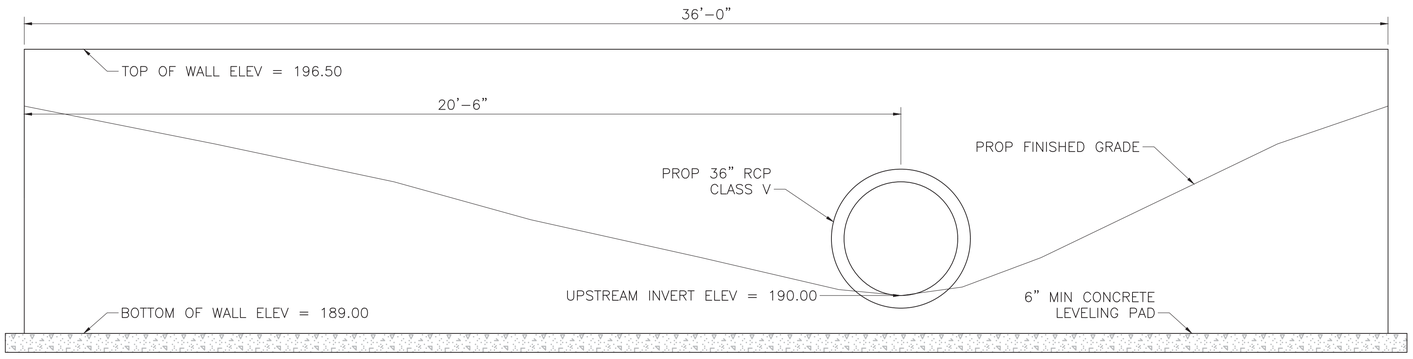
Tighe & Bond J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_04_CIVIL.dwg



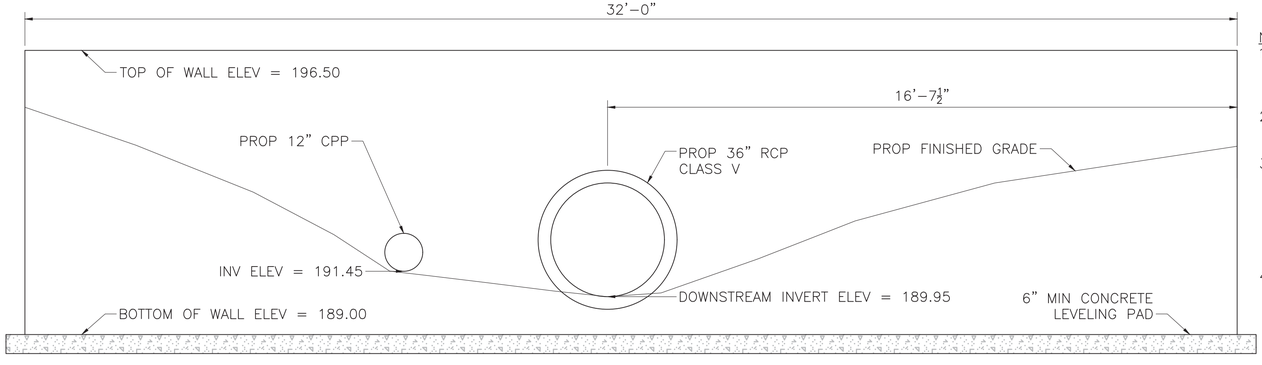
TRANSVERSE SQUARE SECTION

SCALE: ½" = 1'–0"



NORTH HEADWALL ELEVATION

SCALE: ½" = 1'–0"

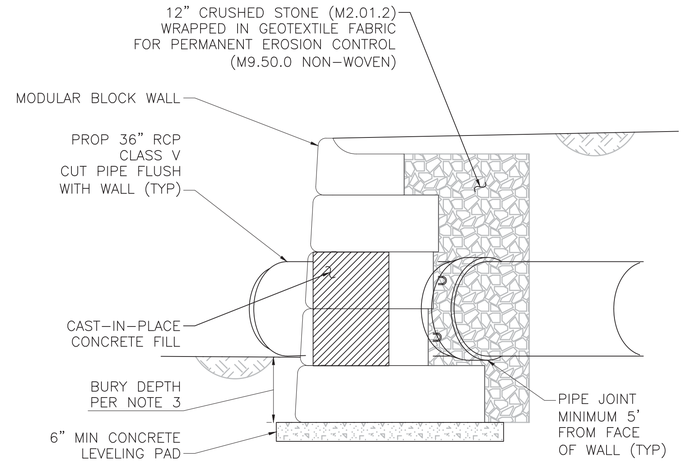


SOUTH HEADWALL ELEVATION

SCALE: ½" = 1'–0"

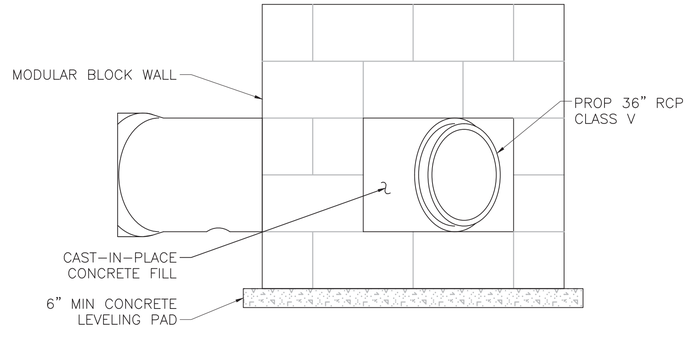
NOTES:

1. MODULAR BLOCK WALL AS SPECIFIED IS REQUIRED.
2. GEOGRID SYSTEMS ARE NOT PERMITTED.
3. BURIED BLOCKS ADJACENT TO STREAM CHANNEL TO BE ON A MINIMUM 6" CONCRETE LEVELING PAD ON BEDROCK.
4. PRECAST CONCRETE RETAINING WALLS WITH STONE FORMLINER MEETING THE MODULAR BLOCK WALL REQUIREMENTS MAY BE SUBSTITUTED IN PLACE OF MODULAR BLOCK WALLS.



TYPICAL HEADWALL SECTION WITH PIPE

SCALE: ½" = 1'–0"



TYPICAL HEADWALL ELEVATION WITH PIPE

SCALE: ½" = 1'–0"

0 2' 4'

SCALE: 1/2" = 1'-0"

Tighe&Bond

Groton Road Over Blue Brook

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Town of Westford

Westford, Massachusetts

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DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

HEADWALL SECTIONS, ELEVATIONS, & DETAILS

SCALE: 1/2" = 1'-0"

SHEET 11 OF 15

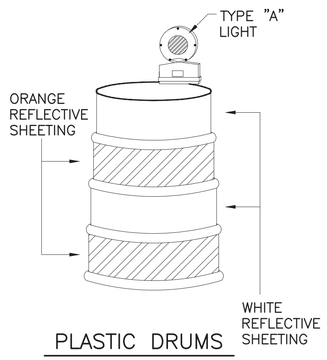
Last Saved: 4/13/2023
Plotted On: Dec 06, 2023-11:33am By: SSak
Tighe & Bond: J:\WW\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_05_STRC.dwg

NOTES:

1. ALL TEMPORARY TRAFFIC CONTROL WORK SHALL CONFORM TO THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD) AND ALL REVISIONS.
2. ALL SIGN LEGENDS, BORDERS, AND MOUNTING SHALL BE IN ACCORDANCE WITH THE MUTCD.
3. TEMPORARY CONSTRUCTION SIGNING AND ALL OTHER TRAFFIC CONTROL DEVICES SHALL BE IN PLACE PRIOR TO THE START OF ANY WORK.
4. TEMPORARY CONSTRUCTION SIGNING, BARRICADES, AND ALL OTHER NECESSARY WORK ZONE TRAFFIC CONTROL DEVICES SHALL BE REMOVED FROM THE HIGHWAY OR COVERED WHEN THEY ARE NOT REQUIRED FOR CONTROL OF TRAFFIC.
5. SIGNS AND SIGN SUPPORTS LOCATED ON OR NEAR THE TRAVELED WAY, CHANNELIZING DEVICES, BARRIERS, AND CRASH ATTENUATORS MUST PASS THE CRITERIA SET FORTH IN NCHRP REPORT 350, "RECOMMENDED PROCEDURES FOR THE SAFETY PERFORMANCE EVALUATION OF HIGHWAY FEATURES" AND/OR "MANUAL FOR ASSESSING SAFETY HARDWARE" (MASH).
6. CONTRACTORS SHALL NOTIFY EACH ABUTTER AT LEAST 24 HOURS IN ADVANCE OF THE START OF ANY WORK THAT WILL REQUIRE THE TEMPORARY CLOSURE OF ACCESS, SUCH AS CONDUIT INSTALLATION, EXISTING PAVEMENT EXCAVATION, TEMPORARY DRIVEWAY PAVEMENT PLACEMENT, AND SIMILAR OPERATIONS.
7. THE FIRST FIVE PLASTIC DRUMS OF A TAPER SHALL BE MOUNTED WITH TYPE A LIGHTS.
8. THE ADVISORY SPEED LIMIT, IF REQUIRED, SHALL BE DETERMINED BY THE ENGINEER.
9. MAXIMUM SPACING OF TRAFFIC DEVICES IN A TAPER (DRUMS OR CONES) IS EQUAL IN FEET TO THE SPEED LIMIT IN MPH.
10. MINIMUM LANE WIDTH IS TO BE 11 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.
12. PORTABLE CHANGEABLE MESSAGE SIGNS SHALL BE PROVIDED ON GROTON ROAD AT BOTH ENDS OF THE PROJECT LIMITS.
13. DURING ALL CONSTRUCTION ACTIVITIES ON THE ROADWAYS, ONE LANE ALTERNATING TRAFFIC FLOW SHALL BE MAINTAINED.
14. FULL ROADWAY WIDTH MUST BE RETURNED AT THE END OF EACH WORK DAY.
15. THE NUMBER OF POLICE OFFICERS AT ANY LOCATION IS TO BE DETERMINED BY THE TOWN OF WESTORD.
16. ONE LANE TRAFFIC FLOW SHALL BE REQUIRED DURING ALL OPERATIONS WHICH REDUCE DRIVE LANE(S) LESS THAN 12'.
17. HALF WIDTH CONSTRUCTION METHODS SHALL BE UTILIZED FOR ROAD EXCAVATION, BASE PREPARATION, AND PAVING OPERATIONS.
18. AS CONSTRUCTION OPERATIONS CHANGE, SO SHALL WARNING SIGNS. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND ARRANGING SIGNS AS CONSTRUCTION VARIES AND PROCEEDS.

