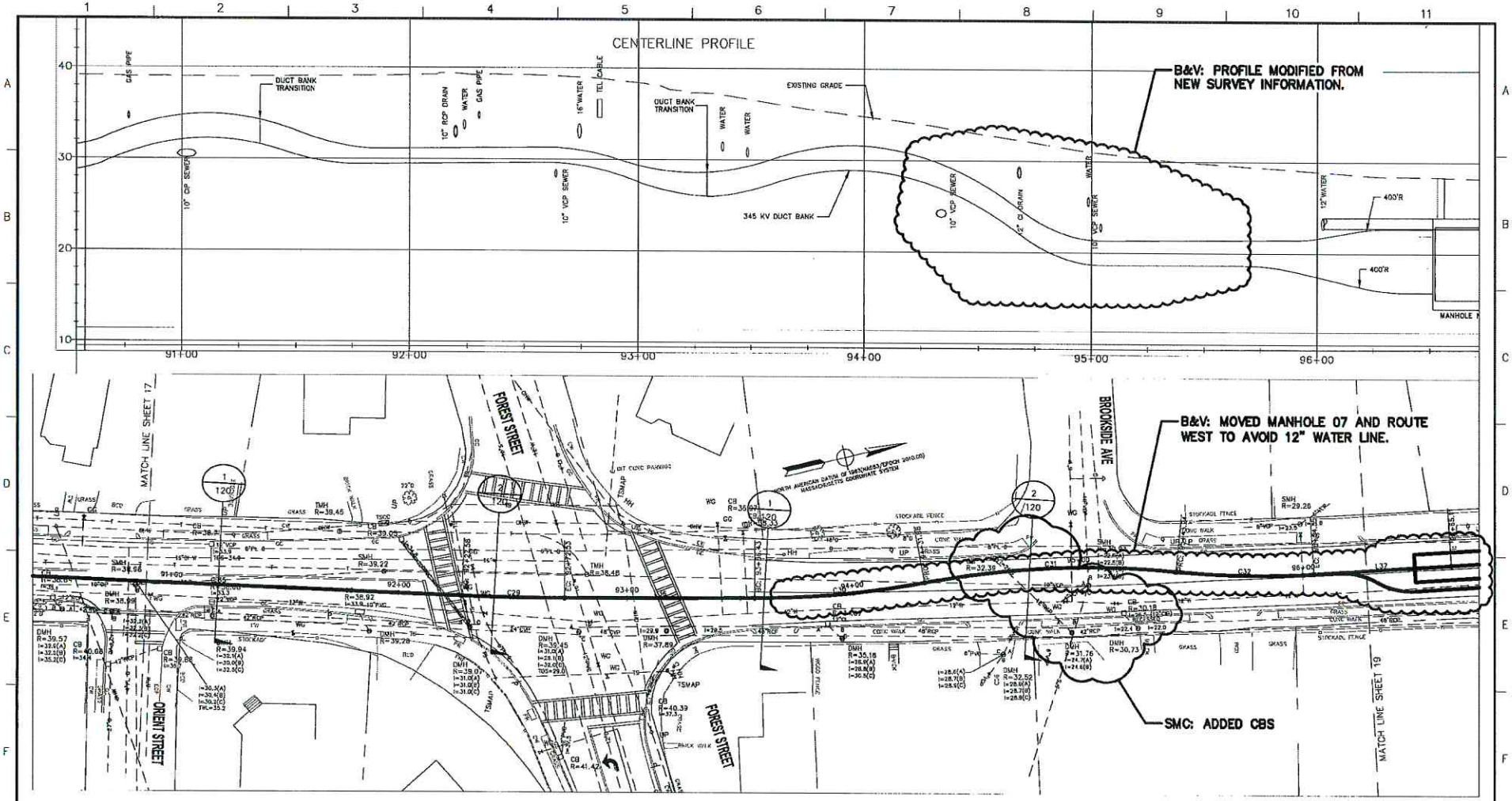

NO.	DESCRIPTION	BY	DATE	APPR.
2	ROUTE MODIFICATIONS PER CITY - (SMC UPDATES)		07/22/16	
1	ROUTE MODIFICATIONS PER CITY		06/17/16	
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

FEET

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REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

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DRAWING NO. 312003

EVERSOURCE

345 kV LINE

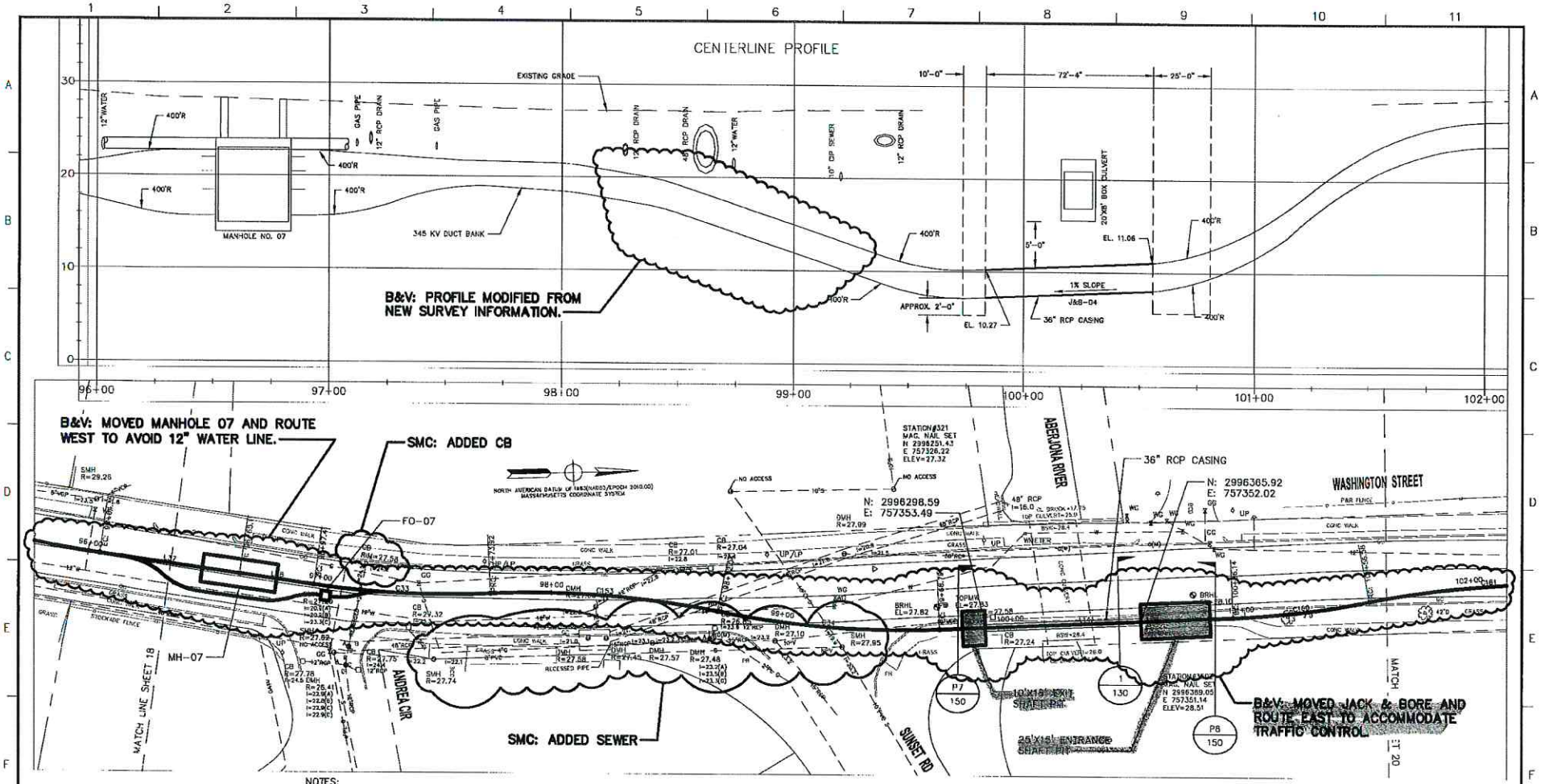
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET

PLAN 18 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	06/17/15	SH/RB/MM		–	028	2



NOTES:

1. GEOTECHNICAL INFORMATION UNKNOWN AT THIS TIME.
2. FINAL SIZES OF SHAFT PITS TO BE DETERMINED BY CONTRACTOR.
3. REINFORCED CONCRETE PIPE – ASTM SPEC. C-76, CLASS V, WALL C; SHALL BE USED FOR THE JACK AND BORE CASING.
4. JACK AND BORE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ANY AND ALL UNDERGROUND FACILITIES REGARDLESS OF PREVIOUS EFFORTS IN THE REGARD, AND SHALL BE HELD RESPONSIBLE FOR ALL LOSSES AND REPAIRS FROM DAMAGED CAUSED BY DRILLING OR BORING OPERATIONS.

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

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REFERENCES:
DWG. 103 & 130
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR
3	ROUTE MODIFICATIONS PER CITY – (SMC UPDATES)		07/22/16	
2	ROUTE MODIFICATION PER CITY		06/17/16	
1	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
WASHINGTON AVENUE — PLAN 19 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	06/17/16	SH/RR/MM		–	029	3

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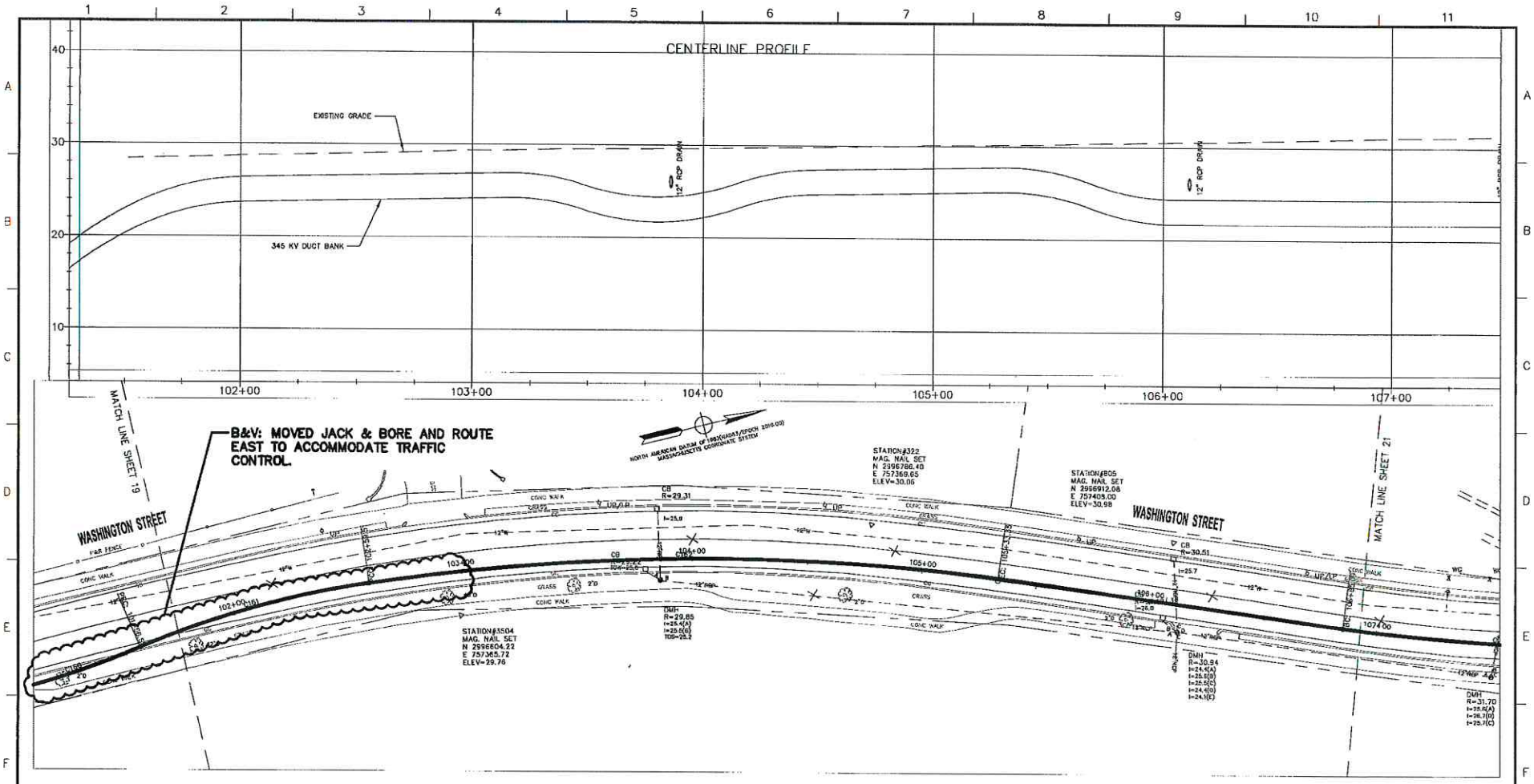

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO.	DESCRIPTION	BY	DATE	APPR.
1	ROUTE MODIFICATIONS PER CITY		06/17/16	
0	ISSUED FOR CLIENT REVIEW		09/05/15	

REVISION

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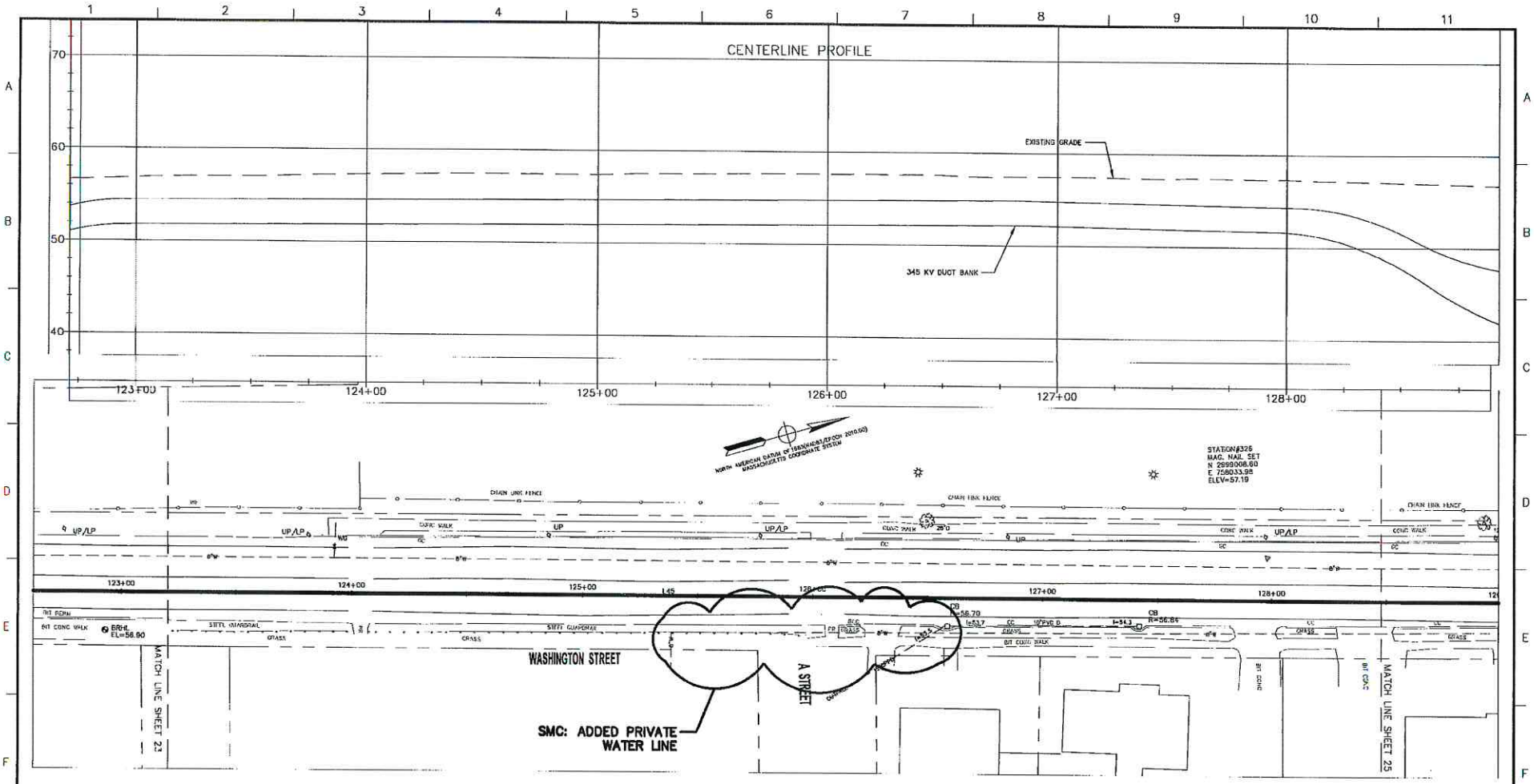
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET — PLAN 20 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	06/17/16	SH/RB/MM		–	0.30	1



NO.	DESCRIPTION	BY	DATE	APPR.
1	ROUTE MODIFICATIONS PER CITY – (SMC UPDATES)		07/22/16	
0	ISSUED FOR CLIENT REVIEW		05/08/15	

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STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET — PLAN 24 OF 83

SCALE: unless noted	DATE	DRAWN	CHKD.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	05/08/15	SH/RB/NM		–	034	1

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

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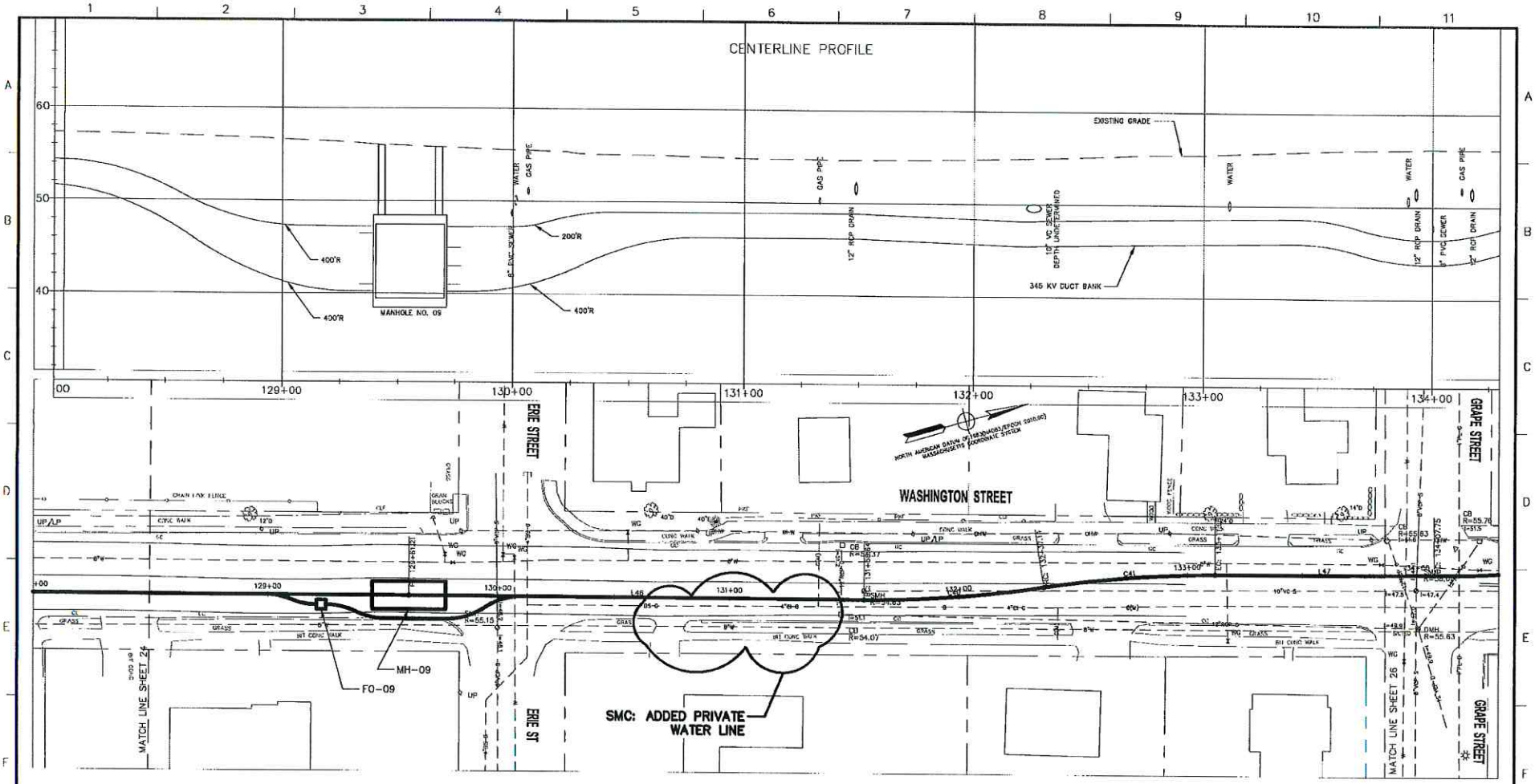
DRAWING NO. 612903



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REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
2	ROUTE MODIFICATIONS PER CITY - (SMC UPDATES)		07/22/16	
1	ISSUED FOR CLIENT REVIEW		09/08/15	
0	TEST PIT ISSUE		07/10/15	

