Coastal Resilience Grant Program

Feasibility Study:

Elevation of Apple Street for Alternate Transportation Route

Essex, MA

Prepared for: **Town of Essex**
Essex, MA

Prepared by: **TEC, Inc.**
Andover, MA
TEC Project #T1043
March 29, 2021

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I. INTRODUCTION

PURPOSE OF STUDY

The Town of Essex has received a grant under the Coastal Resilience Grant Program to study the feasibility of raising a section of Apple Street, which is subjected to tidal surge flooding during storm events. This report will evaluate alternatives to raise a section of Apple Street above the measured flood elevation of 13.7' (NAVD 88). The Massachusetts Sea Level Rise and Coastal Flooding Viewer, developed by the Massachusetts Office of Coastal Zone Management, was used as the study's flooding evaluation tool. The four alternatives that are examined as a part of this study include raising Apple Street to a minimum 14.0' and 15.3'. Both profile increases are further analyzed with and without a retaining wall along the northern side. The elevation of the existing roadbed is approximately 11.0', meaning that all alternatives presented here provide a significant roadway elevation increase over the existing conditions. While the design may not be sufficient to stay above the highest tidal storm surges decades in the future, a variety of limitations, discussed herein, prevent additional elevation in the present day.

PROJECT DESCRIPTION

The Town of Essex is divided north to south by a coastal causeway on Route 133, with approximately half of the community on either side of the causeway. The causeway carries approximately 16,841 vehicles per day (VPD)[1]. During coastal storm surge events, the causeway typically floods, making Route 133 impassable, requiring all traffic to be detoured. If a particular coastal surge event is large enough, the only other roadway in Essex linking both halves of the community (Apple Street) also floods. While engineering complexities surrounding the Route 133 causeway do not allow that transportation route to be easily elevated out of the coastal surge area, it is possible to elevate a short portion of the Apple Street roadbed, which would provide a critical second transportation connection within the Town when the Route 133 causeway is flooded.

Most of Apple Street, the only other north-south transportation link in Essex, is well above the coastal surge elevation. However, during the coastal storms of early 2018, it was evident that two low areas at the Southern Avenue end of Apple Street are vulnerable to tidal surge flooding, splitting the community in half, from north to south. The only other alternative travel path involves a long detour out to Route 128, with access to the other half of Essex requiring circuitous travel through other towns and increasing travel times substantially. Since the current low spots at the southern end of Apple Street cause a serious transportation cutoff risk, roadbed elevation adjustments in this area would alleviate this vulnerability for several decades (since the rest of Apple Street is well above the coastal flood elevation). This feasibility

[1]Source: MassDOT 2019 traffic count – Essex – Main Street at causeway.

study will evaluate alternatives to raise Apple Street above the 13.7’ measured flood elevation to provide significant added resiliency for the future sea level rise and future potential for adaptive management. The flood of January 2018 that reached an elevation of 13.7 was an anomaly of a storm. However, given the potential for future sea level rise, storms of this magnitude will likely become a more common occurrence.

II. EXISTING CONDITIONS

STUDY AREA

Apple Street is a two-lane, north-south, local roadway under Town of Essex jurisdiction carrying approximately 821 VPD[2]. The roadway provides a connection between Martin Street (Route 22) to the north and Southern Avenue to the south. In the vicinity of the project area, Apple Street is approximately 18 feet wide with no pavement markings. The project area road segment actually runs roughly east-west, even though the road generally runs north-south when its entire length is considered. The posted speed limit along Apple Street is 20 miles per hour (mph). Apple Street serves as an important link between the northern and southern sections of the community.

There are two low points on Apple Street that are subject to flooding. The first is where an unnamed tributary to the Essex River crosses under Apple Street via a 36-inch diameter high-density polyethylene (HDPE) culvert approximately 120 feet north of Southern Avenue. The town is proposing to replace the existing culvert for ecological improvement, while also elevating the road to be less prone to flooding. This work will be done under a separate project and is being pursued through different grant avenues. There is a second low point about 400 feet in length located approximately 200 feet north of the culvert which also is subject to flooding. This low point is the focus of this feasibility study.