LEGEND:

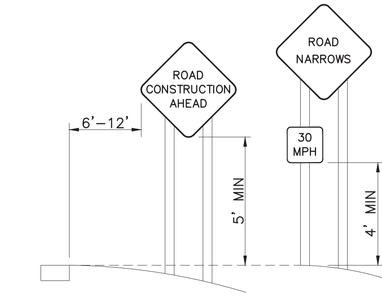
- REFLECTORIZED PLASTIC DRUM OR 36" CONE
- P/F POLICE/FLAGGER DETAIL
- TYPE III BARRICADE
- CHANGEABLE MESSAGE SIGN
- ARROW BOARD
- WORK ZONE
- DIRECTION OF TRAFFIC
- IMPACT ATTENUATOR
- MEDIAN BARRIER
- MEDIAN BARRIER WITH WARNING LIGHTS
- WORK VEHICLE
- TRUCK MOUNTED ATTENUATOR
- TRAFFIC OR PEDESTRIAN SIGNAL
- SIGN



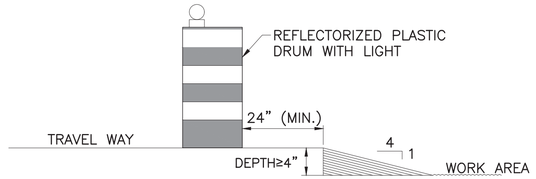
PLASTIC DRUMS

NOTES:

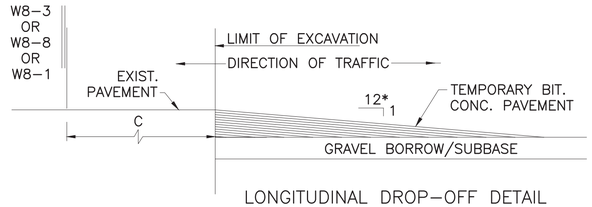
1. DRUM DESIGN AND APPLICATION SHALL BE AS PER THE CURRENT EDITION OF THE MUTCD.
2. DRUMS SHALL BE APPROXIMATELY 36" IN HEIGHT, HAVING A MINIMUM WALL THICKNESS OF 3/32" AND A MINIMUM DIAMETER OF 18" REGARDLESS OF ORIENTATION.
3. DRUM MATERIAL MUST BE APPROVED UV RESISTANT, LOW DENSITY, IMPACT RESISTANT, LINEAR POLYETHYLENE (OR APPROVED EQUIVALENT).
4. SHEETING SHALL BE APPROVED ORANGE AND WHITE TYPE IV REFLECTORIZED SHEETING CONFORMING TO M9.30.0.
5. ALL DRUMS SHALL BE WELL MAINTAINED INCLUDING REMOVAL OF DUST OR ROAD FILM, SO AS NOT TO REDUCE REFLECTIVE EFFICIENCY. WHEN A DRUM LOSES TARGET VALUE IT SHALL BE REPLACED.
6. STORE UNUSED DRUMS IN ONE LOCATION, AWAY FROM ALL TRAFFIC, OR REMOVE FROM SITE ENTIRELY.



TYPICAL INSTALLATION OF PROJECT SIGNS



LATERAL DROP–OFF DETAILS



LONGITUDINAL DROP–OFF DETAIL
NO SCALE

* – INCREASE SLOPE RATIO FOR HIGHER SPEEDS

LATERAL AND LONGITUDINAL DROP–OFF DETAILS

FORMULAS FOR DETERMINING TAPER LENGTHS

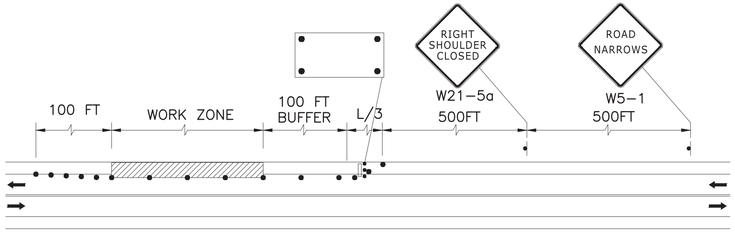
SPEED LIMIT (S)	TAPER LENGTH (L) FEET
40 MPH OR LESS	$L = \frac{WS^2}{60}$
45 MPH OR MORE	L = WS

WHERE:

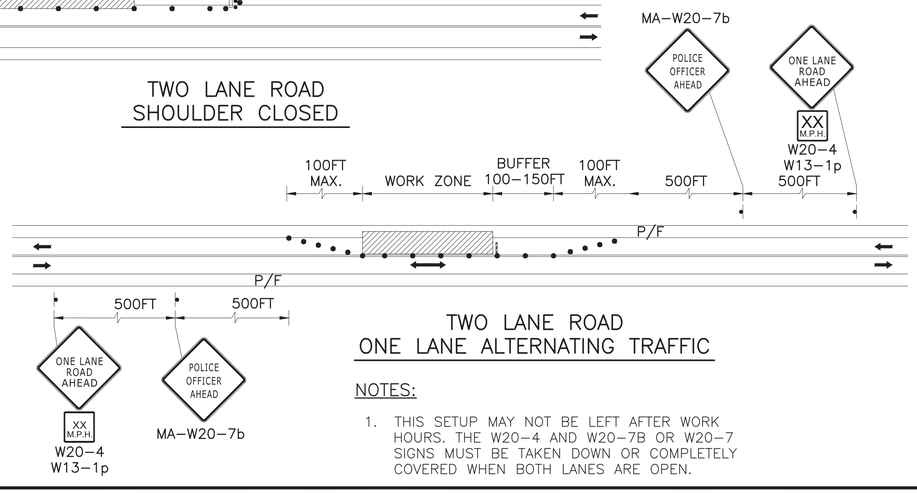
L = TAPER LENGTH IN FEET

W = WIDTH OF OFFSET IN FEET

S = POSTED SPEED LIMIT, OR OFF–PEAK 85TH–PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED IN MPH



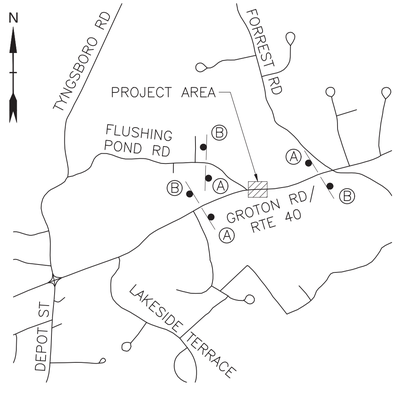
TWO LANE ROAD SHOULDER CLOSED



TWO LANE ROAD
ONE LANE ALTERNATING TRAFFIC

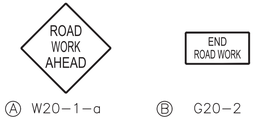
NOTES:

1. THIS SETUP MAY NOT BE LEFT AFTER WORK HOURS. THE W20–4 AND W20–7B OR W20–7 SIGNS MUST BE TAKEN DOWN OR COMPLETELY COVERED WHEN BOTH LANES ARE OPEN.



ADVANCED WARNING SIGNING

SIGN LEGEND					
CODE	DESCRIPTION	SIZE	AREA	NO.	TOTAL AREA
W20–1–a	ROAD WORK AHEAD	36"x36"	9 SF	3	27 SF
G20–2	END ROAD WORK	36"x18"	4.5 SF	3	13.5 SF
W20–4	ONE LANE ROAD AHEAD	36"x36"	9 SF	2	18 SF
MA–W20–7b	POLICE OFFICER AHEAD	36"x36"	9 SF	2	18 SF
W5–1	ROAD NARROWS	36"x36"	9 SF	1	9 SF
W21–5a	RIGHT SHOULDER CLOSED	36"x36"	9 SF	1	9 SF
					TOTAL = 94.5 SF



Ⓐ W20–1–a Ⓑ G20–2

Tighe&Bond

Groton Road Over Blue Brook

Culvert Replacement Alternate No. 1

Town of Westford

Westford, Massachusetts

MARK	DATE	DESCRIPTION

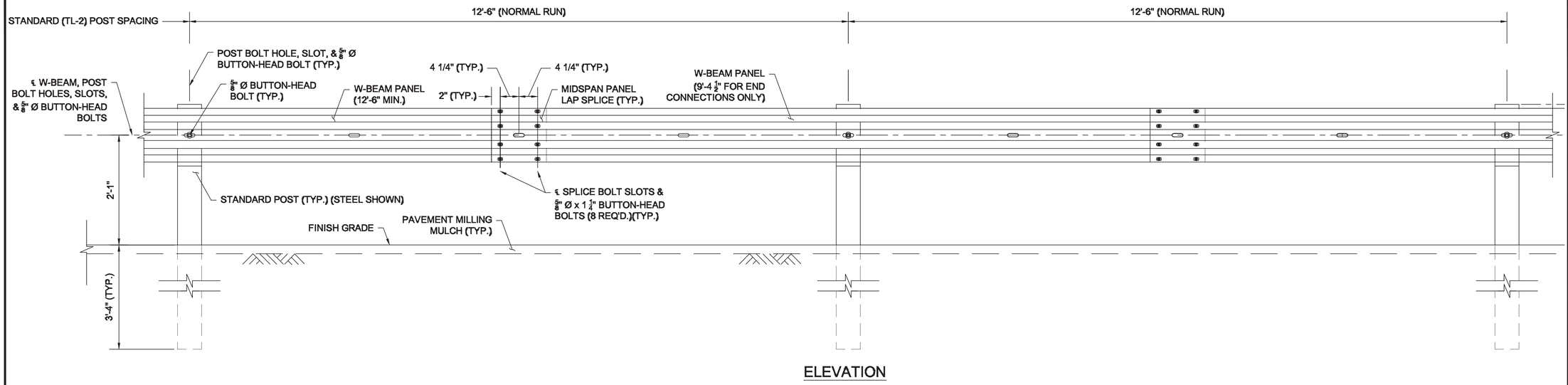
PROJECT NO:	W5005-029
DATE:	DECEMBER 2023
FILE:	W5005-029_05_STRC.dwg
DRAWN BY:	SDS/MRB
DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