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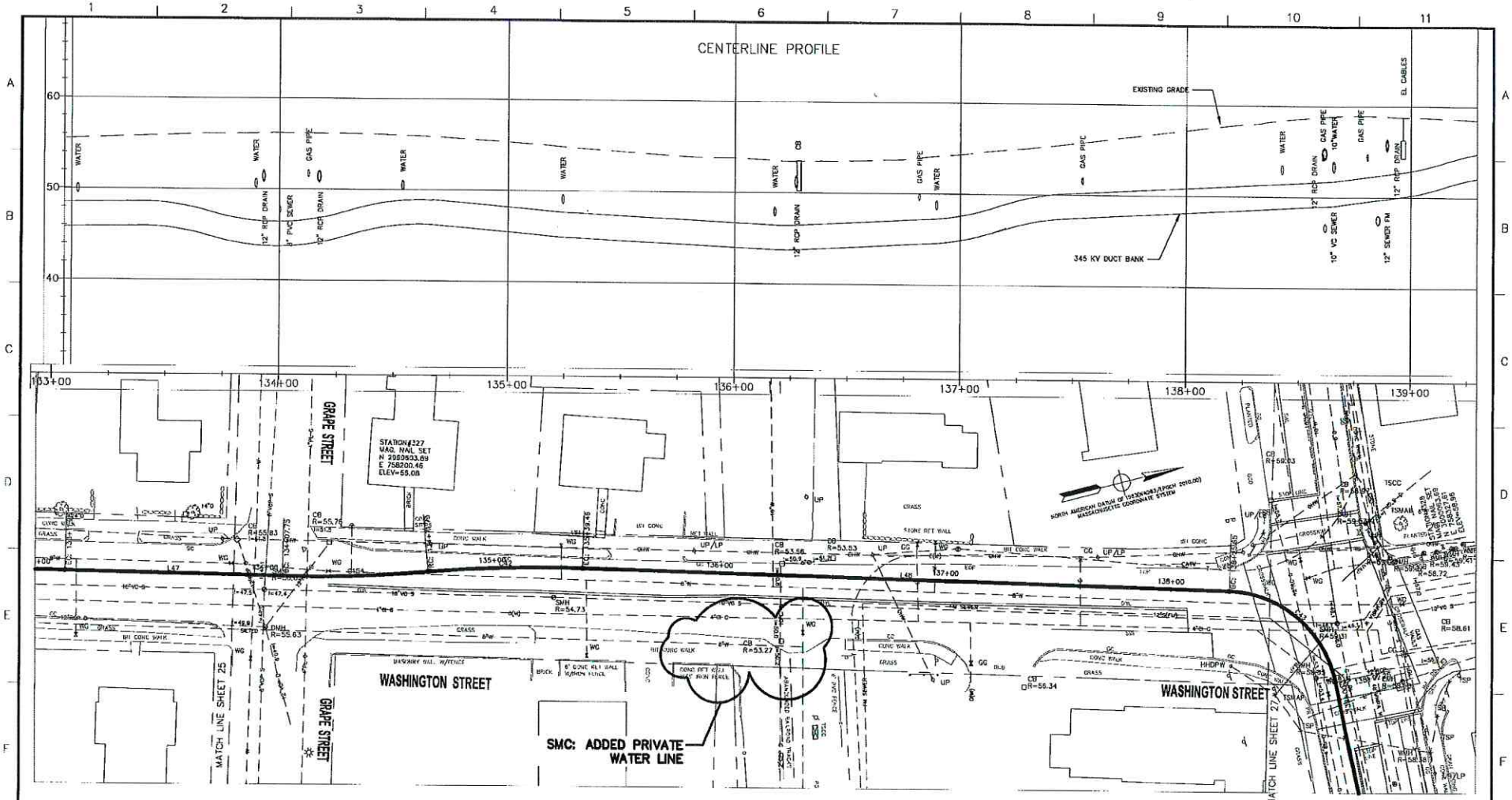
345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET — PLAN 25 OF 83

SCALE: unless noted	DATE	DRAWN	CHKD.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RR/MW		-	035	2



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DRAWING NO. X12903

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0	ISSUED FOR CLIENT REVIEW		09/08/15	

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345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET — PLAN 26 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	036	1

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STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION 345kV LINE

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REVISION

COVER

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

COVER SHEET

SCALE: unless noted | APPR. | DRAWING NO. 000 | REV. 0

TITLE	DRAWING NUMBER
Cover Sheet	000
Drawing Index	001
Legend and Notes	002
Key Map 1 of 2	003
Key Map 2 of 2	004
Plan & Profile: 1"=20'	010
Plan & Profile: 1"=20'	011
Plan & Profile: 1"=20'	012
Plan & Profile: 1"=20'	013
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NO.	DESCRIPTION	BY	DATE	APPR.
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REVISION

EVERSOURCE

DRAWING INDEX

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

DRAWING INDEX

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
	09/08/15	SLH	–	–	001	0

SURVEY LEGEND

SB	STONE BOUND
CB	CONCRETE BOUND
DH	DRILL HOLE
IP	IRON PIPE
•	PK, REBAR, NAIL, SPIKE
H/T	HUB & TACK
EP/LP	ESCUTCHEON PIN IN LEAD PLUG
FND	FOUND
(R)	RECORD
	TOWN LINE
	STONE WALL
	TREE LINE
	HEDGE
	DECIDUOUS TREE
	EVERGREEN
	BUSH
	FENCE
CLF	CHAIN LINK FENCE
WRF	WROUGHT IRON FENCE
	RETAINING WALL
BIT CONC	BITUMINOUS CONCRETE
GRAN	GRANITE
BCC	BITUMINOUS CONCRETE CURB
CC	CONCRETE CURB
GC	GRANITE CURB
EOP	EDGE OF PAVEMENT
GP	GUARD POST (BOLLARD)
FL	FLOOD LIGHT
TRANS	TRANSFORMER
HVAC	HEATING VENTILATION AIR CONDITIONING
TC	TRASH CAN
PM	PARKING METER
S	SIGN
PVI	POST VALVE INDICATOR
TS	TRAFFIC SIGNAL
MAST ARM	TRAFFIC SIGNAL/MAST ARM
TSCC	TRAFFIC SIGNAL CONTROL CABINET
FA	FIRE ALARM BOX
MB	MAILBOX
HH	HANDHOLE
	GUY POLE
	GUY WIRE
UP#	UTILITY POLE
UP/LP	UTILITY POLE/LIGHT POLE
MBTA	TROLLEY POWER POLE
LP	LIGHT POLE
LPB	LIGHT POLE BASE
OHW	OVERHEAD WIRE
W/RSR(S)	WITH RISER(S)
(M)	MARKED IN FIELD
DMH	DRAIN MANHOLE
CB	CATCH BASIN
	CURB INLET
R	RIM
I	INVERT
NPV	NO PIPE VISIBLE
CCW	CONCRETE WALK
HE	HEAT EXCHANGER
BCW	BITUMINOUS CONCRETE WALK
SHH	SEWER HANDHOLE
EHH	ELECTRIC HANDHOLE
EL/ELEC	ELECTRIC
ECC	ELECTRIC CONTROL CABINET
SLCC	STREET LIGHTING CONTROL CABINET
HPFF	HIGH PRESSURE FLUID FILLED
ALT	ALTERNATE ROUTE
CIR	8-5/8" DIAMETER SCHEDULE 40 STEEL FLUID CIRCULATION PIPE COATED WITH PRITEC

CMP	CORRUGATED METAL PIPE
RCP	REINFORCED CONCRETE PIPE
CI	CAST IRON PIPE
PVC	POLYVINYL CHLORIDE PIPE
VCP	VITREOUS CLAY PIPE
CPP	CORRUGATED PLASTIC PIPE
ST	STEEL
DICL	DUCTILE IRON CEMENT LINED PIPE
CS	COATED STEEL
RET	RETIRED
MBTA	MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
BRW	BRICK WALK
TP	TEST PIT
BRD	BRICK DRIVEWAY
SG	TRAFFIC SIGNAL
PO OR PL	PLASTIC PIPE
PY	PLASTIC YELLOW PIPE
LP	LOW PRESSURE PIPE
HP	HIGH PRESSURE PIPE
TSP	TRAFFIC SIGNAL POLE
MWRA	MASSACHUSETTS WATER RESOURCES AUTHORITY
CU	CONTINUATION UNKNOWN
DI	DUCTILE IRON
UGV	UNDERGROUND VAULT
UNK	UNKNOWN
GG	GAS GATE
GMH	GAS MANHOLE
GM	GAS METER
TMH	TELEPHONE MANHOLE
EMH	ELECTRIC MANHOLE
EM	ELECTRIC METER
SMH	SEWER MANHOLE
	HYDRANT
WM	WATER METER
WMH	WATER MANHOLE
WG	WATER GATE
MH	UKNOWN MANHOLE
UG	UNKNOWN GATE
115kV	115 KILOVOLT ELECTRIC LINE/CONDUIT
CATV	CABLE TELEVISION LINE
	COMBINED SEWER & DRAIN
D	DRAIN LINE
E	ELECTRIC LINE
G	GAS LINE
S	SEWER LINE
T	TELEPHONE LINE
TS	TRAFFIC SIGNAL LINE
W	WATER LINE
SP#	BORE HOLE
MW	MONITORING WELL
U/G	UNDERGROUND
ABAN	ABANDONED
ELEV	ELEVATION
GND	GROUND
MP	MARKER POST (GREEN) WITH LABEL
DIA	DIAMETER
MDC	METROPOLITAN DISTRICT COMMISSION
CATV	CABLE TELEVISION
TOS	TOP OF SILT
TOW	TOP OF WATER
	RIGHT-OF-WAY LINES

DESIGN LEGEND

11	MATERIAL LIST CALLOUTS
1 / -	SECTION CUTS AND DETAIL CALLOUTS
	FIBER OPTIC BOX AND CENTERLINE OF ROUTE
	345kV MANHOLE AND CENTERLINE OF ROUTE

GENERAL NOTES:

1. CONTRACTOR SHALL MAINTAIN ACCESS TO ALL DRIVE ENTRANCES AT ALL TIMES. CONTRACTOR SHALL WORK COMPLETELY AND ONLY WITHIN THE RIGHT OF WAY SHOWN ON THE DRAWINGS.
2. ALL UNDERGROUND FACILITY ELEVATIONS & LOCATIONS SHOWN ON THE DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME OF DESIGN. THE DEPTH OF THE UNDERGROUND UTILITIES SHOWN IN THE PROFILE OF THESE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE ACTUAL ELEVATIONS AND LOCATIONS OF ALL UNDERGROUND FACILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE TO SURFACE OR UNDERGROUND FACILITIES WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS. CONTRACTOR SHALL HAVE THE LOCAL UTILITY LOCATING SERVICE LOCATE ALL FACILITIES BEFORE CONSTRUCTION.
3. CONDUIT PHASING IS CRITICAL TO THE INSTALLATION OF THE CABLE. DUCTBANK CONTRACTOR SHALL VERIFY CONDUIT PHASING IS IN ACCORDANCE WITH THE DRAWINGS PRIOR TO CONCRETE ENCASEMENT.
4. CONTRACTOR SHALL SUPPORT ALL EXISTING UNDERGROUND FACILITIES AT CROSSINGS DURING INSTALLATION OF THE DUCT BANK.
5. CONTRACTOR SHALL INSTALL THE DUCT BANK A MINIMUM OF 30 INCHES BELOW GRADE TO TOP OF CONCRETE, EXCEPT AS OTHERWISE NOTED ON DRAWINGS.
6. THE MINIMUM BENDING RADIUS OF CONDUITS WITHIN THE DUCT BANK SHALL BE 400 FEET. EXCEPT AS OTHERWISE NOTED ON DRAWINGS. ALL BENDS OF RADIUS LESS THAN 100' SHALL BE FACTORY FORMED AND MANDREL TESTED PRIOR TO CONCRETE ENCASEMENT. CONDUIT SHALL NOT BE FIELD BENT BY HEATING WITHOUT PURCHASER APPROVAL. FIELD BENT CONDUIT SHALL BE MANDREL TESTED PRIOR TO INSTALLATION AND PRIOR TO ENCASEMENT.
7. REBAR, OR ANY STEEL, SHALL NOT ENCIRCLE AN INDIVIDUAL CONDUIT UNLESS SPECIFICALLY IDENTIFIED.

NOTES REGARDING UTILITY CROSSINGS BEING SHOW IN PROFILES:

1. ELEVATIONS FOR STORM AND SEWER PIPES WERE OBTAINED FROM SURVEY INVERT READINGS WHEREVER AVAILABLE.
2. WATER AND GAS PIPES WERE PROJECTED TO PROFILES AT ELEVATIONS BASED ON MOST COMMON GROUND COVER DEPTH FOR MAIN LINES. SERVICE LINES DEPTH WOULD VARY DEPENDING ON DISTANCE FROM MAIN LINE AND SPECIFIC CONDITIONS OF EACH CONNECTION – BASICALLY SHALLOWER THAN SHOWN.
3. TELEPHONE, ELECTRIC AND TRAFFIC SIGNAL CABLES ARE SHOWN WITH 2-3 FEET BELOW GROUND WITH NO AVAILABLE INFORMATION ABOUT THEIR DEPTH.

NOT TO BE USED FOR CONSTRUCTION

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NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW	-	09/08/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

LEGEND AND GENERAL NOTES

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
	09/08/15	SLH	-	-	002	0

CABLE SECTIONS	
TERMINATION OR MANHOLE NO.	CIRCUIT LENGTH TERM. TO MH ℄ OR MH ℄ TO MH ℄
WOBURN TO MH-01	360'
MH-01 TO MH-02	1472'
MH-02 TO MH-03	1355'
MH-03 TO MH-04	1351'
MH-04 TO MH-05	1762'
MH-05 TO MH-06	1688'
MH-06 TO MH-07	1690'
MH-07 TO MH-08	1700'
MH-08 TO MH-09	1594'
MH-09 TO MH-10	1475'
MH-10 TO MH-11	1565'
MH-11 TO MH-12	1698'
MH-12 TO MH-13	1688'
MH-13 TO MH-14	1695'

LEGEND

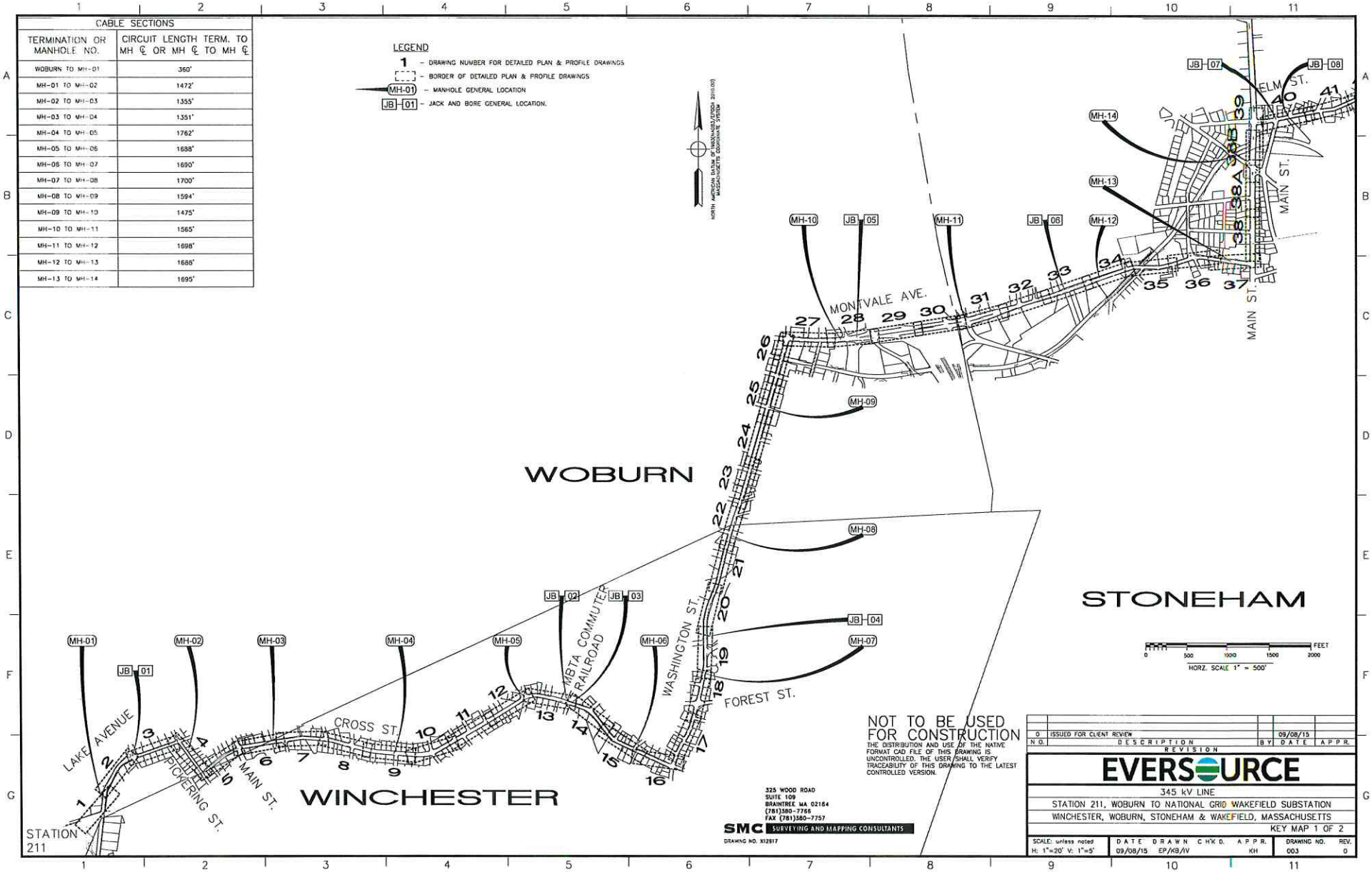
1 – DRAWING NUMBER FOR DETAILED PLAN & PROFILE DRAWINGS

– BORDER OF DETAILED PLAN & PROFILE DRAWINGS

MH-01 – MANHOLE GENERAL LOCATION

JB-01 – JACK AND BORE GENERAL LOCATION.

NORTH AMERICAN DATUM 1983 (NAD83) MASSACHUSETTS COORDINATE SYSTEM



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NO.	DESCRIPTION	BY	DATE	APPR.
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REVISION

EVERSOURCE

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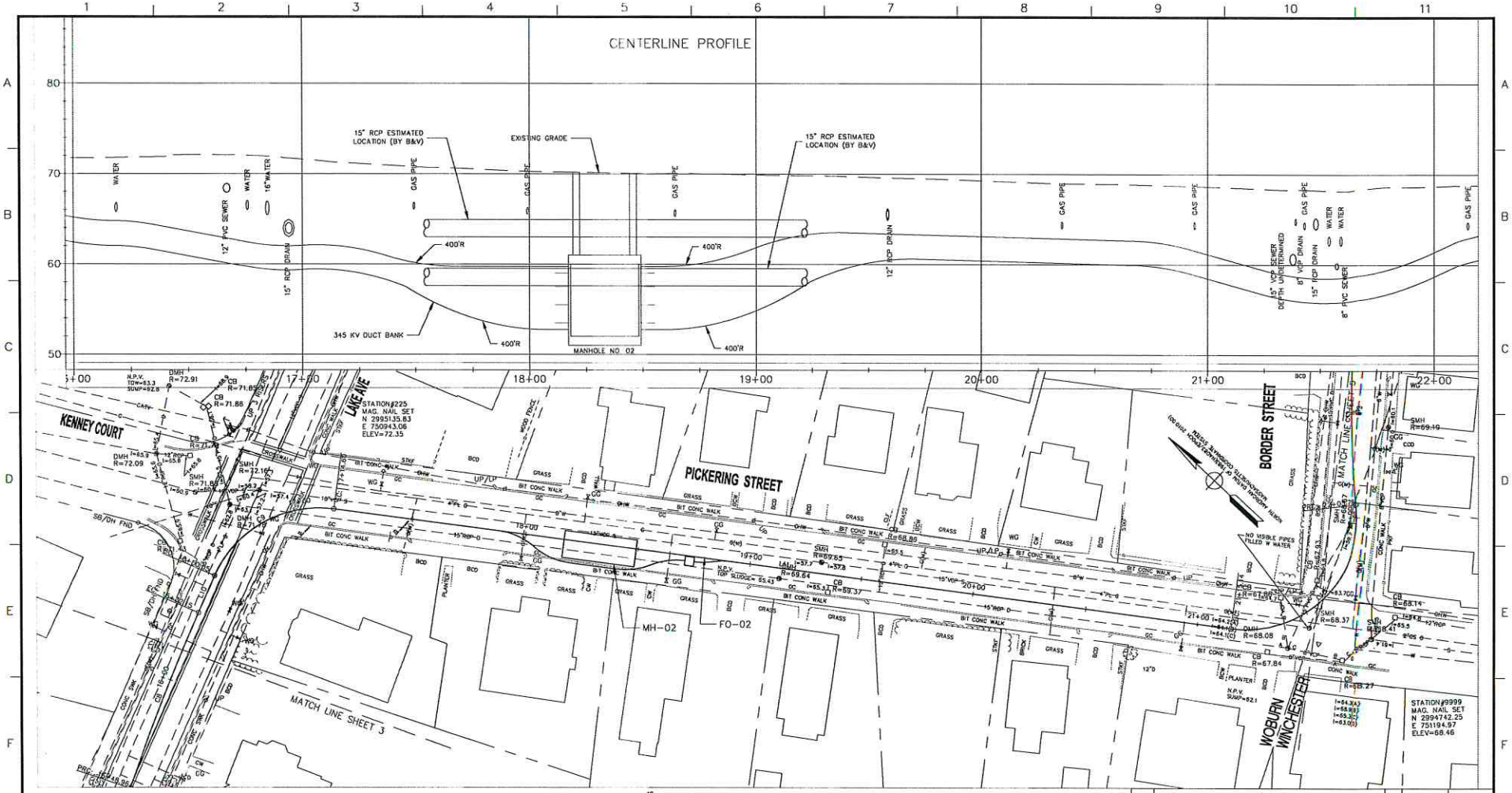
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