An existing conditions survey was performed by Meridian Associates, Inc. (MAI) between October 29 & November 2, 2020 and an Existing Conditions Plan dated November 18, 2020 was prepared (see Appendix A). Derosa Environmental Consulting, Inc. conducted a site evaluation to determine the extent of wetland resource areas within the project area in accordance with the methodology described in the Massachusetts Wetlands Protection Act (MGL Ch. 131 Sec. 40) and its Regulations at 310 CMR 10.00, et seq., as well as guidance documents prepared by the Massachusetts Department of Environmental Protection (MADEP), including the *Guide to Inland Vegetated Wetlands in Massachusetts*, dated March 1988, and, Appendix G of *Delineating Bordering Vegetated Wetlands Under the MA Wetlands Protection Act*, dated March 1995 and its implementing regulations (310 CMR 10.00). A series of wetland flags were placed to demarcate these boundaries. These boundaries can be seen on the Existing Conditions Plan provided by MAI.

[2] Source: Town of Essex Police Department - traffic count, Apple Street- east of Turtleback Road, April 2019.

Figure 1

Project Location Map

TEC, Inc.
146 Dascomb Road
Andover, MA 01810
978-794-1792
www.TheEngineeringCorp.com

EXISTING CONDITIONS PHOTOS

Apple Street – Looking West (to reach the north part of town)

Apple Street – Looking East (to reach the south part of town)

III. PROJECT PARAMETERS AND CONSTRAINTS

ENVIRONMENTAL

This section of roadway is located within a riverfront area, within the FEMA flood zone AE (100-year flood elevation 10'), within a MassWildlife Natural Heritage & Endangered Species Program (NHESP) Natural Community, and is located immediately adjacent to bordering vegetated wetlands (BVW). The project will require a Notice of Intent filing with the Conservation Commission for work within the BVW. The work will also require an Army Corps Pre-Construction Notification (PCN) general permit.

There are also several, mature trees along both sides of Apple Street. The canopy layer within the wetland resource area consists principally of red maple. Species in the upland areas include hickory, red oak, American beech, and white pine. Raising Apple Street would impact the BVW and require removal of some existing trees. The project will require an Environmental Notification Form for the removal of five or more public shade trees to be submitted for review under the Massachusetts Environmental Policy Act (MEPA). The environmental impacts are summarized below for each alternative.

ROADWAY CROSS SECTION

The existing roadway width is approximately 18' wide. In order to raise the road, Apple Street would need to be closed and a detour put in place during construction. Vehicles could detour via Martin Street, Main Street (Route 133), and Southern Avenue. This route is approximately 0.7 miles longer then travelling along Apple Street. There are no intersecting roadways or driveways within the project area that would be directly impacted by the roadway closure.

UTILITIES

There are several utility poles with overhead wires located along both sides of Apple Street. These poles would need to be relocated to accommodate raising the roadway. There is one existing catch basin located on the southerly side of Apple Street that outlets via an existing 12" R.C.P. to the wetlands on the north side. The drop inlet and pipe will need to be replaced, which will capture drainage from the upland side (south side) of Apple Street and direct it to the north side of Apple Street. There are no known underground utilities located on Apple Street.

IV. ALTERNATIVES ANALYSIS

ALTERNATIVE 1 – RAISE APPLE STREET TO ELEVATION 14.0'

This alternative would raise Apple Street to a minimum elevation of 14.0', which is above the measured flood elevation of 13.7. This would alleviate the roadway being overtopped during the 10-year and 25-year flood events. This alternative results in raising the existing low point on Apple Street a total of 3.2'. Apple Street would also be widened slightly to 20' to provide two 10' travel lanes to meet the minimum criteria for width of a local road per the American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets, 7th edition – Table 5-5. The roadway would be reconstructed with full depth pavement, and side slope treatments would consist of 2:1 vegetated side slopes with 1.5:1 side slopes stabilized with rockfill adjacent to wetlands to reduce impacts. A swale would be created on the upland side of Apple Street and drainage would be directed toward the drop inlet and to the Essex River tributary culvert.

ALTERNATIVE 2– RAISE APPLE STREET TO ELEVATION 14.0' WITH WALL

This alternative would raise Apple Street to a minimum elevation of 14', which is above the measured flood elevation of 13.7. This would alleviate the roadway being overtopped during the 10-year and 25-year flood events. This alternative results in raising the existing low point on Apple Street a total of 3.2'. Apple Street would also be widened slightly to 20' to provide two 10' travel lanes to meet the minimum criteria for width of a local road per AASHTO guidelines. The roadway would be reconstructed with full depth pavement, and side slope treatments would consist of a 2:1 vegetated side slopes with a retaining wall adjacent to wetlands to minimize impacts. A swale would be created on the upland side of Apple Street and drainage would be directed toward the drop inlet and to the Essex River tributary culvert.