TEMPORARY TRAFFIC CONTROL PLAN

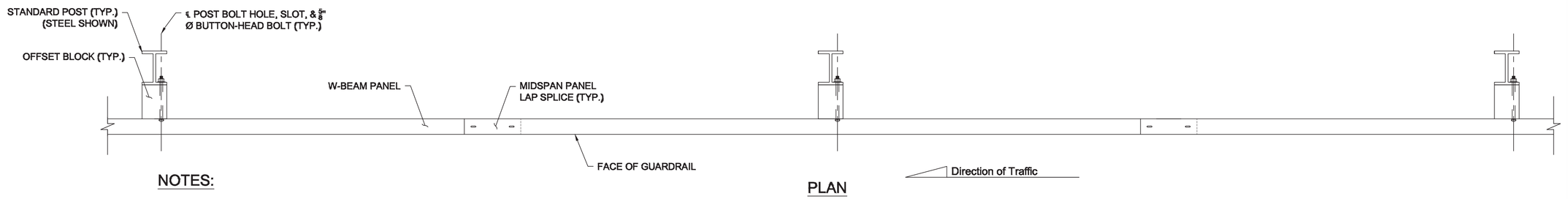
SCALE: NO SCALE

SHEET 12 OF 15

Last Saved: 4/13/2023
Plotted On: Dec 06, 2023-11:33am By: SSak
Tighe & Bond: J:\W\W5005 Westford MA\029 Blue Brook & Pond Brook Culvert Replacement\Drawings_Figures\AutoCAD\Sheet\Blue Brook\W5005-029_05_STRC.dwg



ELEVATION

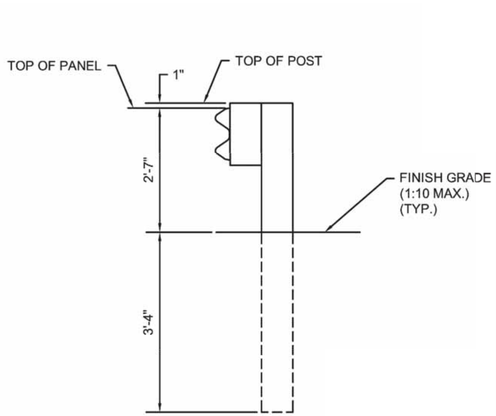


PLAN

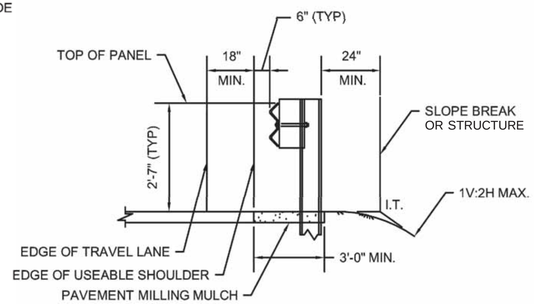
NOTES:

1. A 9'-4 3/4" PANEL IS REQUIRED WHEN TRANSITIONING TO TL-3 W-BEAM GUARDRAIL TO MAINTAIN PROPER POST SPACING.

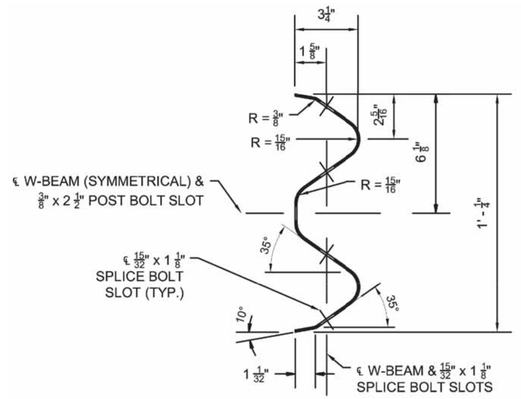
GUARDRAIL, TL2 DETAILS



W-BEAM



FLUSH WITH ROADWAY



W-BEAM PANEL SECTION

GUARDRAIL MOUNTING HEIGHTS & POST DEPTHS

MASSDOT STANDARD DETAILS:

MASSDOT HIGHWAY DIVISION CONSTRUCTION STANDARD DETAILS GUARDRAIL, TL2 & W-BEAM PANEL DETAILS

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DESIGNED/CHECKED BY:	JJC
APPROVED BY:	DSH

HIGHWAY GUARDRAIL DETAILS (SHEET 1 OF 2)

SCALE: NO SCALE

SHEET 13 OF 15

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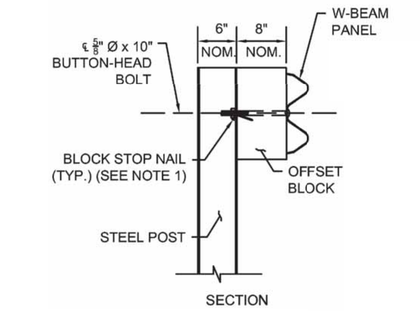
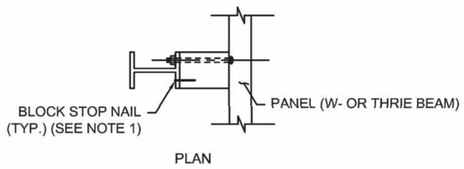