KEY MAP 1 OF 2

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	EP/KB/IV		KH	003	0



VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

PICKERING STREET — PLAN 4 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V. 1"=5'	09/08/15	SH/RB/MM		–	014	0

325 WOOD ROAD
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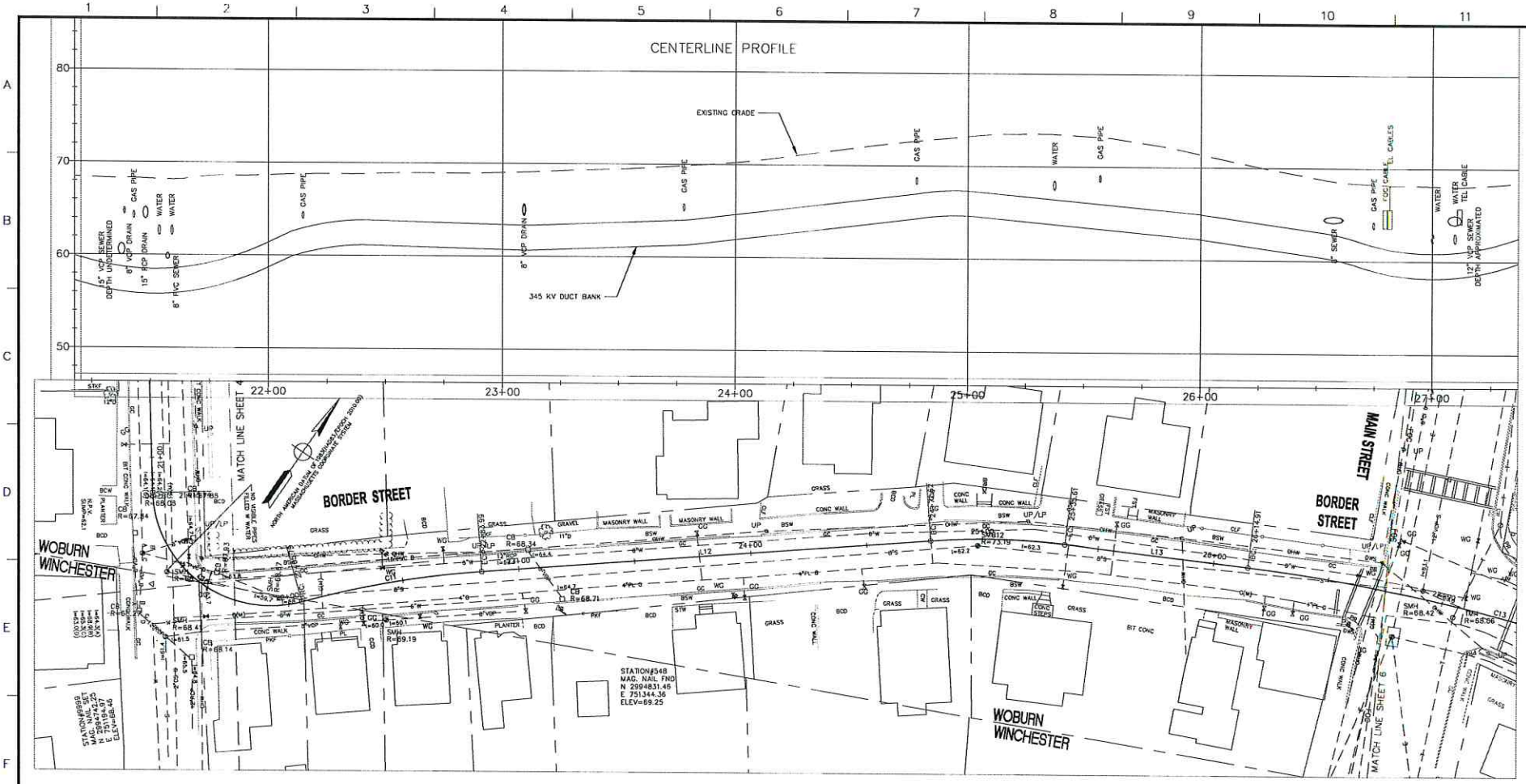
SMC SURVEYING AND MAPPING CONSULTANTS

DRAWING NO. XI2993



VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

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NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

BORDER STREET

PLAN 5 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/VM		–	015	0

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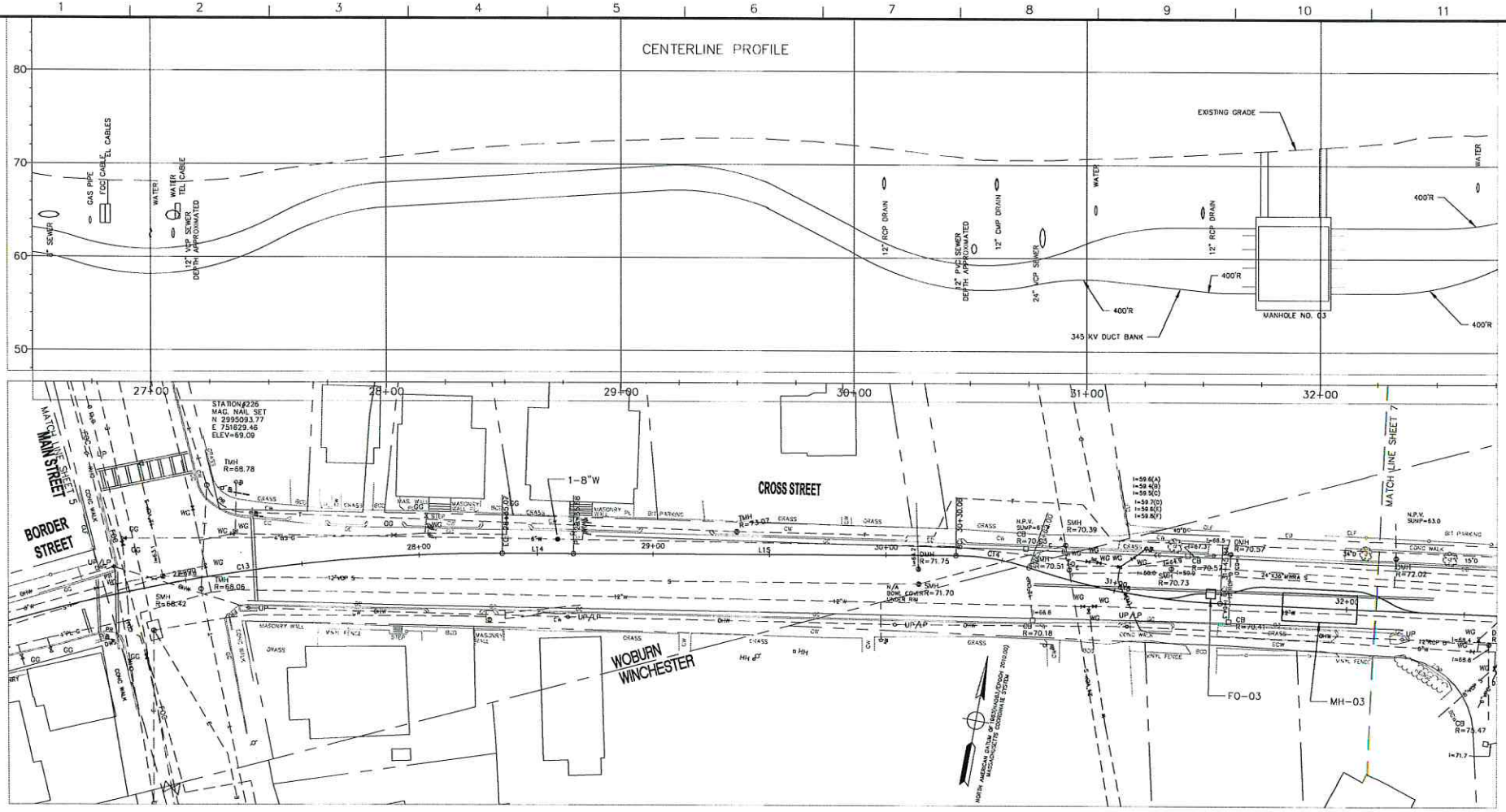
DRAWING NO. X12903



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REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
1	ISSUED FOR CLIENT REVIEW		09/08/15	
0	TEST PIT ISSUE		07/10/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET — PLAN 6 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	016	1

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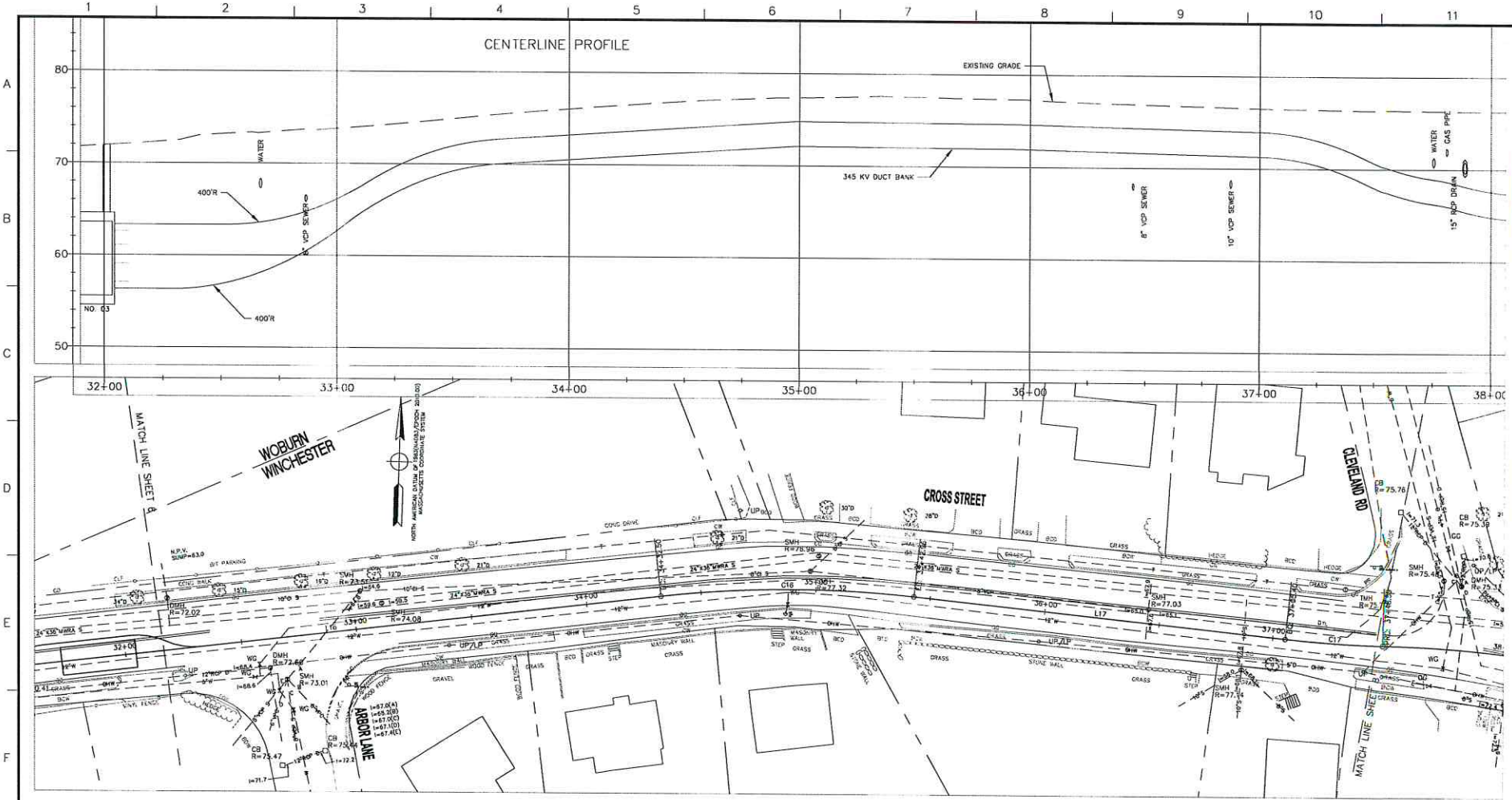
DRAWING NO. X12903



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DRAWING NO. X12603

NOT TO BE USED FOR CONSTRUCTION

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET — PLAN 7 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
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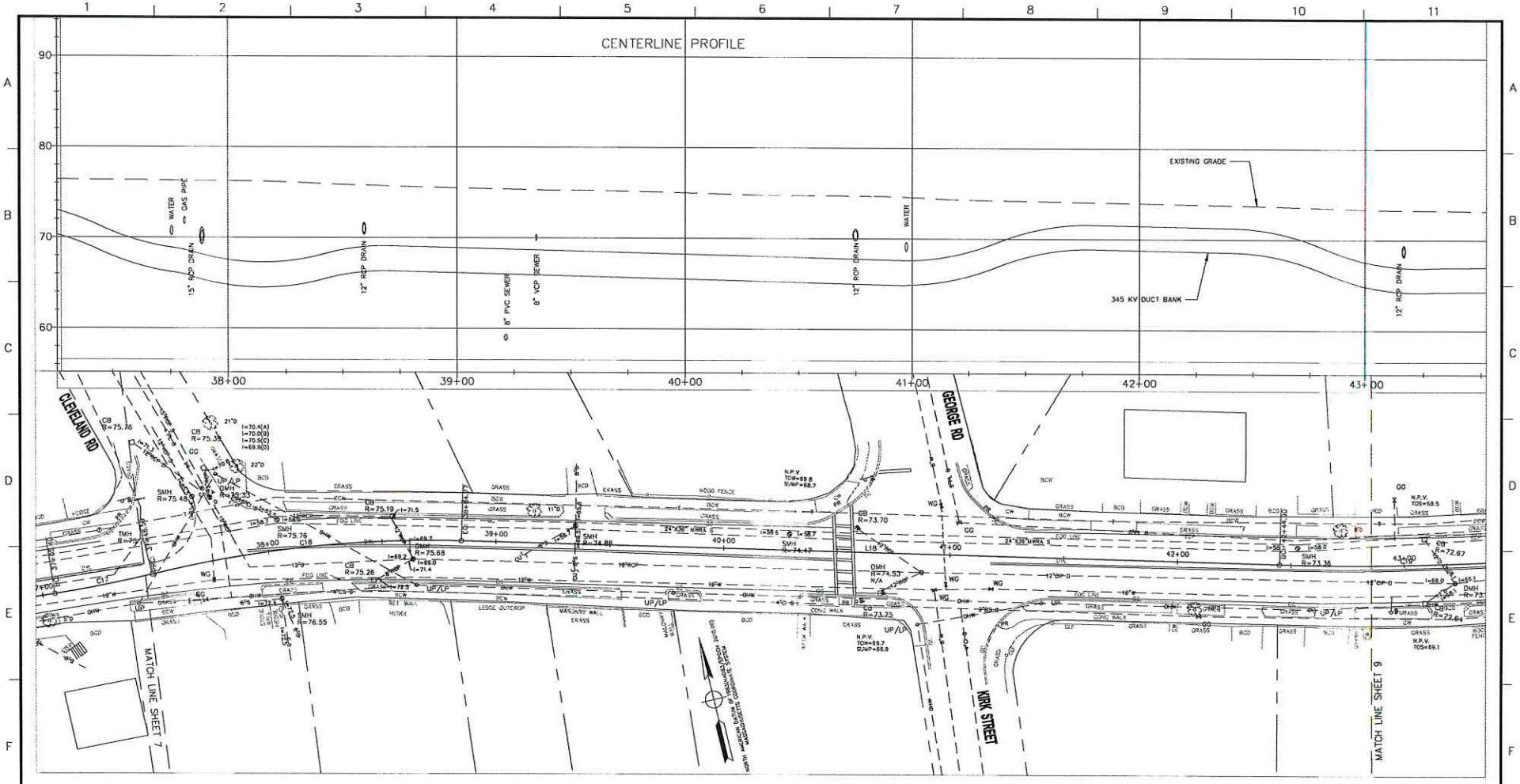

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SMC SURVEYING AND MAPPING CONSULTANTS

DRAWING NO. X12303

NOT TO BE USED FOR CONSTRUCTION

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

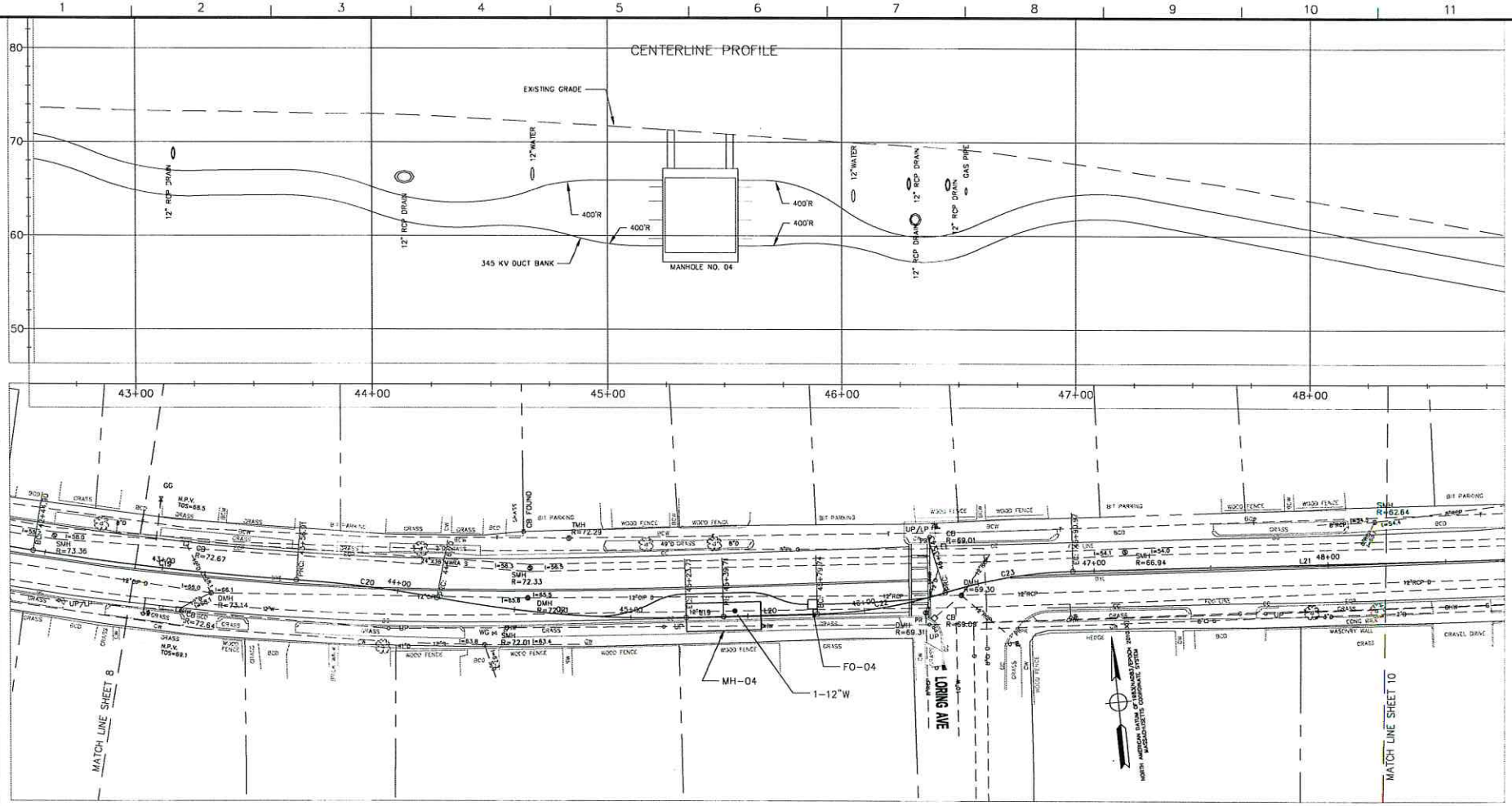
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET

PLAN 8 OF 83

SCALE: unless noted	DATE	DRAWN	CH'K'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	018	0



VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
1	ISSUED FOR CLIENT REVIEW		09/08/15	
0	TEST PIT ISSUE		07/10/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET — PLAN 9 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	019	1