ALTERNATIVE 3 – RAISE APPLE STREET TO ELEVATION 15.3'

This alternative would raise Apple Street to a minimum elevation 15.3'. This accounts for the worst case (+6 ft) of Sea Level Rise (See Figure 2) available on the Massachusetts Office of Coastal Zone Management evaluation tool used for this study. This elevation increase also provides 1.6' of freeboard above the measured flood elevation of 13.7. This alternative results in raising the existing low point on Apple Street a total of 4.4'. Apple Street would be widened slightly to 20' to provide two 10' travel lanes to meet the minimum criteria for width of a local road per AASHTO guidelines. The roadway would be reconstructed with full depth pavement, and side slope treatments would consist of 2:1 vegetated side slopes with 1.5:1 side slopes stabilized with rockfill adjacent to wetlands to reduce impacts. A swale would be created on the upland side of Apple Street and drainage would be directed toward the drop inlet and to the Essex River tributary culvert.

ALTERNATIVE 4 – RAISE APPLE STREET TO ELEVATION 15.3' WITH WALL

This alternative would raise Apple Street to a minimum elevation 15.3', this accounts for the worst case (+6 ft) of Sea Level Rise (See Figure 2) available on the Massachusetts Office of Coastal Zone Management evaluation tool used for this study. This elevation increase also provides 1.6' of freeboard above the measured flood elevation of 13.7. This alternative results in raising the existing low point on Apple Street a total of 4.4'. Apple Street would be widened slightly to 20' to provide two 10' travel lanes to meet the minimum criteria for width of a local road per AASHTO guidelines. The roadway would be reconstructed with full depth pavement, and side slope treatments would consist of 2:1 vegetated side slopes with a retaining wall adjacent to wetlands to minimize impacts. A swale would be created on the upland side of Apple Street and drainage would be directed toward the drop inlet and to the Essex River tributary culvert.

SUMMARY OF IMPACTS

ITEM	UNIT	QUANTITY			
		Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Bordering Vegetated Wetland Impacts	SF	2,200	0	2,350	0
Tree Removal (greater than 8")	EA	17	17	21	21
Utility Pole Impacts	EA	6	6	6	6
Existing Stone Wall Removed	FT	190	190	270	270
New Retaining Wall	FT	0	270	0	275
Temporary Easements	EA	5	5	5	5
Permanent Easements	EA	2	2	2	2

PRELIMINARY COST ESTIMATES

	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**
Construction Cost	$594,000	$1,166,000	$660,000	$1,277,100
Construction Contingency 20%	$118,800	$233,200	$132,000	$255,420
Police Detail 10%	$59,400	$116,600	$66,000	$127,710
Construction Engineering	$89,100	$174,900	$99,000	$191,565
Design and Permitting	$130,000	$190,000	$140,000	$210,000
Utility Pole Relocation	$120,000	$120,000	$120,000	$120,000
Total	$1,111,300	$2,000,700	$1,217,000	$2,181,795
Say	**$1,150,000**	**$2,000,000**	**$1,220,000**	**$2,200,000**

*Does not include property acquisitions

Figure 2: Massachusetts Office of Coastal Zone Management Sea Level Rise Map – output from the Massachusetts Sea Level Rise and Coastal Flooding Viewer

V. ANALYSIS AND RECOMMENDATIONS

TEC recommends that the Town pursue Alternative 3 for additional study. This alternative would raise Apple Street to a minimum elevation of 15.3', reconstruct the road with full depth pavement, and provide side slope treatments consisting of 2:1 vegetated side slopes, with 1.5:1 side slopes stabilized with rockfill adjacent to wetland areas. TEC also recommends raising the second low point at the existing culvert to elevation 15.3'.

Alternative 1 would remove four fewer trees than Alternative 3, reduce the BVW impact by approximately 150 square feet, and would cost approximately 6% less than Alternative 3. However, while Alternative 1 would raise Apple Street above the observed flood elevation, the improvements would not provide any freeboard.