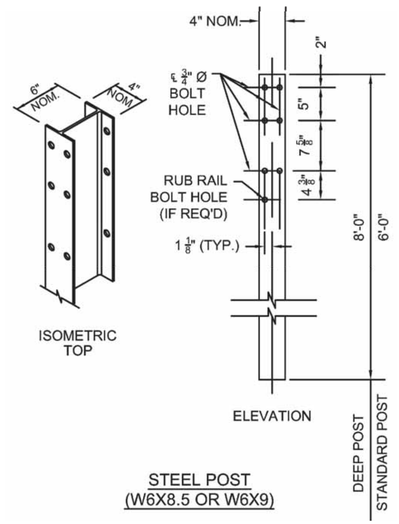


W-BEAM & THRIE BEAM
STEEL POST

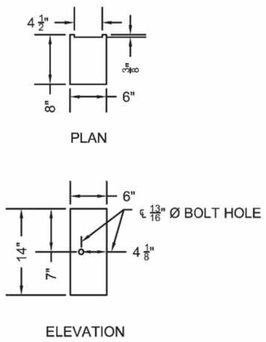
NOTES:

1. DRIVE ONE NAIL PER W BEAM TIMBER OFFSET BLOCK TO PREVENT BLOCK ROTATION. USE ASTM A153 HOT DIP GALVANIZED STEEL 3 ½" TYPE 16D NAILS. FOR STEEL POSTS, DRIVE THE NAIL THROUGH THE UNUSED FLANGE BOLT HOLE AND BEND THE NAIL SO ITS HEAD CONTACTS THE FLANGE.
2. DEEP STEEL POSTS SHALL ONLY BE USED WHERE INDICATED IN THESE STANDARDS OR THE PLANS.
3. WHERE BACK OF POSTS ARE EXPOSED AND PLACED WITHIN 2'-0" OF A SIDEWALK, SEPARATED BIKE FACILITY OR SHARED-USE PATH, TIMBER POSTS SHALL BE USED. ALTERNATIVELY, STEEL POSTS WITH A TIMBER BACKING, PER 400.5.1, MAY BE SUBSTITUTED AT NO ADDITIONAL COST. WHEN TIMBER POSTS ARE USED, ONE OF THE FOLLOWING SAFETY TREATMENTS IS REQUIRED FOR ALL BOLTS PROTRUDING FROM THE BACK FACE OF THE POST:
   - A. AFTER TIGHTENING THE NUT, TRIM THE PROTRUDING POST BOLT FLUSH WITH THE NUT AND GALVANIZE PER M7.04.11;
   - B. USE 15" POST BOLTS AND COUNTERSINK THE WASHER AND NUT BETWEEN 1" AND 1 ½" DEEP INTO THE BACK FACE OF THE POST; OR
   - C. USE 15" POST BOLT SLEEVE NUTS AND WASHERS.

END TREATMENTS AND TRANSITIONS, WHERE SPECIFIC MATERIAL TYPES ARE SPECIFIED, ARE EXEMPT FROM THESE REQUIREMENTS.



STEEL POST
(W6X8.5 OR W6X9)



W-BEAM TIMBER OFFSET BLOCK
FOR USE WITH STEEL POSTS
(6"X8" NOMINAL)

POST & OFFSET BLOCK DETAILS

MASSDOT STANDARD DETAILS:

MASSDOT HIGHWAY DIVISION
CONSTRUCTION STANDARD DETAILS
GUARDRAIL, TL2 & W-BEAM PANEL DETAILS

Tighe&Bond

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APPROVED BY:	DSH

HIGHWAY GUARDRAIL DETAILS (SHEET 2 OF 2)