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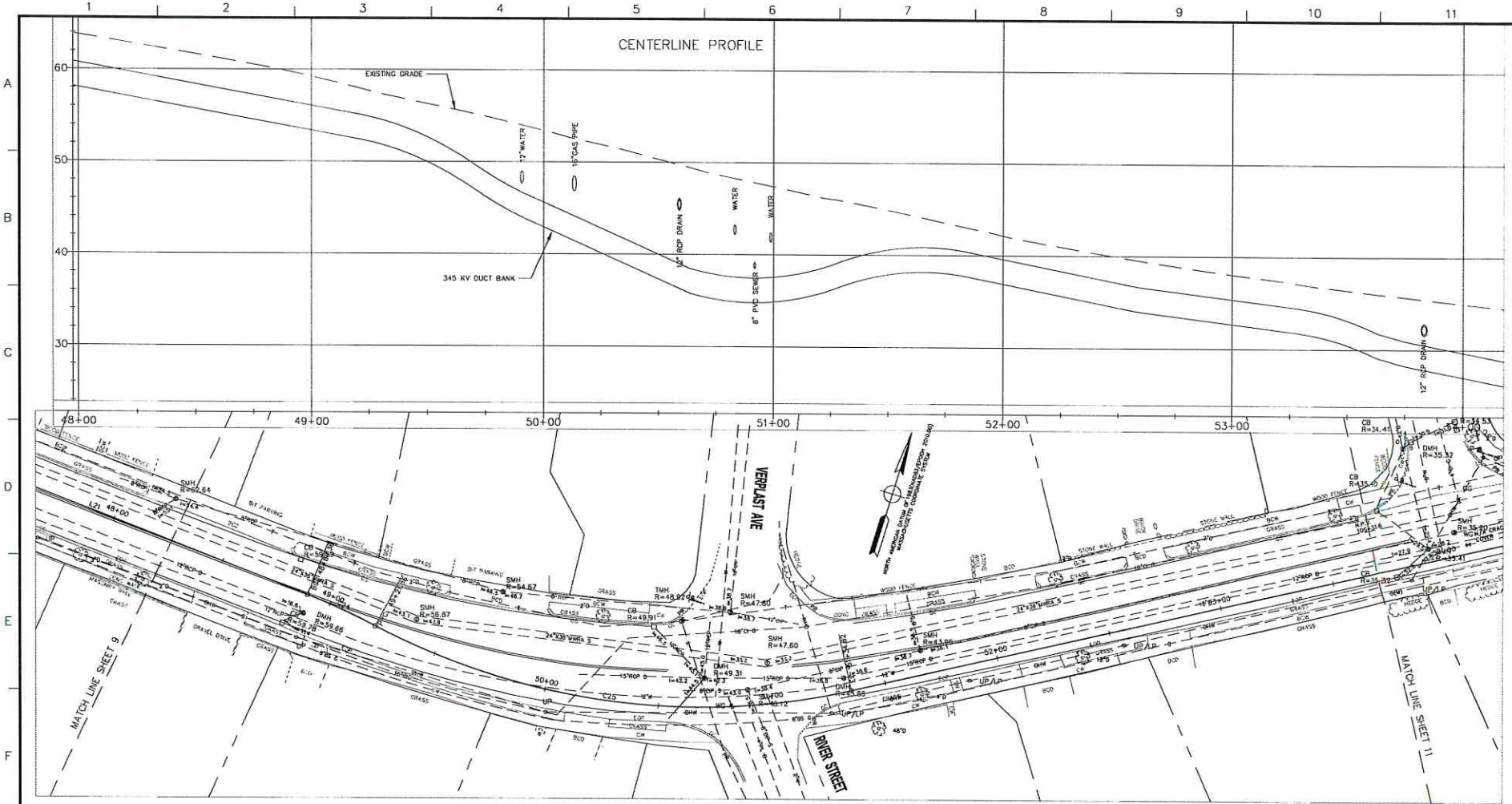
DRAWING NO. X12903



NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET — PLAN 10 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	020	0

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

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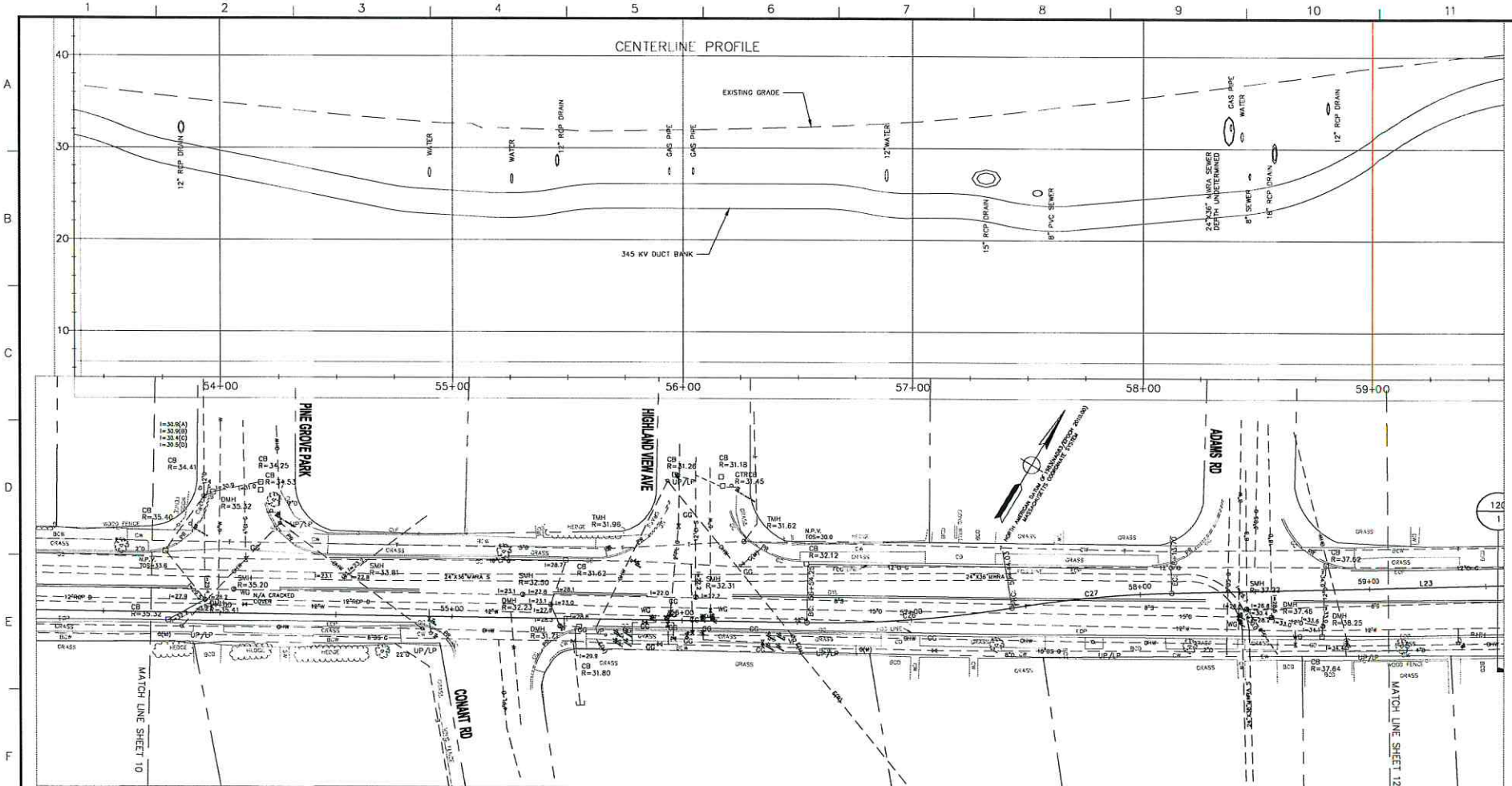
DRAWING NO. X12903



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DRAWING NO. X12903

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

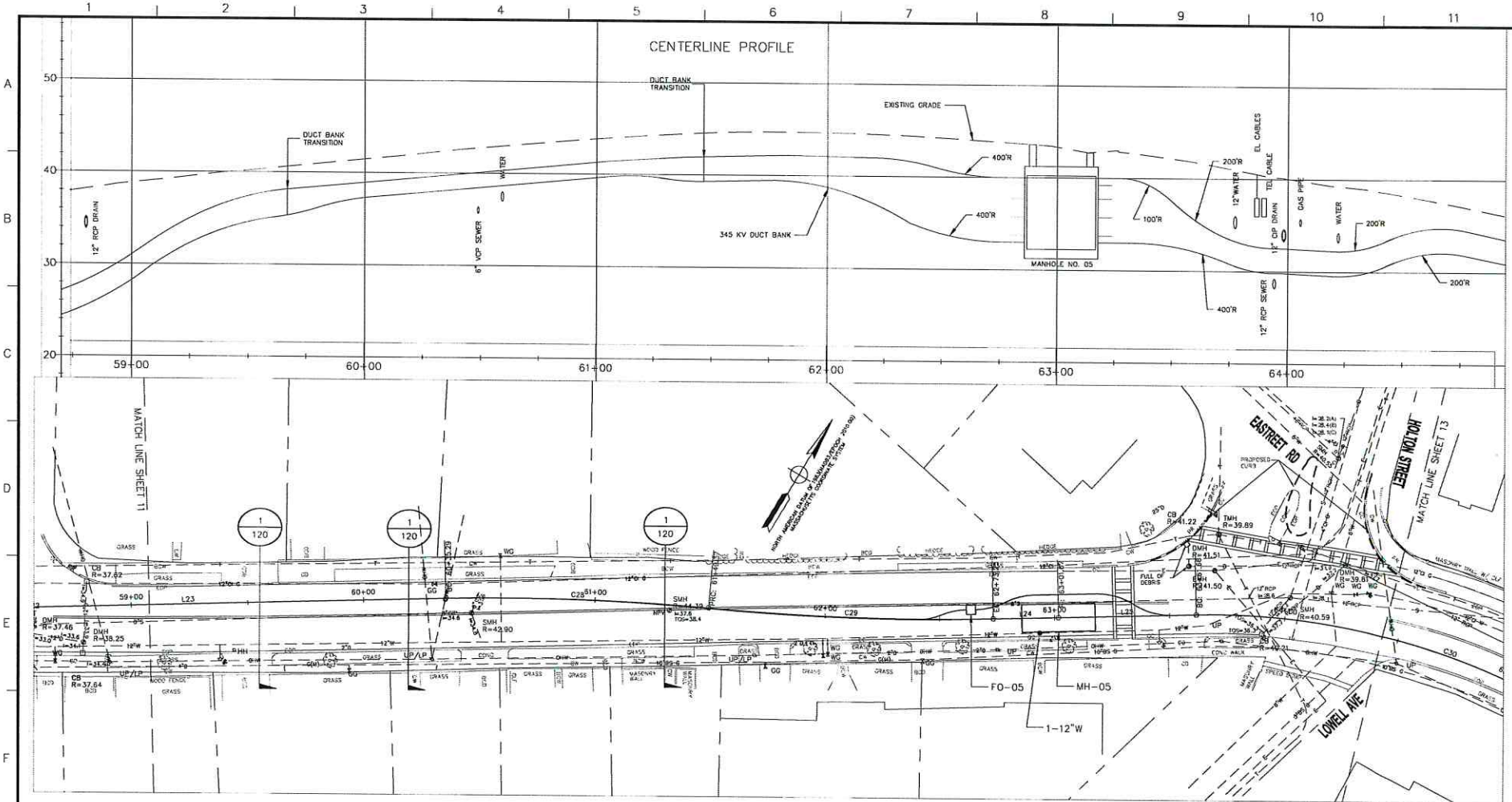
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET

PLAN 11 OF 83

SCALE: unless noted H: 1"=20' V: 1"=5'	DATE	DRAWN	CHKD.	APPR.	DRAWING NO.	REV.
	09/08/15	SH/RB/MM		–	021	0



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DRAWING NO. X12503

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

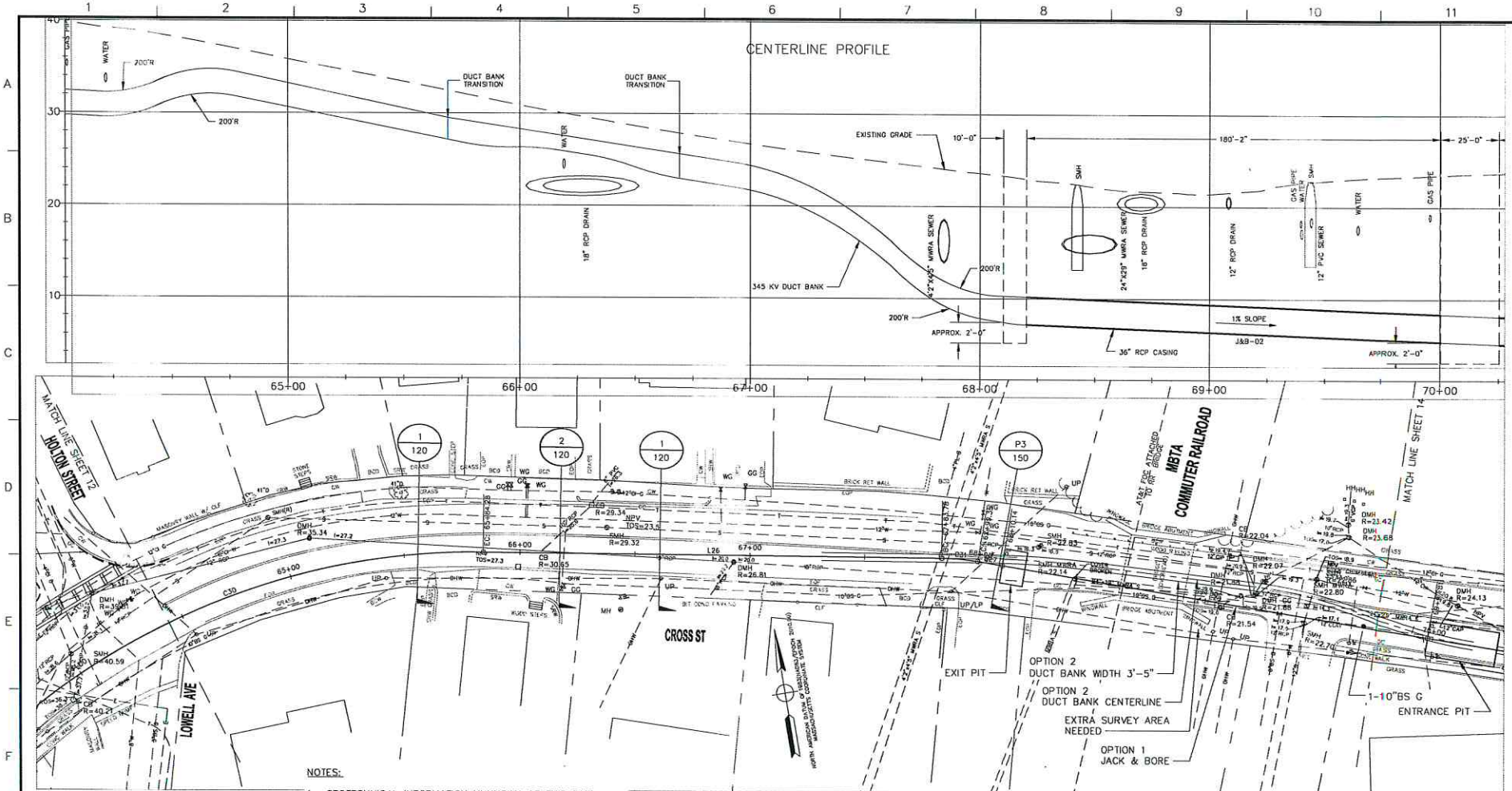
NO.	DESCRIPTION	BY	DATE	APPR.
1	ISSUED FOR CLIENT REVIEW		09/08/15	
0	TEST PIT ISSUE		07/10/15	

REVISION

EVERSOURCE

345 kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
CROSS STREET — PLAN 12 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		-	022	1



DESIGN NOTE:
OPTION 1 – CURRENTLY THE DESIGN IS FOR A JACK & BORE UNDER THE MBTA AREA, BECAUSE OF CONGESTED UTILITIES.
OPTION 2 – THIS WOULD BE A DUCT BANK THAT MAY REQUIRE A VERTICAL STACKED CONDUIT LAYOUT.

BOTH OPTIONS WILL REQUIRE DETAILED FIELD (OR OTHERWISE) SURVEY INFORMATION.

325 WOOD ROAD
SUITE 109
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DRAWING NO. X12903

NOTES:

1. GEOTECHNICAL INFORMATION UNKNOWN AT THIS TIME.
2. FINAL SIZES OF SHAFT PITS TO BE DETERMINED BY CONTRACTOR.
3. REINFORCED CONCRETE PIPE – ASTM SPEC. C-76, CLASS V, WALL C; SHALL BE USED FOR THE JACK AND BORE CASING.
4. JACK AND BORE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ANY AND ALL UNDERGROUND FACILITIES REGARDLESS OF PREVIOUS EFFORTS IN THE REGARD, AND SHALL BE HELD RESPONSIBLE FOR ALL LOSSES AND REPAIRS FROM DAMAGED CAUSED BY DRILLING OR BORING OPERATIONS.

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

OPEN

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REFERENCES:
DWG. 130 JACK & BORE DETAILS

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1	ISSUED FOR CLIENT REVIEW		09/08/15	
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EVERSOURCE

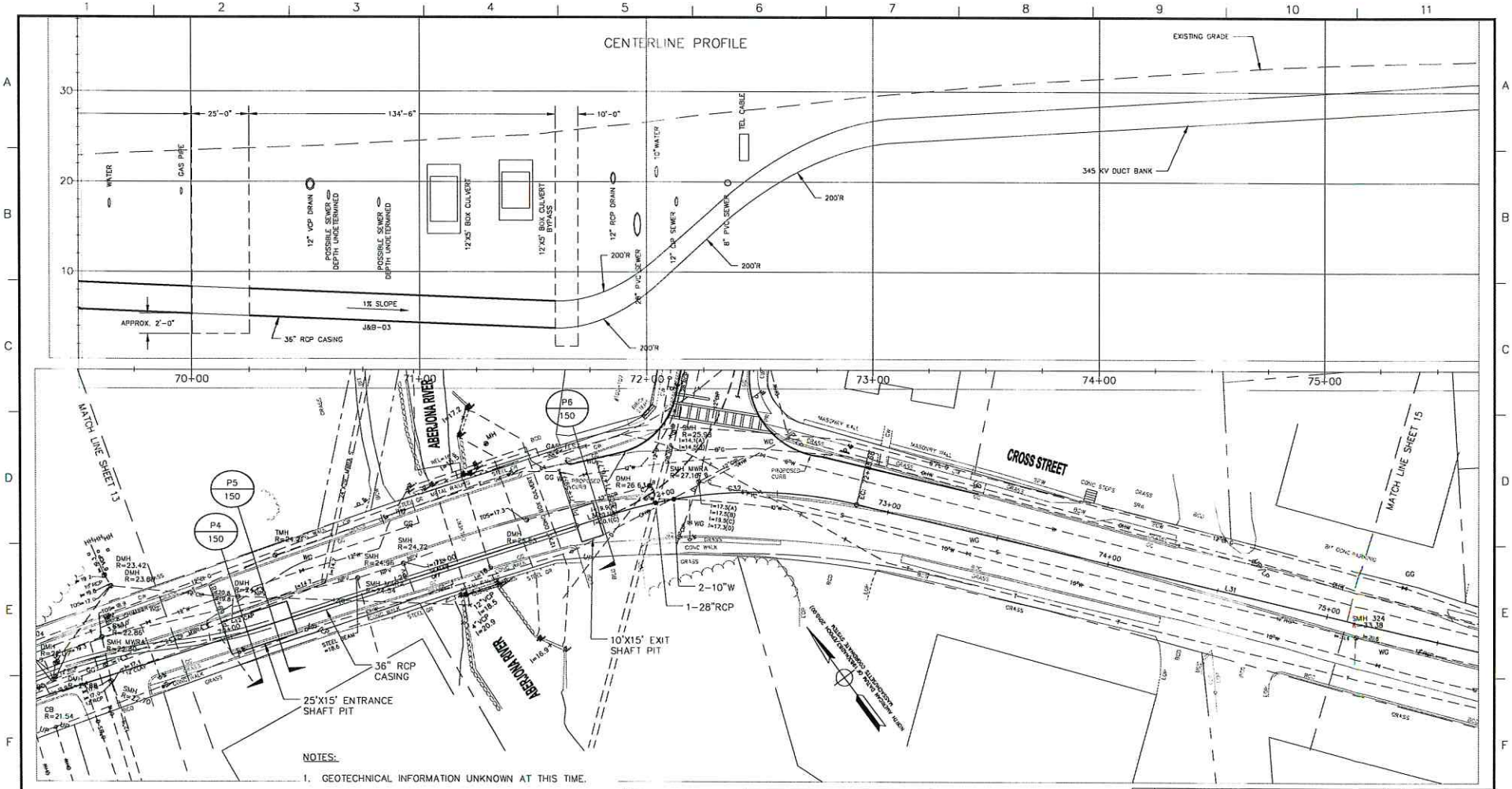
345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET — PLAN 13 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	08/03/15	SH/RB/MM		–	023	1



NOTES:

1. GEOTECHNICAL INFORMATION UNKNOWN AT THIS TIME.
2. FINAL SIZES OF SHAFT PITS TO BE DETERMINED BY CONTRACTOR.
3. REINFORCED CONCRETE PIPE – ASTM SPEC. C-76, CLASS V, WALL C; SHALL BE USED FOR THE JACK AND BORE CASING.
4. JACK AND BORE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ANY AND ALL UNDERGROUND FACILITIES REGARDLESS OF PREVIOUS EFFORTS IN THE REGARD, AND SHALL BE HELD RESPONSIBLE FOR ALL LOSSES AND REPAIRS FROM DAMAGED CAUSED BY DRILLING OR BORING OPERATIONS.