Alternative 2 would remove four fewer trees than Alternative 3, and constructing a retaining wall would reduce the permanent BVW impact by approximately 2,350 square feet. However, the wall construction would require excavation in the BVW resulting in approximately 1,400 square feet of temporary wetland impacts. A guardrail system would be installed at the top of the retaining wall or slope to shield a motorist who has left the roadway. However, guardrail systems are not 100% effective. The guardrail may not stop large trucks and or vehicles traveling at high rates of speed. If an errant vehicle crashes through the guardrail it may be able to traverse the stabilized side slope, but would not fare well going off of a wall. Therefore, a stabilized slope provides a safer roadside treatment than a vertical retaining wall. The cost to implement Alternative 2 is approximately 64% more than Alternative 3. Although Alternative 2 would raise Apple Street above the observed flood elevation, it would not provide any freeboard.

Alternative 4 would raise Apple Street to a minimum elevation 15.3', which would provide freeboard above the observed flood elevation and constructing a retaining wall would reduce the permanent BVW impact by approximately 2,350 square feet. However, the wall construction would require excavation in the BVW, resulting in approximately 1,500 square feet of temporary wetland impacts. As discussed above, the stabilized slope proposed in Alternative 4 provides a safer roadside treatment for vehicles than the vertical retaining wall proposed in Alternative 3. The cost to implement Alternative 4 is approximately 80% more than Alternative 3, nearly doubling the project cost. In addition to the initial construction costs, additional inspections (by registered professional engineers) and increased maintenance costs would be incurred by the Town over the life of the retaining wall.

Alternative 3 would raise Apple Street to a minimum elevation 15.3' which, as seen in Figure 2, accounts for the worst case (+6 ft) of Sea Level Rise available on the Massachusetts Office of Coastal Zone Management evaluation tool that was used for this study. Even when tidal surge is factored in on top of what will be a higher static sea level in the future, we are confident that Alternative 3 will provide for a passable roadway for decades to come. The roadway elevation will be raised more than 4' over its original condition. As another point of reference, the NOAA Sea Level Rise viewer (https://coast.noaa.gov/slr/) for Seavey Island, NH (closest location) gives an

approximate Sea Level Rise of 4.5 ft for the extreme scenario at 2060 indicating that this proposed scheme will provide a passable roadway for at least 35 years. This elevation increase also provides 1.6' of freeboard above the measured anomaly flood elevation of 13.7'.

Alternative 3 would have approximately 2,350 square feet of permanent BVW impacts which could be mitigated within the project area. As mitigation, a wetland replication area will be designed that will meet the performance standards of the wetland protection act and the town of Essex local requirements. While not the subject of this study, TEC also recommends raising the low point at the existing culvert to elevation 15.3' to provide 1.6' of freeboard at this location as well. While all four alternatives would provide the Town of Essex with a critical second transportation connection within the Town, Alternative 3 provides a long-term, cost-effective solution.

It is understood that Alternative 3 would not entirely eliminate all potential future risks of coastal flooding at this location. The direst of scenarios for sea level rise could potentially leave this area vulnerable several decades in the future with extreme storm events still overtopping the roadway. However, due to the residence at 1 Andrews Street in the project vicinity, no other alternatives were analyzed that would increase the roadbed elevation above 15.3'. If the roadbed elevation were raised much above this level, the road may begin to act as a dam during flood events and may flood the residence at 1 Andrews Street.

In addition, if this area were raised to a level that would make the location completely dry in all future storm surge events, then the cost of this project would become prohibitive for the Town. The Town will be pursuing a FEMA grant under the Building Resilient Infrastructure and Communities (BRIC) Program to secure most of the necessary funding for this project. The FEMA BRIC grant has a very strict Benefit-Cost Analysis (BCA) requirement. If the chosen alternative does not meet the BCA requirements of this program, the project will remain unfunded and no improvements will be made at this location, translating to NO increase in resiliency at all. The Town is presently working with MEMA to understand how best to approach the BCA and has reported that it will already be difficult to meet, even with the elevation and design that has been recommended.

Finally, Alternative 3 also provides increased potential for adaptive management of the corridor. If in the future the Town begins to experience a sea level increase beyond the present design, Alternative 3 would allow for modification of the roadbed to some higher elevation. If a retaining wall approach was used, and the roadbed needed to be elevated further, the existing retaining wall would need to be completely removed or substantially retrofitted to allow for the raise of the roadbed. However, a slope revetment type approach would allow for additional fill to raise the roadway, albeit with increased wetland impacts. With the understanding that the roadbed elevation noted here may not be sufficient to keep the roadbed dry for all future storm surge events, it will be important to select the most flexible design.