SCALE: NO SCALE

SHEET 14 OF 15

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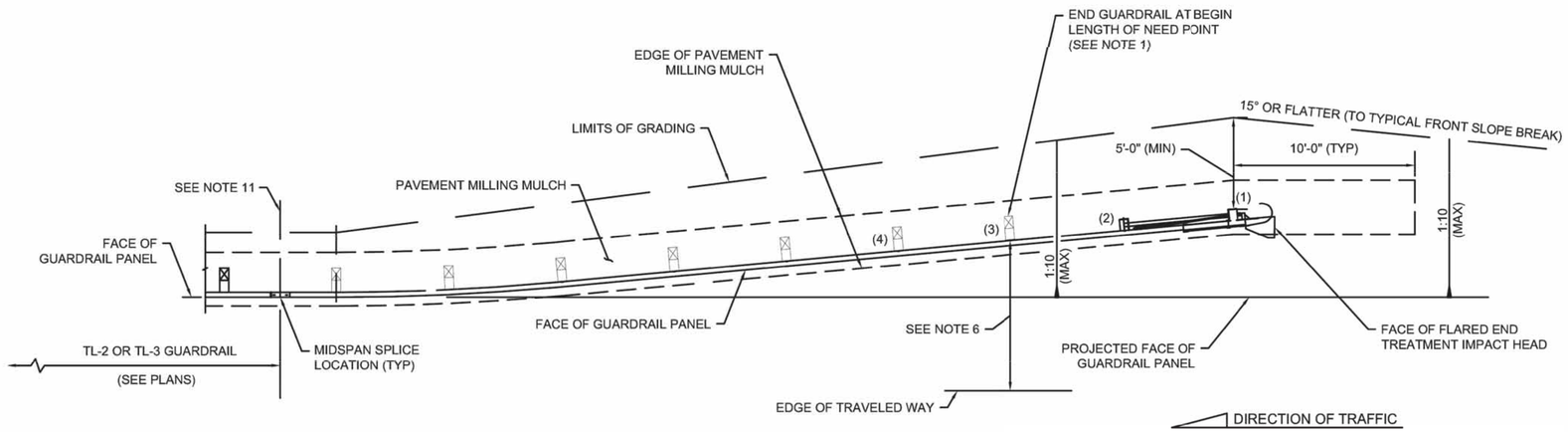
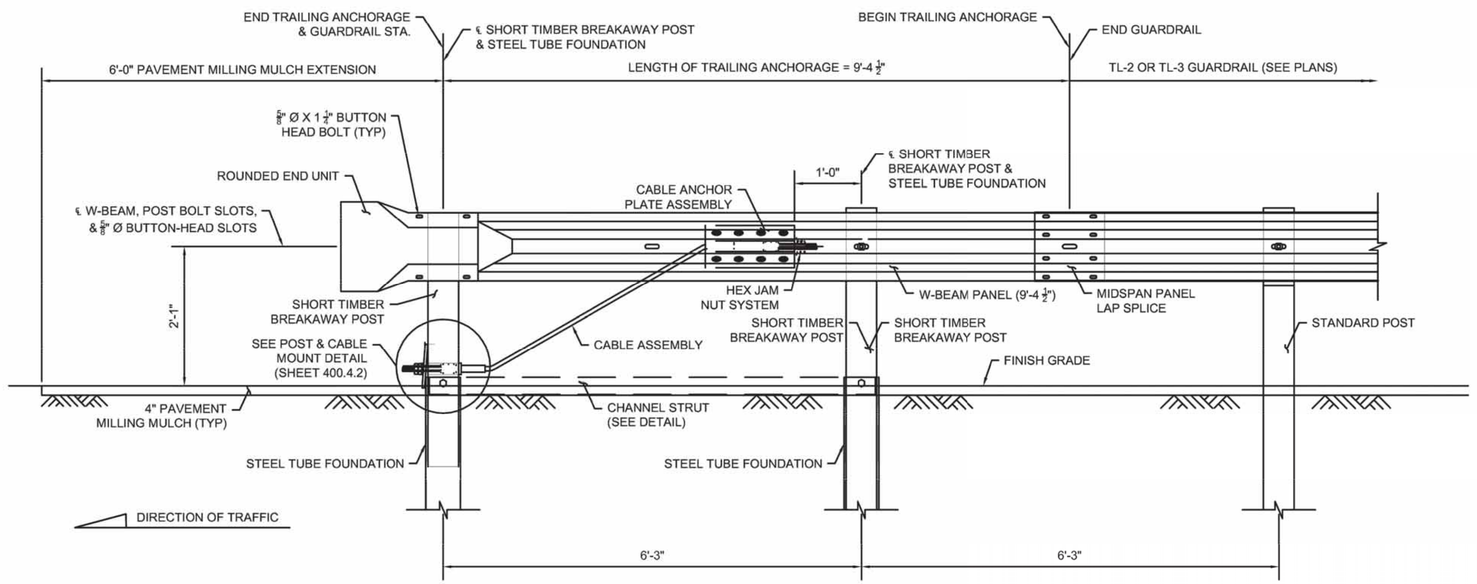


FLARED END TREATMENT SEGMENT - PLAN

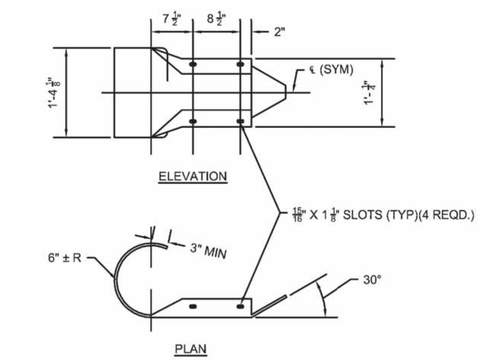
NOTES:

1. INSTALL GUARDRAIL AT STATION AND OFFSET SHOWN IN THE PLANS. THE END OF THE GUARDRAIL SHOWN IN THE PLANS CORRESPONDS WITH THE BEGIN LENGTH OF NEED POINT FOR THE END TREATMENT (SHOWN AT POST 3 IN THESE STANDARDS, BUT MAY VARY BY MANUFACTURER).
2. PROPRIETARY END TREATMENTS MAY VARY IN SIZE AND SHAPE FROM WHAT IS DEPICTED IN THESE STANDARDS. HOWEVER, THE MAXIMUM SLOPES AND MINIMUM OFFSETS DIMENSIONED FROM THE POSTS SHOWN HEREIN SHALL STILL APPLY.
3. END TREATMENT TEST LEVEL AND TYPE (TANGENT OR FLARED) SHALL BE SPECIFIED IN THE PLANS.
4. CONSTRUCT TANGENT AND FLARED END TREATMENTS IN ACCORDANCE WITH THE MANUFACTURER'S UNIQUE DRAWING DETAILS, PROCEDURES, AND SPECIFICATIONS.
5. AT THE DISCRETION OF THE ENGINEER, THE FACE OF THE TANGENT END TREATMENT IMPACT HEAD MAY BE OFFSET UP TO 2'-0" FROM THE PROJECTED FACE OF GUARDRAIL TO MINIMIZE NUISANCE HITS. THE OFFSET SHALL OCCUR OVER THE ENTIRE LENGTH OF THE END TREATMENT UNLESS OTHERWISE SPECIFIED BY THE MANUFACTURER.
6. LATERAL OFFSET OF FLARED END TREATMENT SHALL BE DETERMINED BY THE DESIGN ENGINEER FOLLOWING THE METHODOLOGY FOUND IN THE *ROADSIDE DESIGN GUIDE* AND SHOULD FALL WITHIN THE ALLOWABLE TOLERANCES SPECIFIED BY THE MANUFACTURER. LATERAL OFFSET SHALL BE MEASURED FROM THE EDGE OF TRAVELED WAY TO THE FACE OF THE GUARDRAIL AT POST #3.
7. END TREATMENTS SHALL NOT TERMINATE CURVED W-BEAM SEGMENTS.
8. END TREATMENT IMPACT HEAD DELINEATION SHALL CONFORM TO 601.63.
9. INSTALL GRADING AS SHOWN HEREIN UNDER SEPARATE PAY ITEMS.
10. SEE 400.2.2 FOR APPROACH TERMINAL GEOMETRY FOR GUARDRAIL INSTALLED ADJACENT TO CURB AND DOUBLE FACED GUARDRAIL.
11. MAINTAIN 2'-0" (MIN) OFFSET TO FRONT SLOPE BREAK DOWNSTREAM OF MIDSPAN SPLICE LOCATION AT ALL TIMES. IF, DOWNSTREAM OF THE SPLICE, GRADING CONSTRAINTS INHIBIT THIS MINIMUM OFFSET THEN USE DEEP STEEL POSTS AND TRANSITION TO A SLOPE BREAK CONDITION DESIGN PER THE DETAIL IN 400.1.5 UNTIL THE 2'-0" OFFSET CAN BE MET.

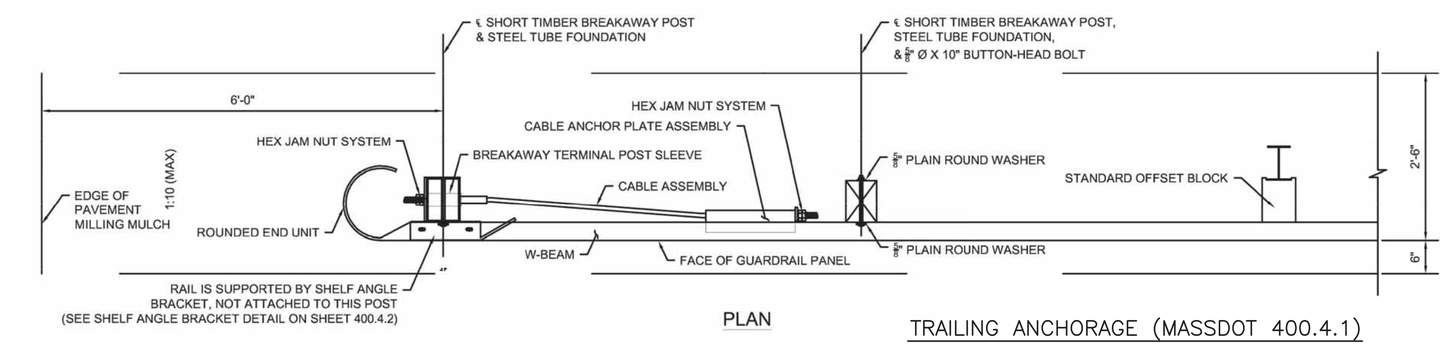
APPROACH GEOMETRY: SINGLE FACED (MASSDOT 400.2.1)



ELEVATION



ROUNDED END UNIT



PLAN

NOTES:

1. FOR ADDITIONAL DETAILS, SEE 400.4.2.
2. LAP THE ROUNDED END UNIT OVER THE FACE OF THE W-BEAM PANEL.
3. INSTALL STEEL TUBE FOUNDATIONS BY ONE OF THE FOLLOWING METHODS:

A. EXCAVATE, INSTALL TUBE, BACKFILL, AND SUITABLY COMPACT MATERIALS; OR

B. DRIVE THE TUBE USING A DUMMY TIMBER POST TO PREVENT DAMAGE TO THE SHORT BREAKAWAY POST.

TRAILING ANCHORAGE (MASSDOT 400.4.1)

MASSDOT STANDARD DETAILS:

MASSDOT HIGHWAY DIVISION CONSTRUCTION STANDARD DETAILS APPROACH GEOMETRY & TRAILING ANCHORAGE DETAILS

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GUARDRAIL APPROACH GEOMETRY

SCALE: NO SCALE

SHEET 15 OF 15

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