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

OPEN

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REFERENCES:
DWG. 102 & 130

NO.	DESCRIPTION	BY	DATE	APPR.
1	ISSUED FOR CLIENT REVIEW		09/08/15	
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REVISION

EVERSOURCE

345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET

PLAN 14 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		-	024	1

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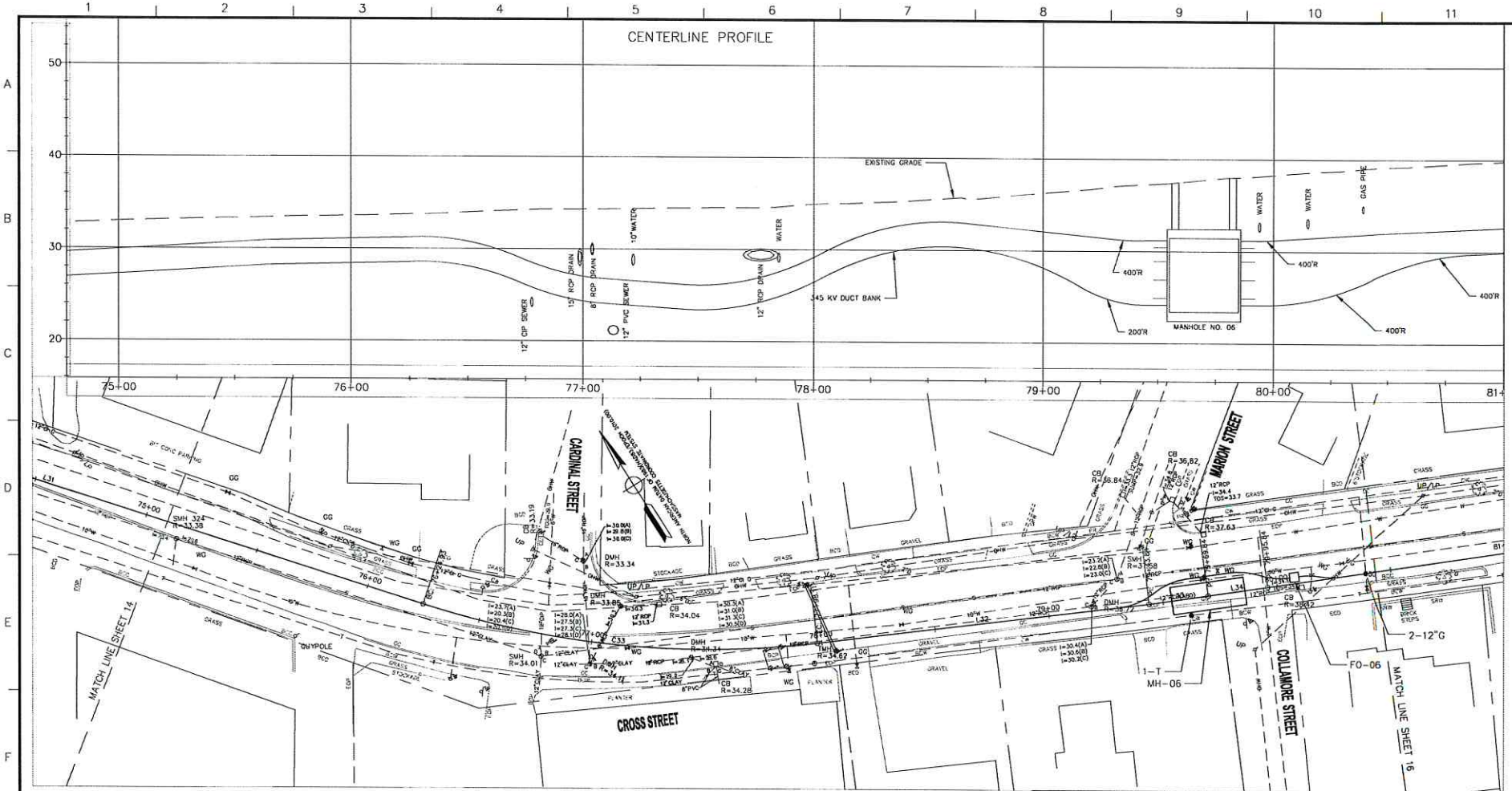
DRAWING NO. X12903



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DRAWING NO. X12903

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

FEET

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REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO	DESCRIPTION	BY	DATE	APPR.
1	ISSUED FOR CLIENT REVIEW		09/08/15	
0	TEST PIT ISSUE		07/10/15	

REVISION

EVERSOURCE

345 kV LINE

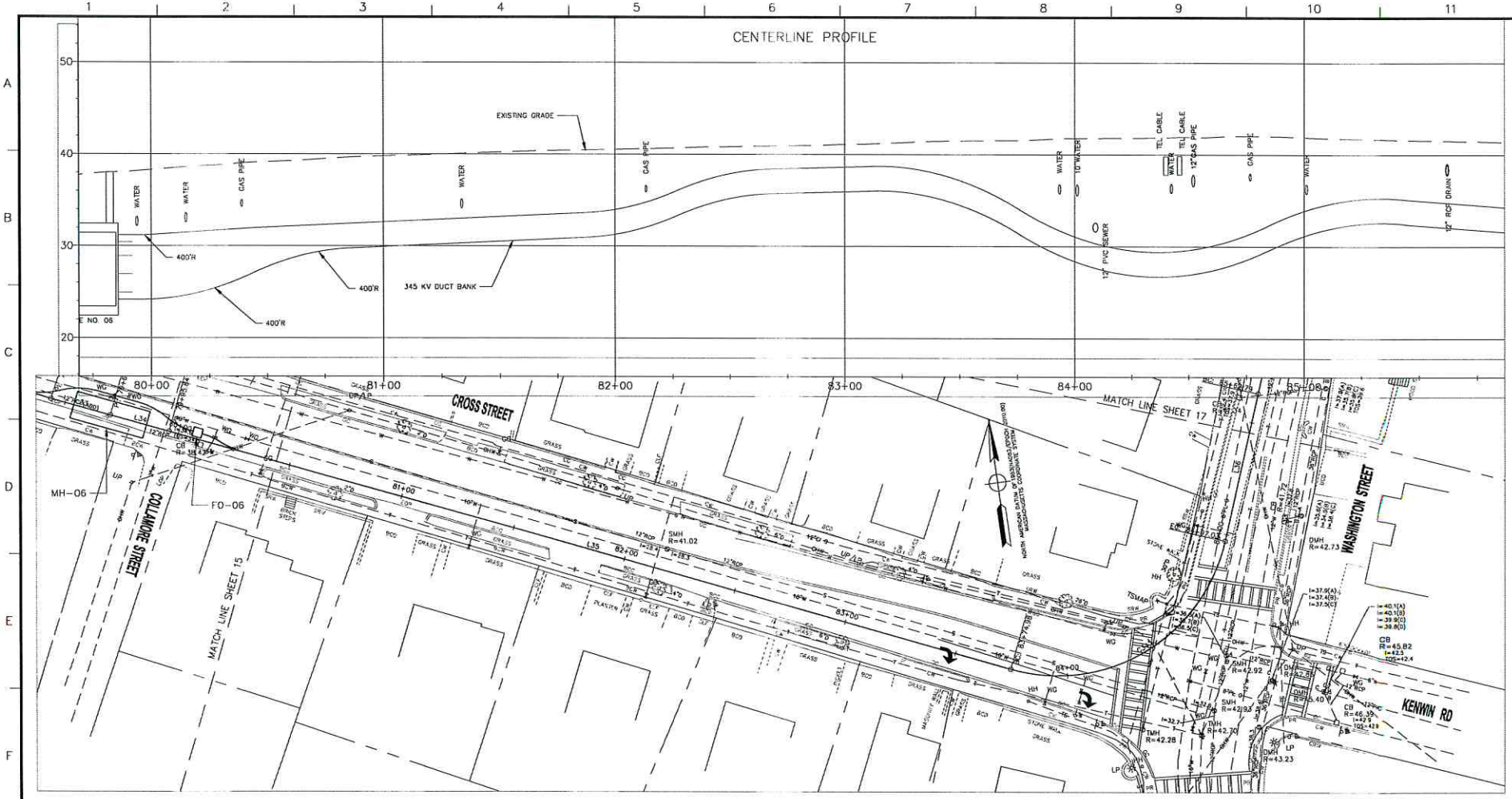
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET

PLAN 15 OF 83

SCALE: unless noted	DATE	DRAWN	CH'K D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	025	1



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DRAWING NO. X12903

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

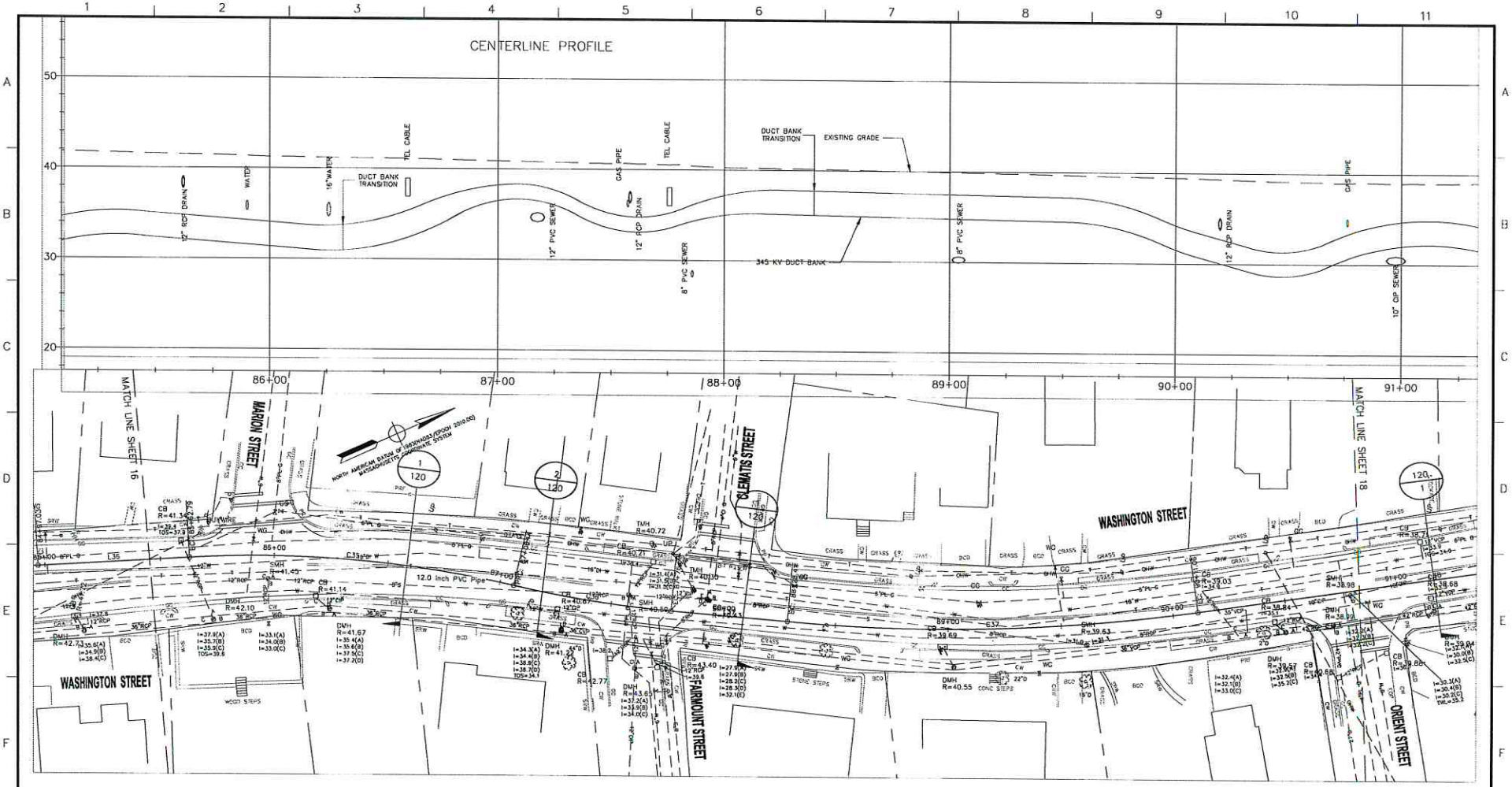
345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CROSS STREET — PLAN 16 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	026	0



VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

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DRAWING NO. X12903

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

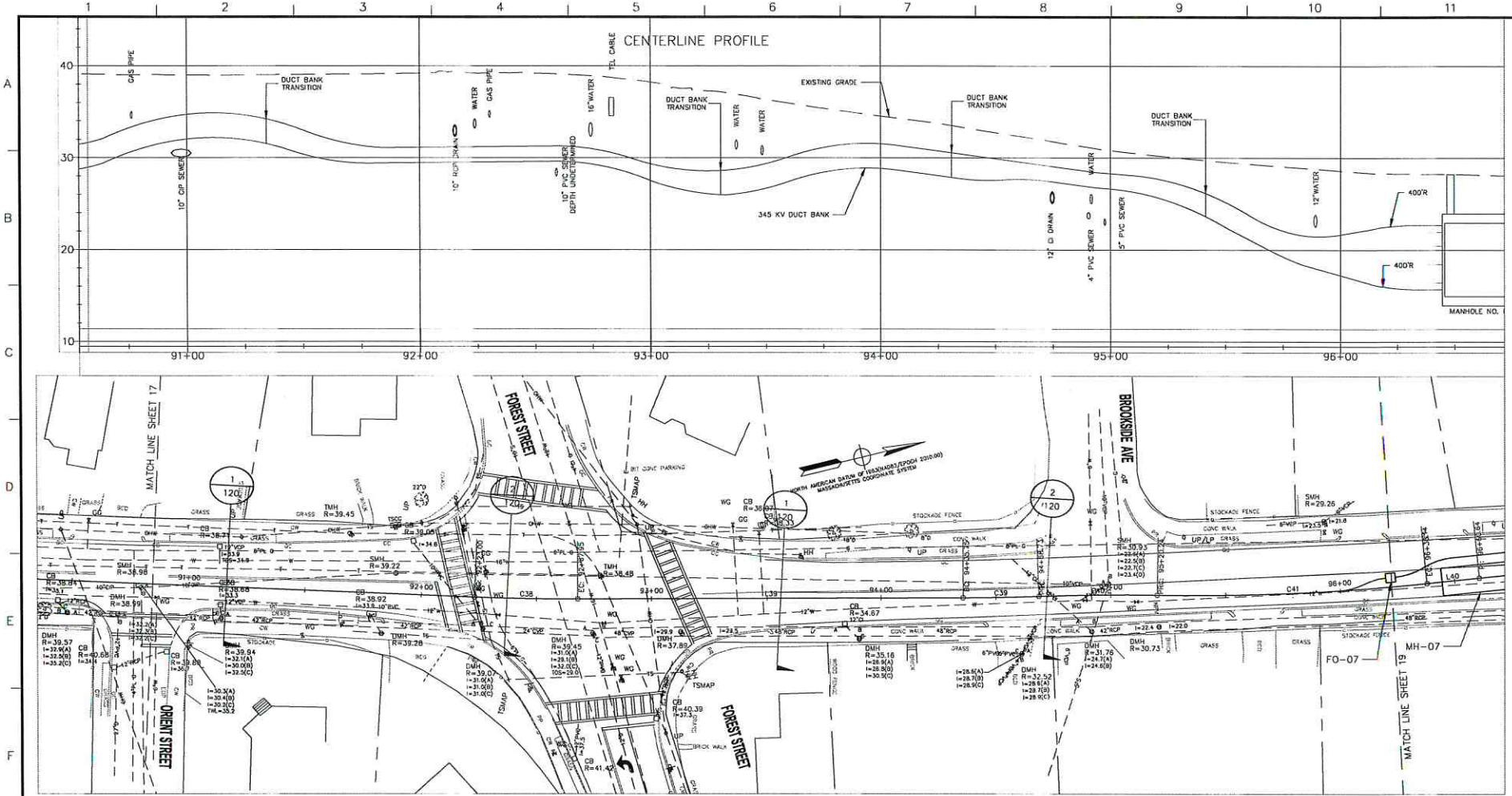
345 kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET — PLAN 17 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	027	0



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DRAWING NO. K12903

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

FEET

OPEN

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REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

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EVERSOURCE

345 kV LINE

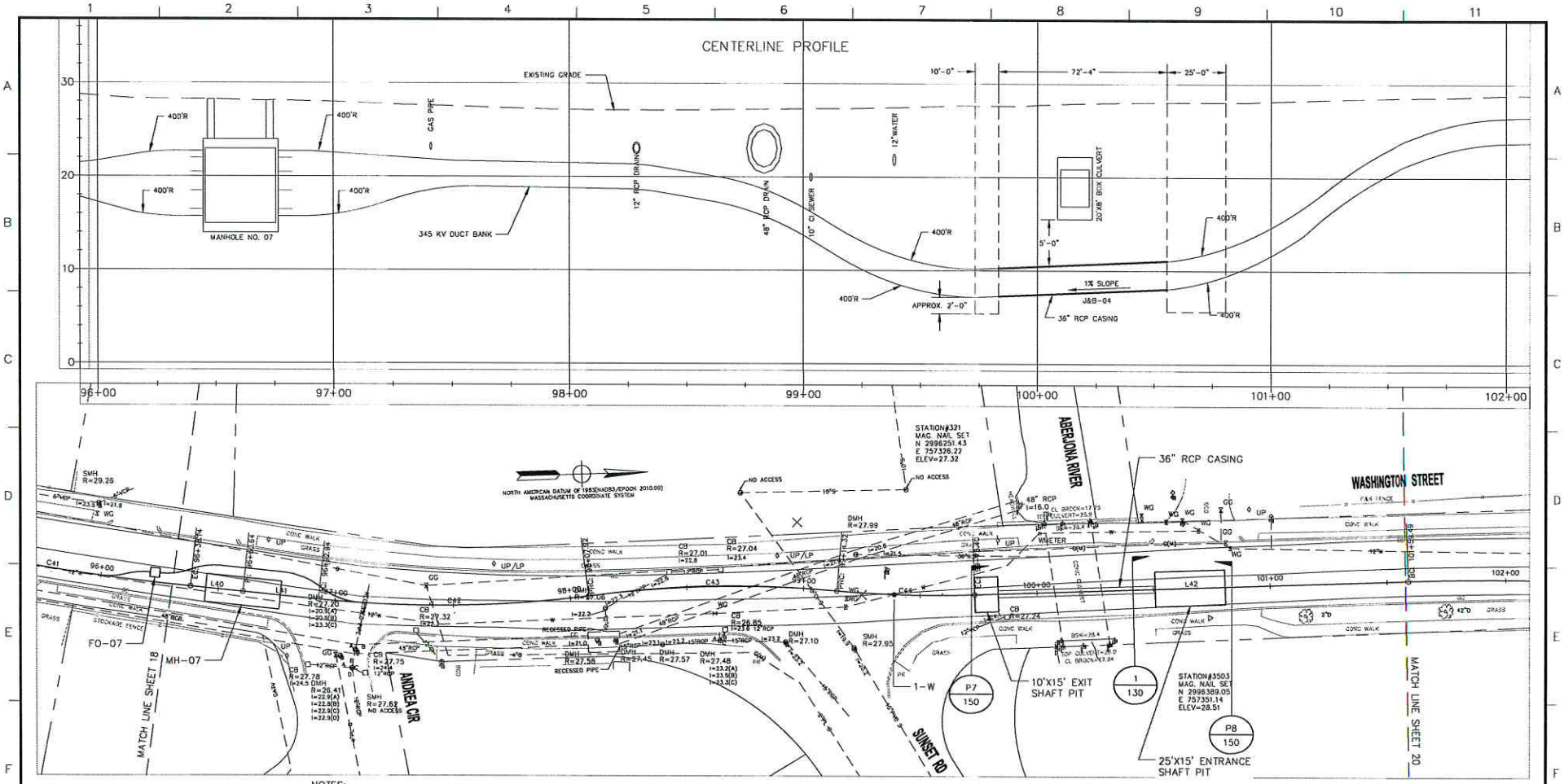
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET

PLAN 18 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	028	0



NOTES:

1. GEOTECHNICAL INFORMATION UNKNOWN AT THIS TIME.
2. FINAL SIZES OF SHAFT PITS TO BE DETERMINED BY CONTRACTOR.
3. REINFORCED CONCRETE PIPE – ASTM SPEC. C-76, CLASS V, WALL C; SHALL BE USED FOR THE JACK AND BORE CASING.
4. JACK AND BORE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ANY AND ALL UNDERGROUND FACILITIES REGARDLESS OF PREVIOUS EFFORTS IN THE REGARD, AND SHALL BE HELD RESPONSIBLE FOR ALL LOSSES AND REPAIRS FROM DAMAGED CAUSED BY DRILLING OR BORING OPERATIONS.

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

OPEN

THIS DRAWINGS IS CURRENTLY OPEN. IT IS NOT FOR CONSTRUCTION AND IS IN DRAFT FORM BETWEEN REVISIONS. IT IS FOR DISCUSSION PURPOSES ONLY.