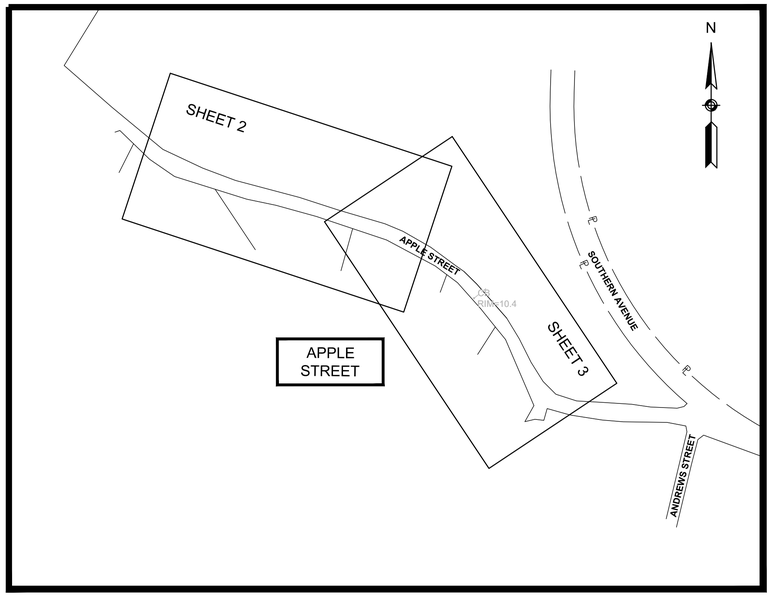
All alternatives considered would require filling in the flood plain. Since the project is in a coastal flood plain, it is assumed compensatory flood storage would not be required. Determination of flood plain impacts and compensatory storage analysis is not included in the scope of this study.

APPENDIX A – DRAWINGS

ESSEX
APPLE STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	-	1	3
PROJECT FILE NO.	XXXXXX		

TITLE SHEET, LEGEND & ABBREVIATIONS



0 150 300 450 600

SCALE: 1" = 150'

ABBREVIATIONS

AUX	AUXILARY
BD	BOUND
BIT	BITUMINOUS
℄	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BR	BRIDGE
BRK	BRICK
BWL	BROKEN WHITE LINE
BYL	BROKEN YELLOW LINE
CAB	CABINET
CB	CATCH BASIN
CC	CEMENT CONCRETE
CCB	CAPE COD BERM
CEN	CENTER
CI	CURB INLET
CIP	CAST IRON PIPE
℄	CENTER LINE
CLF	CHAIN LINK FENCE
CMH	CABLE MANHOLE
CMP	CORRUGATED METAL PIPE
CO	COUNTY
CO BD	COUNTY BOUND
CON	CONIFEROUS
CONC	CONCRETE
CPP	CORRUGATED PLASTIC PIPE
CSP	CORRUGATED STEEL PIPE
CULV	CULVERT
CW	CROSSWALK
DBWL	DOUBLE WHITE LINE
DBYL	DOUBLE YELLOW LINE
DEC	DECIDUOUS
DH	DRILL HOLE
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DMH	DRAIN MANHOLE
DSK	DISK
DWL	DOTTED WHITE LINE
DYL	DOTTED YELLOW LINE
EB	EASTBOUND
EL	ELEVATION
EMH	ELECTRIC MANHOLE
EP	EDGE OF PAVEMENT
EPLP	ESCUTCHEON PIN IN LEAD PLUG
ETW	EDGE OF TRAVELED WAY
EX	EXISTING
FF	FINISH FLOOR
FGS	FLAGSTONE
FL	FLOWLINE
FLDSTN	FIELDSTONE
GAR	GARAGE
GD	GROUND
GIP	GALVANIZED IRON PIPE
GMH	GAS MANHOLE
GRAN	GRANITE
GRAV	GRAVEL
GRD	GUARD
GRL	GUARDRAIL
HDW	HEADWALL
HYD	HYDRANT
INV	INVERT
IP	IRON PIPE
JB	JERSEY BARRIER
L	LENGTH OF CURVE
LB	LEACHING BASIN
LC	LAND COURT
LCB	LAND COURT BOUND
LCD	LAND COURT DISK
LO	LAYOUT
LP	LIGHT POLE
LPD	LIGHT POLE DOUBLE LIGHT
LSA	LANDSCAPED AREA
MAG	MAG NAIL
MBE	MIDDLE BACK EDGE
MED	MEDIAN
MH	MANHOLE
MP	MILE POST
MTL	METAL
N/F	NOW OR FORMERLY
NB	NORTHBOUND
OH	OVERHANG
OHW	OVERHEAD WIRE
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PED	PEDESTRIAN
PI	POINT OF INTERSECTION
PK	PK NAIL
℗	PROPERTY LINE
PP	PRICK PUNCH
PRC	POINT OF REVERSE CURVATURE
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE PIPE
PVMT	PAVEMENT
PWW	PAVED WATERWAY
PZ	PIEZOMETER
R	RADIUS OF CURVATURE
RB	REBAR
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RET	RETAINING
ROW	RIGHT OF WAY
RR	RAILROAD
RRS	RAILROAD SPIKE
S BD	SOUTHBOUND
SB	STONE BOUND
SD	SUBDRAIN
SGE	SLOPED GRANITE EDGING
SHLD	SHOULDER
SHLO	STATE HIGHWAY LAYOUT
SK	SKEW
SL	STOP LINE
SMH	SEWER MANHOLE
SPK	SPIKE
STA	STATION
STN	STONE
SW	SIDEWALK
SWL	SOLID WHITE LINE
SYL	SOLID YELLOW LINE
T	TANGENT DISTANCE
TAN	TANGENT
TEMP	TEMPORARY
TMH	TELEPHONE MANHOLE
TOH	TOP OF HOOD
TR	TOP OF RAIL
TSC	TRAFFIC SIGNAL CONDUIT
TYP	TYPICAL
VAR	VARIABLE
VCP	VITRIFIED CLAY PIPE
VGC	VERTICAL GRANITE CURB
VLT	VAULT
WB	WESTBOUND
WCR	WHEELCHAIR RAMP
WD	WOOD
WIP	WROUGHT IRON PIPE