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

REFERENCES:
DWG. 103 & 130
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
1	ISSUED FOR CLIENT REVIEW		09/08/15	
0	TEST PIT ISSUE		07/10/15	

REVISION

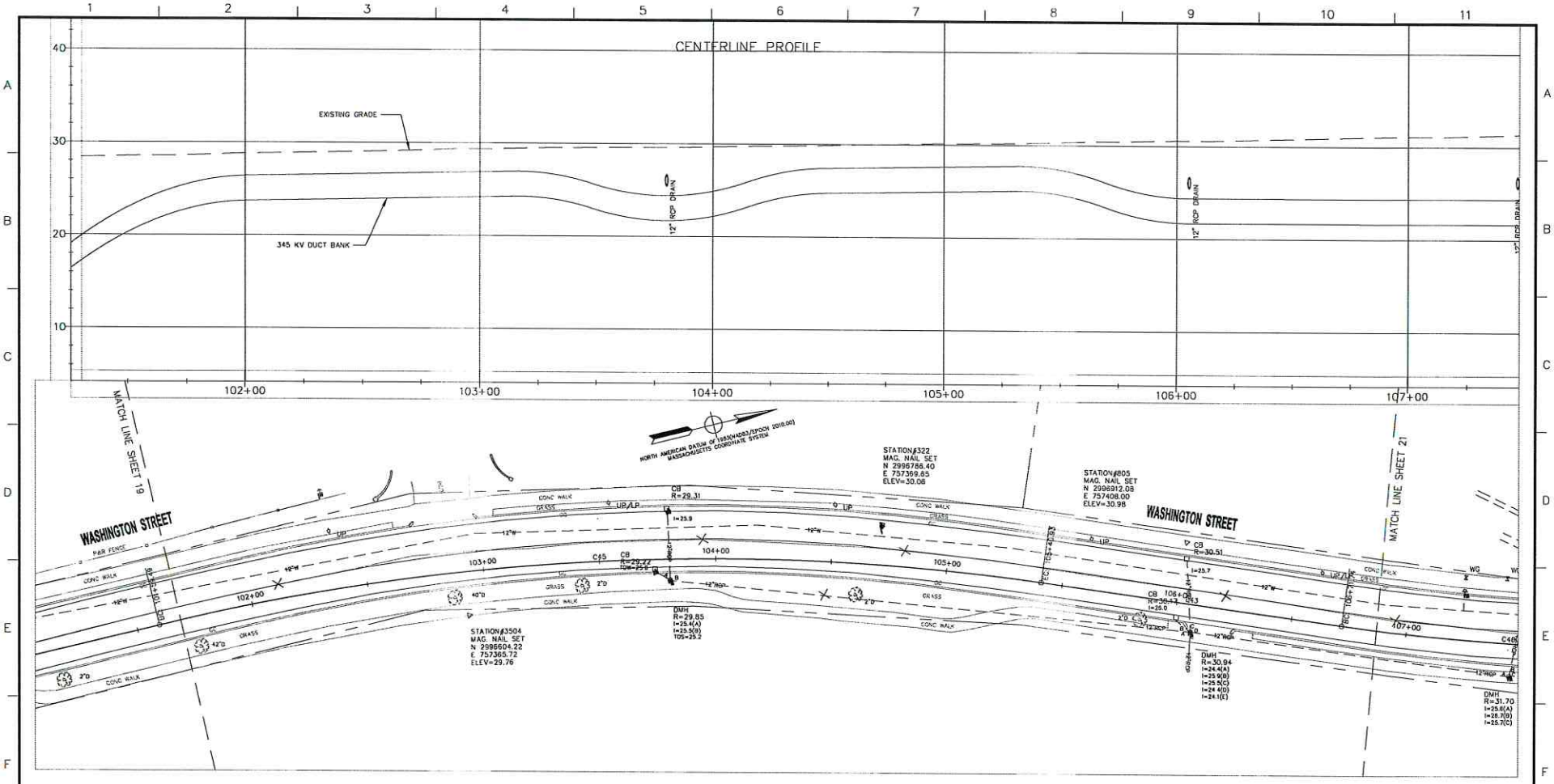
EVERSOURCE

345 kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
WASHINGTON AVENUE
PLAN 19 OF 83

SCALE: unless noted	DATE	DRAWN	CH'KD.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	029	1

325 WOOD ROAD
SUITE 109
BRAINTREE MA 02184
(781)380-7766
FAX (781)380-7757
SMC SURVEYING AND MAPPING CONSULTANTS

DRAWING NO. X12903



325 WOOD ROAD
SUITE 109
BRAINTREE MA 02184
(781)380-7765
FAX (781)380-7757
SMC SURVEYING AND MAPPING CONSULTANTS

DRAWING NO. X12903

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

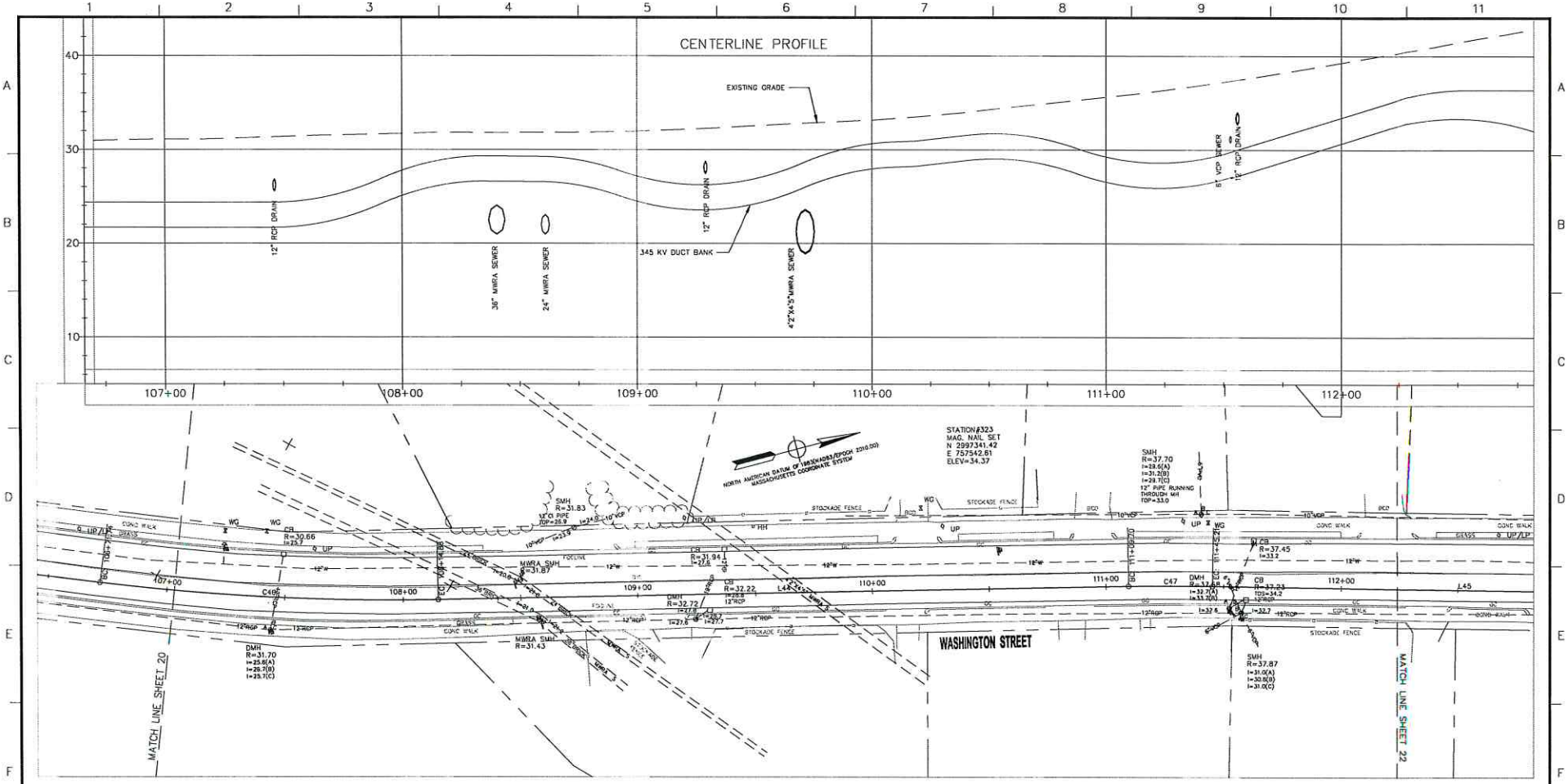
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET

PLAN 20 OF 83

SCALE: unless noted	DATE	DRAWN	CH'K'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	030	0



325 WOOD ROAD
SUITE 109
BRAINTREE MA 02184
(781)380-7766
FAX (781)380-7757
SMC SURVEYING AND MAPPING CONSULTANTS

DRAWING NO. X12903

NOT TO BE USED FOR CONSTRUCTION

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VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NO	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE

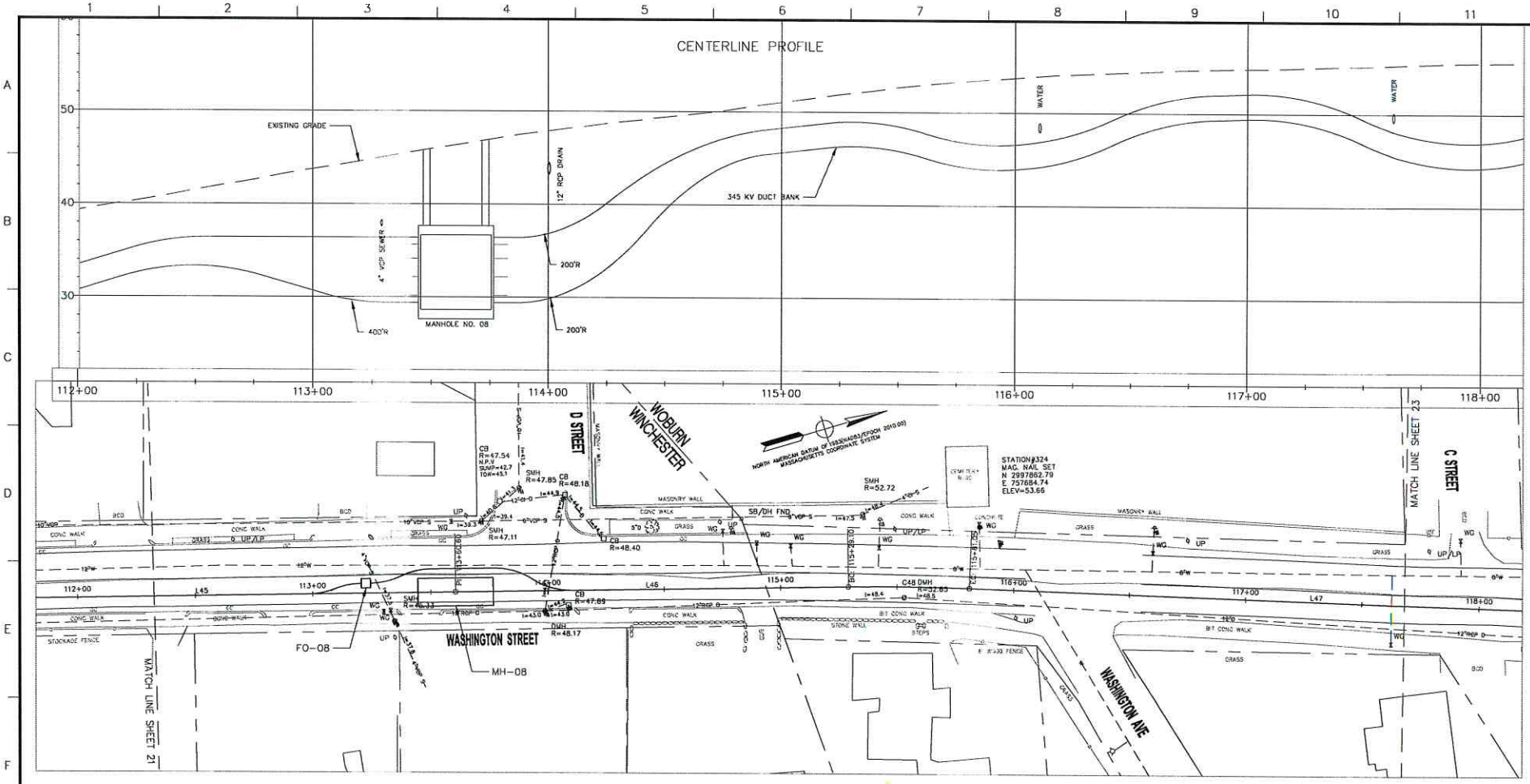
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

WASHINGTON STREET

PLAN 21 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	031	0



325 WOOD ROAD
SUITE 109
BRAINTREE MA 02184
(781)380-7766
FAX (781)380-7757
SMC SURVEYING AND MAPPING CONSULTANTS

DRAWING NO. X12903

VERT. SCALE 1" = 5'

HORZ. SCALE 1" = 20'

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

REFERENCES:
DWG. 140 TYPICAL MANHOLE DETAILS
DWG. 141 TYPICAL COMMUNICATION MANHOLE DETAILS

NO.	DESCRIPTION	BY	DATE	APPR.
0	ISSUED FOR CLIENT REVIEW		09/08/15	

REVISION

EVERSOURCE

345 kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
WASHINGTON STREET — PLAN 22 OF 83

SCALE: unless noted	DATE	DRAWN	CHK'D.	APPR.	DRAWING NO.	REV.
H: 1"=20' V: 1"=5'	09/08/15	SH/RB/MM		–	032	0

LINE TABLE		
Line #	LENGTH	BEARING
L1	9.493	N88° 56' 59.19"E
L2	142.933	N50° 50' 35.49"E
L3	240.657	N08° 06' 12.86"E
L4	101.332	N23° 41' 38.65"E
L5	157.054	N32° 30' 12.60"E
L6	97.078	N62° 44' 50.75"E
L9	241.858	N70° 57' 58.00"E
L10	17.898	N70° 26' 24.45"E
L11	400.534	S35° 35' 17.36"E
L12	193.622	N51° 43' 49.11"E
L13	79.303	N62° 48' 19.48"E
L14	30.610	N79° 37' 28.94"E
L15	164.380	N79° 37' 28.94"E
L16	286.659	N81° 54' 26.98"E
L17	162.441	S85° 26' 06.75"E
L18	360.129	S74° 46' 48.39"E
L19	16.000	S85° 32' 17.00"E
L20	40.038	S85° 32' 17.00"E
L21	198.390	S85° 34' 53.56"E
L22	519.429	N59° 57' 12.86"E
L23	221.583	N57° 38' 52.39"E
L24	28.441	N57° 49' 09.68"E
L25	59.984	N57° 38' 52.39"E
L26	199.498	S79° 50' 02.61"E
L27	10.787	S70° 54' 42.32"E
L28	187.673	S70° 54' 42.32"E
L29	161.961	S70° 54' 42.32"E
L30	16.995	S70° 54' 42.32"E

LINE TABLE		
Line #	LENGTH	BEARING
L87	22.500	N66° 23' 41.26"E
L88	169.834	N66° 23' 41.26"E
L89	840.533	N65° 59' 30.13"E
L90	251.356	N66° 10' 32.87"E
L91	204.129	N66° 35' 02.39"E
L92	48.567	N66° 35' 02.39"E
L93	43.936	N50° 26' 05.29"E
L94	383.674	N48° 52' 41.62"E
L95	86.554	N40° 31' 23.16"E
L96	346.662	N38° 00' 17.38"E
L97	49.386	N36° 18' 47.66"E
L98	22.500	N37° 41' 46.81"E
L99	22.500	N37° 41' 46.81"E
L100	256.940	N40° 36' 04.01"E
L101	243.882	N41° 21' 18.87"E
L102	10.628	N56° 53' 35.50"E
L103	469.103	N77° 04' 34.07"E
L104	447.804	N77° 04' 34.07"E
L105	484.536	N76° 35' 44.94"E
L106	232.699	N76° 34' 41.94"E
L107	76.080	N76° 34' 41.94"E
L108	98.174	N63° 11' 00.60"E
L109	415.100	N60° 32' 12.45"E
L110	7.855	N66° 37' 57.12"E
L111	166.593	N66° 37' 57.12"E
L112	138.138	N65° 49' 30.96"E
L113	57.451	N66° 39' 31.76"E
L114	47.932	N14° 14' 33.01"E

LINE TABLE		
Line #	LENGTH	BEARING
L31	339.251	S39° 42' 36.65"E
L32	145.734	S64° 30' 55.82"E
L33	26.000	S65° 59' 55.55"E
L34	26.000	S65° 59' 55.55"E
L35	379.142	S65° 59' 55.55"E
L36	65.760	N20° 45' 48.87"E
L37	51.720	N29° 08' 20.43"E
L38	211.942	N16° 01' 27.48"E
L39	167.797	N13° 26' 54.42"E
L40	22.500	N07° 45' 15.11"E
L41	32.300	N07° 45' 15.11"E
L42	186.093	N00° 00' 00.00"E
L43	130.818	N21° 51' 17.48"E
L44	294.818	N13° 39' 14.01"E
L45	215.390	N15° 41' 18.61"E
L46	168.501	N15° 41' 18.61"E
L47	298.582	N18° 39' 53.74"E
L48	180.796	N16° 24' 40.95"E
L49	848.245	N16° 12' 01.00"E
L50	197.431	N16° 12' 01.00"E
L51	95.770	N15° 46' 51.61"E
L52	285.187	N16° 08' 18.46"E
L53	242.200	S87° 31' 24.53"E
L54	22.187	N89° 58' 17.78"E
L55	23.615	N88° 54' 13.73"E
L56	171.342	N88° 54' 13.73"E
L57	27.961	N85° 45' 46.63"E
L58	198.873	N85° 45' 46.63"E

LINE TABLE		
Line #	LENGTH	BEARING
L115	151.364	N14° 14' 33.01"E
L116	197.456	N14° 34' 23.40"E
L117	23.460	N17° 18' 43.33"E
L118	397.217	N24° 02' 02.02"E
L119	249.220	N26° 41' 39.71"E
L120	174.920	N31° 59' 31.38"E
L121	309.220	N31° 59' 31.38"E
L122	85.264	N18° 32' 37.94"E
L123	331.577	N07° 46' 57.72"E
L124	939.368	N07° 46' 57.72"E
L125	712.506	N06° 39' 42.77"E
L126	148.949	N06° 39' 42.77"E
L127	5.000	N49° 20' 13.50"E
L128	121.654	N49° 20' 13.50"E
L129	10.000	N49° 20' 13.50"E
L130	697.504	S84° 18' 42.55"E
L131	67.541	N83° 46' 16.39"E
L132	304.806	N83° 46' 16.39"E
L133	210.663	N85° 13' 30.77"E
L134	122.460	N75° 07' 00.94"E
L135	79.892	N72° 58' 40.08"E
L136	591.957	N72° 38' 42.65"E
L137	48.238	N71° 45' 34.91"E
L138	615.871	N71° 45' 34.91"E
L139	257.158	N70° 50' 49.45"E
L140	66.076	S87° 58' 48.96"E
L141	400.465	S69° 07' 22.71"E
L142	69.750	S70° 28' 54.95"E

LINE TABLE		
Line #	LENGTH	BEARING
L59	156.080	N60° 42' 53.33"E
L60	284.882	N81° 30' 34.24"E
L61	364.371	N81° 30' 34.24"E
L62	22.500	N74° 22' 21.41"E
L63	328.679	N74° 22' 21.41"E
L64	19.202	N69° 49' 34.42"E
L65	254.434	N71° 40' 36.58"E
L66	156.437	N70° 35' 17.65"E
L67	14.422	N75° 14' 50.56"E
L68	145.959	N70° 35' 02.12"E
L69	373.505	N70° 35' 02.12"E
L70	85.971	S88° 42' 52.97"E
L71	42.917	N76° 15' 25.42"E
L72	101.192	N72° 06' 38.88"E
L73	258.192	S81° 46' 53.84"E
L74	221.305	S81° 46' 53.84"E
L75	189.449	N00° 00' 00.00"E
L76	655.325	N00° 01' 43.68"E
L77	25.708	N00° 09' 48.14"E
L78	140.819	N02° 05' 03.73"E
L79	273.961	N02° 05' 03.73"E
L80	189.779	N77° 58' 56.06"E
L81	83.253	N78° 05' 37.72"E
L82	98.763	N78° 01' 04.77"E
L83	163.865	N78° 35' 59.18"E
L84	129.136	N81° 24' 47.04"E
L85	270.816	N66° 23' 41.26"E
L86	22.500	N66° 23' 41.26"E

LINE TABLE		
Line #	LENGTH	BEARING
L143	22.500	S70° 28' 54.95"E
L144	127.423	S70° 28' 54.95"E
L145	79.167	S68° 38' 40.66"E
L146	13.530	S67° 27' 05.00"E
L147	436.594	S57° 10' 20.22"E
L148	333.254	S56° 08' 08.73"E
L149	237.533	S24° 26' 37.47"W
L150	4.893	S21° 00' 50.07"W
L151	22.500	S21° 00' 50.07"W
L152	22.500	S21° 00' 50.07"W
L153	31.760	S21° 00' 50.07"W
L154	188.232	S21° 00' 50.07"W
L155	228.528	S04° 56' 36.38"E
L156	147.837	S03° 58' 48.22"W
L157	74.217	S17° 33' 40.66"E
L158	22.500	S41° 31' 40.16"E
L159	26.538	S41° 31' 40.16"E
L160	41.518	S18° 49' 41.60"E
L161	99.194	S41° 46' 29.58"E
L162	10.000	S41° 46' 29.58"E

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C1	66.51	38° 06' 24"	100.00	34.537
C2	78.09	44° 44' 23"	100.00	41.155
C3	30.70	17° 35' 28"	100.00	15.472
C4	75.68	8° 48' 34"	500.00	38.514
C5	52.79	30° 14' 38"	100.00	27.023
C6	71.72	8° 13' 07"	500.00	35.922
C7	92.38	5° 17' 34"	1000.00	46.221
C8	83.20	4° 46' 01"	1000.00	41.622
C9	64.55	73° 58' 18"	50.00	37.658
C10	90.66	103° 53' 00"	50.00	63.863
C11	78.20	11° 12' 06"	400.00	39.227
C12	57.99	11° 04' 30"	300.00	29.085
C13	220.16	16° 49' 09"	750.00	110.879
C14	31.93	18° 17' 46"	100.00	16.103
C15	83.65	16° 00' 48"	300.00	42.198
C16	110.46	12° 39' 26"	500.00	55.454
C17	43.19	4° 56' 59"	500.00	21.611

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C69	92.55	8° 50' 16"	600.00	46.366
C70	103.95	9° 55' 35"	600.00	52.105
C71	41.33	4° 44' 08"	500.00	20.675
C72	81.99	9° 23' 41"	500.00	41.085
C73	81.39	4° 39' 48"	1000.00	40.719
C74	57.54	6° 35' 39"	500.00	28.804
C75	100.91	2° 30' 50"	2300.00	50.464
C76	145.05	16° 37' 16"	500.00	73.036
C77	157.38	15° 01' 42"	600.00	79.142
C78	72.37	4° 08' 47"	1000.00	36.199
C79	273.40	26° 06' 27"	600.00	139.114
C80	171.42	98° 13' 06"	100.00	115.481
C81	34.62	3° 58' 00"	500.00	17.315
C82	34.36	3° 56' 16"	500.00	17.189
C83	58.87	5° 37' 17"	600.00	29.458
C84	70.32	5° 45' 22"	700.00	35.192
C85	51.50	9° 50' 10"	300.00	25.814

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C137	375.64	10° 45' 40"	2000.00	188.372
C138	39.12	1° 07' 15"	2000.00	19.563
C139	114.84	10° 57' 58"	600.00	57.595
C140	43.07	53° 38' 29"	46.00	23.257
C141	28.99	3° 19' 18"	500.00	14.498
C142	346.78	49° 40' 22"	400.00	185.134
C143	104.00	11° 55' 01"	500.00	52.185
C144	12.69	1° 27' 14"	500.00	6.345
C145	88.21	10° 06' 30"	500.00	44.220
C146	39.48	4° 31' 25"	500.00	19.748
C147	103.99	11° 55' 00"	500.00	52.185
C148	45.85	5° 15' 14"	500.00	22.941
C149	6.39	0° 21' 57"	1000.00	3.194
C150	14.87	0° 51' 08"	1000.00	7.437
C151	15.93	0° 54' 45"	1000.00	7.964
C152	92.38	21° 10' 22"	250.00	46.725
C153	65.82	18° 51' 26"	200.00	33.213

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C18	136.18	15° 36' 17"	500.00	68.513
C19	112.01	5° 20' 53"	1200.00	56.045
C20	59.79	6° 51' 07"	500.00	29.933
C21	107.00	12° 15' 43"	500.00	53.708
C22	55.69	15° 57' 12"	200.00	28.025
C23	55.54	15° 54' 35"	200.00	27.948
C24	32.50	6° 12' 27"	300.00	16.267
C25	212.96	40° 40' 20"	300.00	111.189
C26	89.79	10° 17' 20"	500.00	45.015
C27	69.67	7° 59' 00"	500.00	34.890
C28	114.08	6° 32' 11"	1000.00	57.103
C29	123.87	6° 21' 54"	1115.00	61.996
C30	222.62	42° 31' 05"	300.00	116.718
C31	15.57	8° 55' 20"	100.00	7.802
C32	108.91	31° 12' 06"	200.00	55.844
C33	173.17	24° 48' 19"	400.00	87.965
C34	122.05	93° 14' 16"	75.00	79.363

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C86	41.44	7° 54' 54"	300.00	20.754
C87	77.89	89° 15' 35"	50.00	49.358
C88	116.60	13° 21' 42"	500.00	58.567
C89	35.08	4° 01' 10"	500.00	17.546
C90	40.30	4° 37' 05"	500.00	20.161
C91	48.81	2° 47' 48"	1000.00	24.410
C92	78.64	15° 01' 06"	300.00	39.544
C93	30.53	4° 22' 25"	400.00	15.274
C94	30.53	4° 22' 25"	400.00	15.274
C95	30.53	4° 22' 25"	400.00	15.274
C96	30.53	4° 22' 25"	400.00	15.274
C97	7.04	0° 24' 11"	1000.00	3.518
C98	89.73	5° 08' 28"	1000.00	44.896
C99	46.47	5° 19' 31"	500.00	23.253
C100	7.12	0° 24' 30"	1000.00	3.562
C101	84.56	16° 08' 57"	300.00	42.561
C102	79.01	9° 03' 16"	500.00	39.590

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C154	23.72	1° 21' 32"	1000.00	11.860
C155	17.34	9° 56' 09"	100.00	8.692
C156	17.34	9° 56' 09"	100.00	8.692
C157	12.83	1° 50' 14"	400.00	6.414
C158	10.41	1° 11' 35"	500.00	5.207
C159	89.70	10° 16' 45"	500.00	44.972
C160	18.09	1° 02' 11"	1000.00	9.046
C161	210.96	80° 34' 46"	150.00	127.163
C162	59.86	3° 25' 47"	1000.00	29.940
C163	6.40	12° 13' 06"	30.00	3.211
C164	21.33	12° 13' 06"	100.00	10.703
C165	21.33	12° 13' 06"	100.00	10.703
C166	6.40	12° 13' 06"	30.00	3.211
C167	271.82	25° 57' 26"	600.00	138.286
C168	77.87	8° 55' 23"	500.00	39.013
C169	112.79	21° 32' 27"	300.00	57.057
C170	131.93	25° 11' 48"	300.00	67.049

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C35	143.35	16° 25' 35"	500.00	72.169
C36	70.55	8° 05' 04"	500.00	35.333
C37	182.65	13° 04' 53"	800.00	91.724
C38	44.96	2° 34' 33"	1000.00	22.482
C39	32.98	1° 53' 23"	1000.00	16.493
C40	51.50	2° 57' 03"	1000.00	25.757
C41	117.90	6° 45' 19"	1000.00	59.020
C42	114.98	13° 10' 34"	500.00	57.746
C43	106.40	12° 11' 32"	500.00	53.400
C44	59.08	6° 46' 13"	500.00	29.575
C45	381.44	21° 51' 17"	1000.00	193.066
C46	143.13	8° 12' 03"	1000.00	71.689
C47	35.51	2° 02' 05"	1000.00	17.757
C48	51.95	2° 58' 35"	1000.00	25.980
C49	39.33	2° 15' 13"	1000.00	19.668
C50	7.37	0° 12' 40"	2000.00	3.684
C51	78.50	8° 59' 42"	500.00	39.329

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C103	65.43	7° 29' 52"	500.00	32.762
C104	72.91	8° 21' 18"	500.00	36.521
C105	76.01	8° 42' 36"	500.00	38.077
C106	54.03	6° 11' 30"	500.00	27.042
C107	64.96	7° 26' 37"	500.00	32.524
C108	79.72	9° 08' 06"	500.00	39.944
C109	67.08	9° 36' 30"	400.00	33.618
C110	57.42	8° 13' 31"	400.00	28.761
C111	54.89	7° 51' 44"	400.00	27.487
C112	75.17	10° 46' 01"	400.00	37.695
C113	13.16	0° 45' 15"	1000.00	6.581
C114	461.03	15° 32' 18"	1700.00	231.938
C115	88.06	20° 10' 58"	250.00	44.493
C116	54.22	3° 06' 24"	1000.00	27.117
C117	45.84	2° 37' 35"	1000.00	22.923
C118	68.55	7° 51' 17"	500.00	34.327
C119	68.70	7° 52' 20"	500.00	34.403

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C171	111.78	42° 41' 45"	150.00	58.627
C172	85.19	9° 45' 45"	500.00	42.701
C173	137.01	22° 25' 47"	350.00	69.396
C174	10.82	6° 11' 59"	100.00	5.416
C175	59.43	22° 41' 59"	150.00	30.109
C176	35.24	20° 11' 26"	100.00	17.804
C177	75.29	43° 08' 14"	100.00	39.529
C178	250.00	57° 17' 45"	250.00	136.576

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C52	74.84	8° 34' 32"	500.00	37.486
C53	63.99	6° 05' 38"	600.00	32.023
C54	67.73	6° 28' 03"	600.00	33.900
C55	66.62	76° 20' 17"	50.00	39.302
C56	48.59	2° 47' 03"	1000.00	24.302
C57	92.31	5° 17' 21"	1000.00	46.190
C58	51.53	8° 48' 48"	400.00	30.825
C59	54.07	7° 44' 44"	400.00	27.079
C60	54.82	3° 08' 27"	1000.00	27.416
C61	88.11	5° 02' 53"	1000.00	44.082
C62	13.87	0° 47' 41"	1000.00	6.935
C63	66.48	3° 48' 32"	1000.00	33.252
C64	66.48	3° 48' 32"	1000.00	33.252
C65	49.82	7° 08' 13"	400.00	24.945
C66	158.70	4° 32' 47"	2000.00	79.391
C67	99.91	9° 32' 28"	600.00	50.073
C68	119.29	11° 23' 30"	600.00	59.844

CURVE TABLE				
CURVE #	LENGTH	DELTA	RADIUS	TANGENT
C120	32.26	4° 37' 18"	400.00	16.141
C121	125.78	18° 00' 59"	400.00	63.413
C122	46.19	2° 38' 48"	1000.00	23.101
C123	41.72	4° 46' 50"	500.00	20.871
C124	94.91	10° 52' 34"	500.00	47.599
C125	61.49	7° 02' 47"	500.00	30.785
C126	54.45	6° 14' 21"	500.00	27.250
C127	67.37	7° 43' 11"	500.00	33.734
C128	60.09	6° 53' 10"	500.00	30.082
C129	91.48	52° 24' 59"	100.00	49.224
C130	93.30	5° 20' 45"	1000.00	46.684
C131	99.07	5° 40' 35"	1000.00	49.577
C132	47.80	2° 44' 20"	1000.00	23.906
C133	117.32	6° 43' 19"	1000.00	58.727
C134	46.43	2° 39' 38"	1000.00	23.221
C135	92.46	5° 17' 52"	1000.00	46.264
C136	586.79	13° 26' 53"	2500.00	294.748

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EVERSOURCE

CURVE TABLE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS

CURVE TABLE

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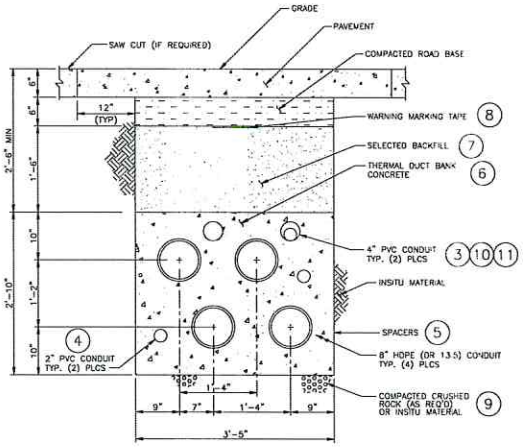
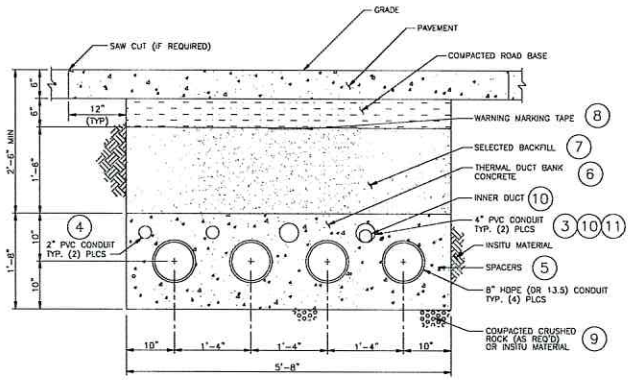


8" HDPE CONDUIT
2 X 2 DUCT BANK
SECTION 1
SCALE: 1" = 1'-0"



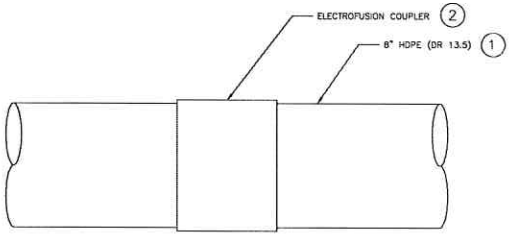
8" HDPE CONDUIT
1 X 4 DUCT BANK
SECTION 2
SCALE: 1" = 1'-0"

NOTES

1. THERMAL CONCRETE FOR DUCT BANK ENCASEMENT SHALL MEET PROJECT SPECIFICATIONS. MIX DESIGN SHALL BE TESTED AND APPROVED PRIOR TO INSTALLATION.
2. BACKFILL FOR DUCT BANK SHALL BE THERMALLY ACCEPTABLE. FLOWABLE THERMAL BACKFILL (FTB), SELECTED GRANULAR FILL, AND NATIVE SOIL ARE POSSIBLE BACKFILL MATERIALS. ALL BACKFILL MATERIALS SHALL BE APPROVED BEFORE INSTALLATION. ALL BACKFILL SHALL BE INSTALLED IN ACCORDANCE WITH THE SPECIFICATIONS.
3. CONDUIT SHALL BE RESTRAINED TO PREVENT FLOATING DURING ENCASEMENT. ONLY NON-METALLIC RESTRAINTS SHALL BE USED.
4. CONDUIT SPACERS SHALL BE ANCHORED BY MEANS OF REBAR STAKES OR ACCEPTABLE EQUAL.
5. ALL REINFORCING REBAR SHALL BE AT LEAST 2-INCHES FROM CONDUITS, FITTINGS AND ANCHORS, AND SHALL HAVE 3-INCHES MINIMUM CONCRETE COVER.
6. ALL CONDUIT ENDS SHALL BE SEALED AT THE END OF EACH WORKING DAY.
7. ONE INNERDUCT WITH INTERIOR PULL STRING IN ONE 4" PVC CONDUIT SHALL BE INSTALLED.
8. CONTRACTOR TO INSTALL WARNING MARKING TAPE ABOVE THE DUCT BANK 18 INCHES BELOW GRADE. CABLE MARKING TAPE SHALL BE PROVIDED BY THE CONTRACTOR TO COVER THE ENTIRE UNDERGROUND LENGTH OF THE CONCRETE DUCT. CABLE MARKING TAPE SHALL BE A 6-INCH WIDE (MINIMUM) PLASTIC STRIP WITH THE WORDS "CAUTION ELECTRIC LINE BURIED BELOW" PRINTED IN BLACK ON A RED BACKGROUND. THE TAPE SHALL BE INSTALLED FLAT AND DIRECTLY ABOVE THE DUCT BANK WITH THE PRINTED SIDE UP. TAPE SHALL BE INSTALLED AS INDICATED ON THE DRAWINGS.
9. 3" EDGE TO EDGE SPACING SHALL BE MAINTAINED BETWEEN CONDUITS AT ALL LOCATIONS.
10. ALL DUCT BANK DIMENSIONS ARE MINIMUMS.

BILL OF MATERIALS

ITEM NO.	ITEM DESCRIPTION	QUANTITY
1	8" HDPE DR 13.5 (40' LENGTHS)	180,000'
2	ELECTROFUSION COUPLERS	4,500'
3	4" PVC SCH 40, BELL AND SPIGOT	90,000'
4	2" PVC SCH 40, BELL AND SPIGOT	90,000'
5	CONDUIT SPACERS, RESTRAINTS, AND ANCHORS	AR
6	THERMAL DUCT BANK CONCRETE	AR
7	SELECT BACKFILL	AR
8	WARNING MARKING TAPE	45,000'
9	CRUSHED ROCK (AS REQ'D)	AR
10	1 1/4" ORANGE INNERDUCT	45,000'
11	PULL STRING	45,000'



HDPE COUPLING
DETAIL A
SCALE: 3" = 1'-0"

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REFERENCES:
DWG. 121 DUCT BANK CLEARANCES TO UTILITIES.

NO.	DESCRIPTION	BY	DATE
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REVISION

EVERSOURCE

345 kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
TRENCH DETAILS

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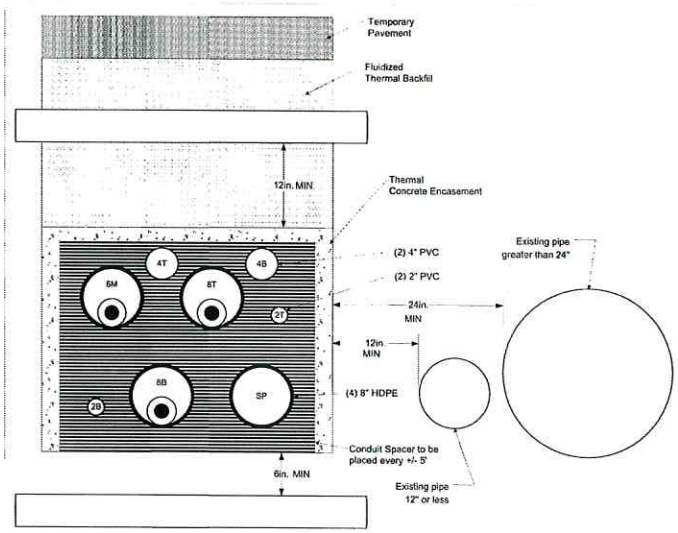

Figure 4
Single Line Installation
2 x 2 Trefoil Configuration
Minimum Clearance to Neighboring Utilities

Notes:

1. All pipe sizes are nominal
2. Minimum desired separation between outside of pipe surface and outside of foreign structures shall be as follows:

Structure	Minimum Separation
Concrete and Masonry	6"
Welded-Joint Gas and Water Pipes	12"
Communication, other Electric Supply Pipes and Bell-and-Spigot Joint Gas and Water Pipes	18"
Steam Lines	Alert Project Manager

NSTAR ELECTRIC

Standard 30' XLPE Manhole

Appendix XX
Sheet 3 of 3

NO.	DESCRIPTION	BY	DATE
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EVERSOURCE

345 kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
DUCT BANK CLEARANCES TO UTILITIES

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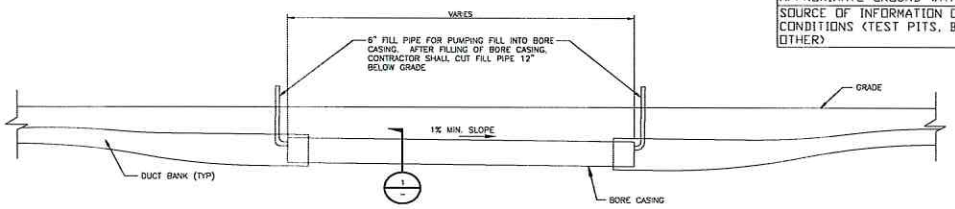
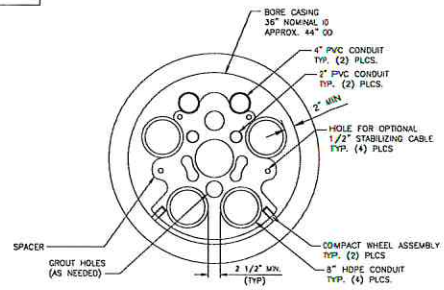
PIPE CROSSING DATA SHEET		
	CARRIER PIPE	CASING PIPE
CONTENTS TO BE HANDLED	8" HDPE 4" & 2" PVC	REINFORCED CONCRETE PIPE
NORMAL OPERATING PRESSURE	NONE	NONE
NORMAL SIZE OF PIPE	8", 4" AND 2"	36"
O.S. DIAMETER	8.625"	44"
I.S. DIAMETER	7.27"	36"
THICKNESS WEIGHT	"LATER"	"LATER"
PER FOOT MATERIAL	"LATER"	"LATER"
PROCESS OF MANUFACTURE	EXTRUDED	"LATER"
GRADE OR CLASS	DR 13.5 FOR HDPE SCH 40 FOR PVC	"LATER"
TEST PRESSURE	NONE	NONE
TYPE OF JOINT	BUTT FUSION FOR HDPE COUPLING FOR PVC	"LATER"
TYPE OF COATING	NONE	"LATER"
DETAILS OF CATHODIC PROTECTION	NONE	NONE
DETAILS OF SEAL OR PROTECTION AT ENDS OF CASING	"LATER"	"LATER"
CHARACTER OF SUBSURFACE MATERIAL AT THE CROSSING LOCATION	"LATER"	"LATER"
APPROXIMATE GROUND WATER LEVEL	"LATER"	"LATER"
SOURCE OF INFORMATION ON SUB-SURFACE CONDITIONS (TEST PITS, BORINGS OR OTHER)	"LATER"	"LATER"

NOTES

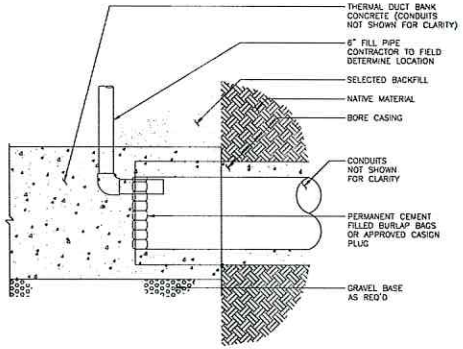
1. EACH BURLAP BAG SHALL BE FILLED WITH CEMENT AND WET DOWN WITH WATER PRIOR TO CONCRETE ENCASEMENT TO ENSURE THAT THE CEMENT IN THE BAG DOESN'T EXTRACT WATER FROM THE ENCASEMENT CONCRETE. THESE BAGS SHALL NOT BE REMOVED AND SHALL REMAIN AS A PERMANENT PART OF THE BACKFILL. THE SIZE OF EACH BAG SHALL BE APPROXIMATELY 8" HIGH X 8" IN DIAMETER. THE BAGS SHALL BE ARRANGED IN A MANNER THAT WILL PLUG THE END OF THE CASING PIPE AND PREVENT INFILLTRATION OF CONCRETE INTO THE CASING PIPE. CONTRACTOR MAY ELECT AN ALTERNATE BULKHEAD PROCEDURE. ALL PROCEDURES SHALL BE APPROVED AS SPECIFIED IN CONTRACT.
2. BORE CASING SHALL BE COMPLETELY BACKFILLED WITH A THERMALLY ACCEPTABLE SLURRY. CONTRACTOR SHALL ENSURE ALL VOIDS BETWEEN CASING AND INTERNAL CONDUITS ARE FILLED WITH SLURRY. THIS SLURRY SHALL BE AS INDICATED AND TESTED IN THE SPECIFICATION.
3. CONTRACTOR SHALL FURNISH AND INSTALL CASING PIPE SPACERS. SPACERS SHALL BE INSTALLED A MAXIMUM DISTANCE OF 5 FEET APART. SPACERS SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
4. STEEL REBAR WITHIN THE DUCT BANK SHALL NOT FORM A CLOSED LOOP AROUND ANY INDIVIDUAL 8-INCH HDPE CONDUIT. REBAR LOOPS ARE ACCEPTABLE WHEN ENCIRCLING ALL CONDUITS. TO AVOID FORMING LOOPS AROUND INDIVIDUAL CONDUIT, THE CONSTRUCTION CONTRACTOR SHALL INSTALL A RUBBER HOSE ON THE TIE REBAR AND SECURELY FASTEN THE REBAR TIES TOGETHER WITH APPROPRIATELY SIZED NYLON CABLE TIES. CONTRACTOR SHALL DISCUSS WITH ENGINEER FOR CLARIFICATION IF REQUIRED.
5. SECURE CONDUITS TO SPACER BY NON-METALLIC BANDING OR POLYPROPYLENE STRAPPING.
6. CASING SECTION COLLARS SHALL BE APPROVED BY EVERSOURCE. STEEL COLLARS MAY NOT BE ACCEPTABLE AND MUST BE REVIEWED FOR ELECTRICAL INTERFERENCES.
7. 8" HDPE CONDUITS SHALL BE BUTT FUSION CONNECTED.



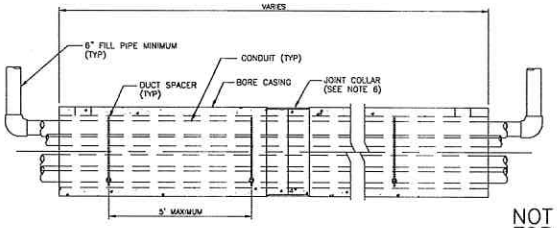
TYPICAL JACK AND BORE INSTALLATION
SCALE: NTS



SECTION 1
TYPICAL BORE CASING
SCALE: NTS



TYPICAL BORE CASING/
DUCT BANK INTERFACE
SCALE: NTS



SIDE VIEW
TYPICAL BORE CASING
SCALE: NTS

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AUGER BORING & DUCT INTERFACE DETAILS
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM & WAKEFIELD, MASSACHUSETTS
JACK & BORE DETAILS

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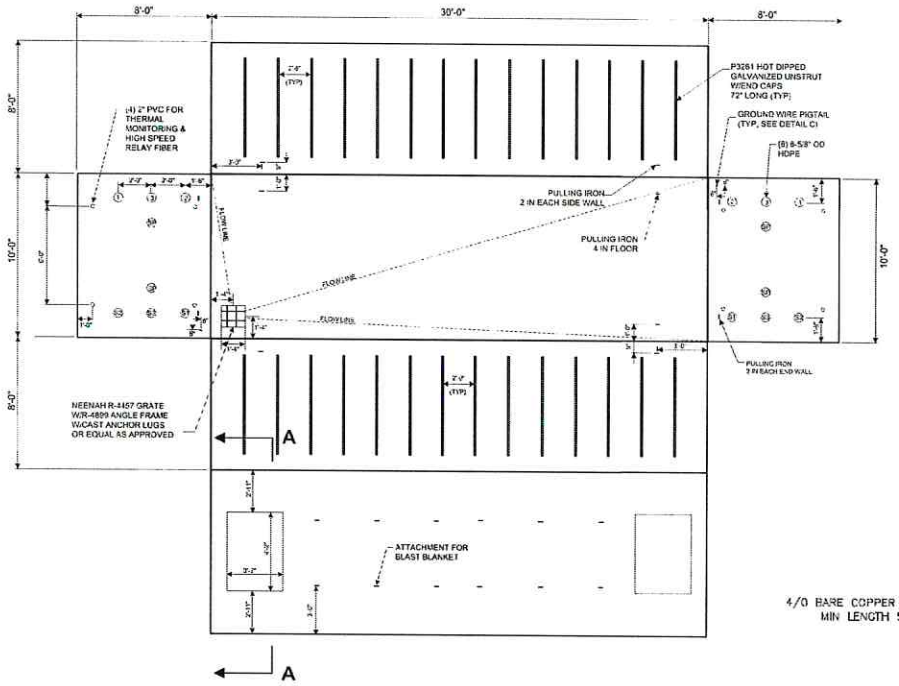


Figure 1
Typical XLPE 30' Manhole
Plan

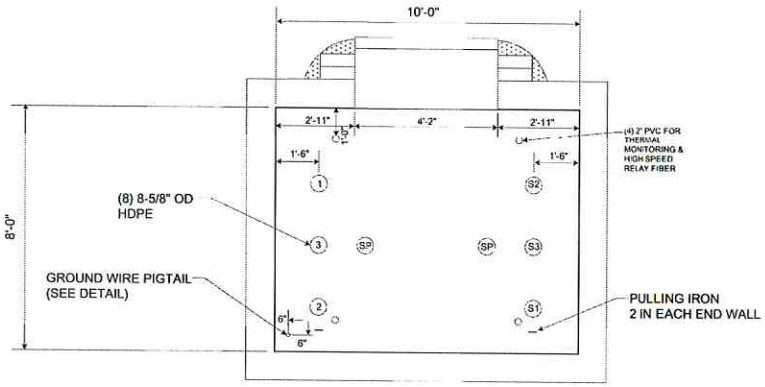
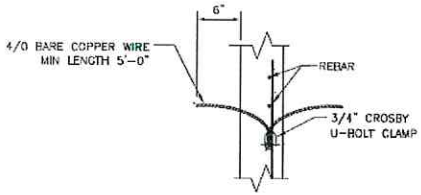


Figure 2
Section A-A
End View



GROUND WIRE DETAIL "C"
N.T.S

Figure 3
Detail "C"

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345kV LINE
STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION
WINCHESTER, WOBURN, STONEHAM, & WAKEFIELD, MASSACHUSETTS
345kV MANHOLE DETAIL SHEET — SHEET 0

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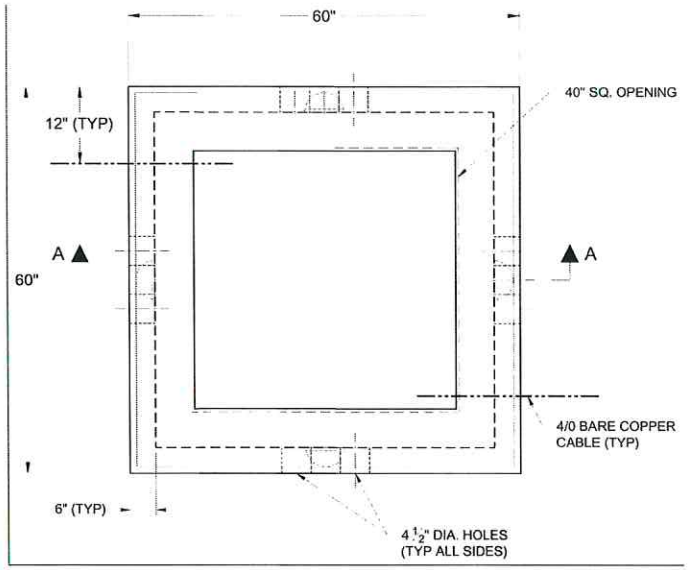
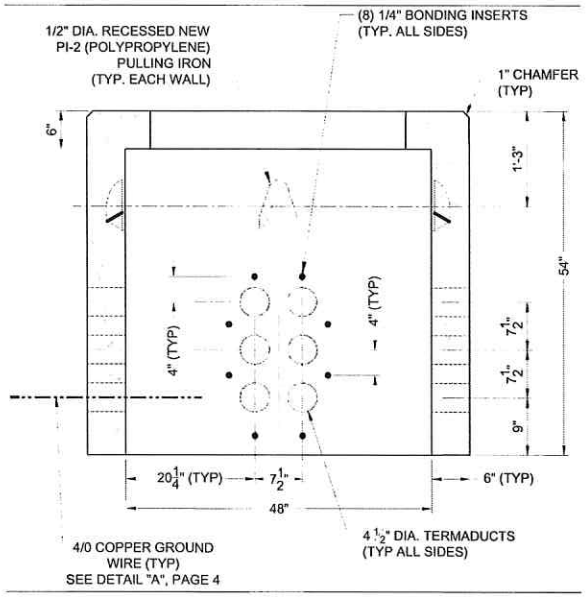


PLAN

NOTE: DRAWING IS NOT TO SCALE



SECTION A-A

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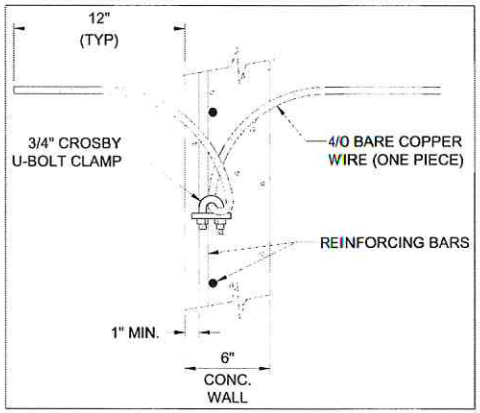

DETAIL "A"

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345kV LINE

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM, & WAKEFIELD, MASSACHUSETTS

COMMUNICATION MANHOLE DETAILS

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P1

P2

P3

P4

P5

P6

P7

P8

P9

P10

P11

P12

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CROSSING PHOTOS

STATION 211, WOBURN TO NATIONAL GRID WAKEFIELD SUBSTATION

WINCHESTER, WOBURN, STONEHAM, & WAKEFIELD, MASSACHUSETTS

CROSSING PHOTOS 1–12

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Town of Winchester, Massachusetts
Weston & Sampson Project No. 2160381

July 1, 2016

Beth Rudolph, PE
Town Engineer
Town of Winchester
71 Mount Vernon Street
Winchester, MA 01890

Re: Constructability Review for Proposed 345kV Line, Plan and Profile Drawings 14-32

Ms. Rudolph:

In accordance with our Agreement for Engineering Services, dated May 12, 2016, titled, Engineering Services for the Constructability Review of Proposed Station 211, Woburn to National Grid Wakefield Substation 345kV Line, Weston & Sampson is pleased to present our findings. Our review is based on Black & Veatch Corporation's plans dated September 08, 2015 and titled "Station 211, Woburn to National Grid Wakefield Substation 345kV Line", stamped "Issued to Town of Winchester on" October 27, 2015" (the "Plans"). Specifically, our review will be limited to Drawing Nos. 14 – 32 (19 plan sheets).

LONG TERM UTILITY AND ROADWAY IMPACTS

- In general, proposed vertical and horizontal alignments show limited priority for protection of existing utilities and mitigation of long term impacts to the future availability of utility corridors. Both Cross Street and Washington Street are highly congested with existing utilities, including main transmission lines and local services, both public and private. Proposed layouts for 345kV line maximize utilization of available corridor assets in apparent effort to mitigate construction costs. The proposed layout bisects available utility corridors ranging in widths of 12-15 feet at several locations, including the following extended runs:
  - STA 38+00 to STA 43+50 Cross Street (Central & Holton Street routes)
  - STA 73+00 to STA 76+50 Cross Street (Central route only)
  - STA 101+00 to STA 113+00 Washington Street (Central route only)

- Proposed layouts will require more expensive provisions for future public utility improvements, including:
  - Added cost to protect shallow duct bank adjacent to or directly within excavation limits of new sewer and drain (rehabilitation or replacement)
  - Added cost to install temporary water bypass with new in-line water main replacement (compared to offset installation afforded by otherwise available utility corridor)

Recommend designer establishes criteria for proposed duct bank layout that will mitigate seizure of existing available utility corridors while protecting adjacent existing utilities and supporting sub-grades. These criteria (e.g., offset distances) will depend on the depth and horizontal offset of the proposed duct bank and the adjacent utility as well as the age and material of the existing utility.

- Exposure of existing utilities (e.g., vitrified clay pipe sewers) to potential damage and/or failure due to differential settlement of disturbed trenches or undermining of sub-grade during installation of proposed duct bank.

  Recommend provisions for pre-construction inspection of all adjacent sewers, drains and related structures to evaluate repair or replacement needs prior to installation of duct bank. In addition, require that pre-existing conditions survey includes video record of surface conditions along the full extent of the route, within the public way and along the abutting private properties, to document basis for final surface restoration measures.

- Buried services to abutting properties are not shown on the drawings. The proposed layout will impact numerous water and sewer service connections. Private abutters are responsible for sewer services from property to the main line sewer. Contract provisions must be included to protect and/or permanently relocate existing utilities to ensure the integrity of utilities being crossed. It is expected that a number of galvanized steel and lead water services will be encountered during construction. It is critical that all measures are taken to mitigate the likelihood of construction impacts on private services. Any damage to sanitary sewer services could contribute to additional system infiltration and/or trigger additional IDDE work to be in compliance with Winchester's NPDES MS4 Permit.

  Recommend installation of proposed duct bank <u>under</u> all existing sanitary sewer and domestic water services, including provisions to replace all non-copper water services and all non-pvc sewer services from the main to the curb line. Replace all vitrified clay sewer services (typical 5-inch diameter) with 5-inch PVC pipe and all steel/iron pipe water services with copper tubing (minimum 1-inch diameter).

- As proposed, minimum cover (2.5 feet) for duct bank installation is inadequate to provide minimum cover and protection for existing and future utility services.
  - Relocated water services (above proposed duct bank) exposed to freezing
  - Relocated water, gas, etc. services (above proposed duct bank) exposed to damage/disruption during any future full-depth roadway restoration
  - Permanent limitations imposed on existing properties ability to install deeper gravity sewer connections or basement services where duct bank is shallower than existing sewer service connections

  Recommend 6 foot minimum cover for proposed duct bank to address majority of anticipated vertical conflicts. In addition, recommend pre-construction review of available record data for existing sewer and water services, as well as comprehensive

sill elevation survey to ensure protection of existing private service corridor/asset related to gravity service for basement facilities.

- Trench details indicate 6-inch compacted gravel sub-base for 6-inch permanent trench pavement restoration. Typical provision is 12-inch compacted gravel sub-base to adequately support pavement restoration especially on heavily trafficked roadways. Differential settlement of utility trench will require future maintenance.

  Town has indicated that they will require final pavement restoration to include curb-to-curb overlay. Recommend pavement restoration measures include minimum 4-inch temporary trench pavement with 14-inches of compacted gravel sub-base, installed weekly to follow progress of work; and, 2-inch curb-to-curb milling, 4-inch permanent trench pavement and 2-inch curb-to-curb overlay. Final pavement restoration shall be performed during Spring season following completion of excavation work (not less than 90 days) to allow trenches to settle.

- Risks associated with impacts to adjacent ferrous utilities due to inadequate clearances and/or measures to mitigate inductance effects created by 345kV line.
  Recommend obtaining an expert opinion on the long term effects of 345kV line on adjacent existing ferrous infrastructure.

SHORT TERM CONSTRUCTION IMPACTS

- In general, the progress drawings inadequately represent existing conditions as they relate to known active public utilities. As noted in Town review markups, numerous instances of improperly located or undetected public sewers and drains are indicated throughout the proposed route, including:
  - Cross Street sewer in vicinity of Loring Avenue (STA 44+00 to STA 48+00)
  - Cross Street drain in vicinity of River Street (STA 49+00 to STA 50+00)
  - Cross Street drain in vicinity of Conant Road (STA 55+50 to STA 56+00)
  - Washington Street sewer in vicinity of Andrea Circle (STA 97+00 to STA 99+00)

  Coupled with the apparent design criteria to minimize proposed excavation depths, the likelihood of
  utility conflicts and progress delays during construction is high.

  Recommend final design documents fully acknowledge Town's utility review comments as a condition for final approval for solicitation of construction bids.

- As proposed, documents do not reflect prevailing control of work provisions, including:
  - DIGSAFE notice
  - Trench support per 520 CMR 14.00 (re: Jackie's Law, MGL c.82A)
  - Work hour limits
  - Scheduled interruption or relocation/operation of existing utilities

Recommend bid documents fully detail work hour limits, including daytime restrictions to mitigate traffic impacts (e.g., public school bus routes along Washington Street) and nighttime restrictions related to multiple work shifts. In addition, seasonal roadway permit restrictions (e.g., limitations between November 15th and April 15th) shall be identified.

- It is unclear how construction activity will be able to maintain access to abutting properties (driveways). Daily full depth pre-trenching (estimated at 80-100 lf), as required to identify utility conflicts and duct bank configurations, will result in temporary impacts. Layouts in close proximity to existing curb line/driveway cuts are especially vulnerable to these impacts (e.g., Cross Street STA 78+00 to STA 84+00). The urgency of these impacts will vary but could include emergency vehicles, commercial deliveries, owner access/egress, school bus pick-up/drop-off, etc. While jack and bore operations on Washington Street will likely require a temporary detour, access must be maintained for abutting properties, including public and private concerns (e.g., Shields Health Care at 620 Washington Street). Documents do not indicate any mitigating provisions for advance notice to abutters regarding approaching activity and anticipated short term construction impacts to property access.

Recommend adequate control of work provisions are clearly detailed within the bid documents to mitigate issues related to abutter impacts.

- Installation of 30' long precast XLPE MHs may require use of several temporary laydown areas further impacting access to the right-of-way and/or adjoining side streets (e.g., MH-04 at Loring Avenue & MH-06 at Collamore Street). Control of work provisions required to limit these impacts. In addition, proposed MH depths must accommodate proximity and required vertical clearances for existing utilities (e.g., 8-inch sewer at MH-05 & 12-inch water main at MH-04, MH-05, MH-06 & MH-07).

Recommend adequate control of work provisions are clearly detailed within the bid documents to mitigate issues related to abutter impacts.

- Special provisions required for coordination with MWRA to protect existing sewers, especially in locations in close proximity to the 24"x36" brick interceptor sewer (e.g., Cross Street locations at MH-03 and crossing at STA 58+50 opposite Adams Road). Depending upon the condition of the mortar, egg-shaped brick sewers may be especially vulnerable to sub-grade disturbance and vibration associated with construction activity. Indeterminate locations and depths of MWRA sewer shall be verified by test pit exploration.

Recommend designer coordination with MWRA to ensure that final design documents clearly depict all agency utilities and include the required provisions for control of work in their vicinity.

- Proposed layout along Cross Street opposite Highland View Avenue conflicts with existing gas regulator array. Congestion of utilities, including multiple structures/valves, along Cross

Street between Verplast Avenue and Adams Road severely restricts layout options for proposed duct bank along either side of the roadway.

Coordination with Keyspan Energy (gas utility owner) required to evaluate restrictions controlling proposed layout.

- Layout of intermediate jacking pit at RR/river crossing along Cross Street and jacking pits at river crossing along Washington Street provide inadequate safe clearances for temporary jersey barrier/CLF perimeter and minimum lane width for alternating traffic. Edge of excavation to existing curb line at the intermediate pit for the combined RR and river crossing on Cross Street measures 17 feet. Similar clearances for the two jacking pits on Washington Street measure 11 feet. The depth and proximity of the pits to an active travel lane presents a severe hazard. Optional detour routes for Cross Street are restricted by limited proximity of RR grade crossings/overpasses and/or overhead clearances at underpasses.

Jack and bore installations on Cross Street and Washington Street highlight the lack of a comprehensive Traffic Management Plan. Coordination and development of a workable plan, including temporary detour routes, is vital for mitigation of construction phase impacts. The plan should be made part of the design documents.

- Increased traffic delays are likely due to the prevailing requirement for alternating one-lane roadway access during construction activity. Additional delays will include the following:
  - Disruption and delays to scheduled school bus route(s) are likely. Reduced working hours may be required.
  - Disruption and delays to emergency vehicle access route to Winchester Hospital will require coordination with local emergency management services to comply with prevailing regulations.
  - HASP/Control of Work provisions shall comply with any related regulations governing access along emergency evacuation routes.
  - Impacts on available resources for traffic details will be significant, likely overwhelming local police capacities

Recommend comprehensive analysis of daily traffic control needs based on anticipated construction means and methods and prevailing work hour limitations. Identifying staffing capacities and anticipated shortfalls will be required to adequately address secondary resources. Otherwise, project may jeopardize sufficient enforcement of public safety during construction.

- No fewer than ten closed sites and one open site within immediate proximity of the proposed route are included within MassDEP's Waste Site List. Sites are primarily related to reportable releases or threats of release associated with fuel oil or diesel fuel. The open (or active) site is associated with a lagoon on the site of a former industrial/manufacturing property located at 134 Cross Street and immediately opposite the proposed RR/river jack and bore location. The site is adjacent to youth soccer fields and the Muraco Elementary

School, further highlighting the critical need to include adequate provisions for control of work. Investigation of any potential encounter with hazardous materials must be performed prior to the start of construction to mitigate the risk of significant delays in the progress of work. Phase I borings indicate PID readings of ND to 60 ppm VOCs. Higher readings may warrant further investigation to supplement current soil pre-characterization data. None of these sites are shown on the plans.

Recommend additional research be performed to identify relevant MassDEP Waste Sites along the proposed route and to depict them on the drawings. Potential for handling contaminated soils during construction, especially at the jack and bore site on Cross Street, highlights lack of provision for a comprehensive Materials Management Plan. Submittal of a comprehensive plan should be made as a requirement of the contract documents, and the limitations imposed to ensure public health and safety shall be detailed within the documents. The plan shall apply to the temporary stockpiling, characterization and disposal of contaminated soils, as well as the handling of non-contaminated surplus excavate.

- Holton Street at Cross Street acts as direct access for bulk deliveries to commercial/industrial properties. Work in this vicinity will have a direct impact on available turning radii for up to 53' trailers.

  Location impact emphasizes requirement for adequate controls (notices, signage, police details, etc.) to mitigate impacts to local businesses throughout the proposed route. Reduced or modified working hours may be required.

- Provisions required to cut-in new water gates to maintain or provide adequate controls to side street service mains (e.g., Adams Road). These measures are necessary to mitigate extent and duration of service interruptions.

  Recommend coordination with Town personnel to identify specific locations where permanent water system improvements will be required in advance of proposed work. Improvements shall be included within the scope of the Eversource project.

Weston & Sampson appreciates the opportunity to present our findings. We are available at your earliest convenience to discuss our report. I may be reached at (978) 532-1900 x2280 or elmerd@wseinc.com.

Very Truly Yours,

WESTON & SAMPSON ENGINEERS, INC.

7/1/2016

X

David M. Elmer, PE
Vice President
Signed by: David Elmer

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