LEGEND

BF#	BANK FLAG
BHL #	BORE HOLE
	BUSH
BM #	BENCHMARK
	BOUND (CONC, STONE, LAND COURT, ETC.)
C	CABLE MANHOLE
CB	CATCH BASIN - SQUARE
CB	CATCH BASIN - D-FRAME
CB	CATCH BASIN - ROUND
DSK	DISK (CA/T, USC&GS, LAND COURT, ETC.)
DH	DRILL HOLE
D	DRAIN MANHOLE
EHH	ELECTRIC HANDHOLE
E	ELECTRIC MANHOLE
EM	ELECTRIC METER
EPLP	ESCUTCHEON PIN IN LEAD PLUG
FB	FLASHING BEACON
FES	FLARED END SECTION
FP	FLAG POLE
GF	GAS FILL
GG	GAS GATE
GM	GAS METER
GP	GAS PUMP
G	GAS MANHOLE
GPL	GUY POLE
	HANDICAP SYMBOL
	GUY WIRE ANCHOR
HTP	HIGH TENSION POWER POLE
	FIRE HYDRANT
IP	IRON PIPE
	LIGHT POLE
	LIGHT POLE DOUBLE LIGHT
MAG	MAG NAIL
MB	MAIL BOX
MHB	MASSACHUSETTS HIGHWAY BOUND
MW	MONITORING WELL
OIL	OIL FILL
M	OTHER MANHOLE
PB	PULL BOX
PED	PEDESTRIAN SIGNAL
	PHOTO CONTROL - H & V
	PHOTO CONTROL - V ONLY
PK	PK NAIL
PM	PARKING METER
POST	CIRCULAR POST
POST	SQUARE POST
RB	REBAR/IRON PIN
RRS	RAILROAD SPIKE
RRSG	RAILROAD SIGNAL
RRSW	RAILROAD SWITCH
SN	STAKE AND NAIL
SP	STAND PIPE
S	SEWER MANHOLE
ST	STEAM MANHOLE
	STUMP
TB	TOWN LINE BOUND (CORNER)
TCB	TRAFFIC SIGNAL CONTROL CABINET
T	TELEPHONE MANHOLE
TFMR	TRANSFORMER
TLRS	TOWN LINE ROAD STONE
TPIT #	TEST PIT
TPL	TROLLEY POLE
	TRAVERSE POINT
22"M	TREE
TS	TRAFFIC SIGNAL
TS	TRAFFIC SIGNAL MAST ARM/SPAN WIRE POLE
	SIGN
	SIGN - DOUBLE POST
UFB#	UTILITY POLE W/ FIRE PULL BOX
ULT#	UTILITY POLE W/ LIGHT
UPDL#	UTILITY POLE W/ DOUBLE LIGHT
UPL#	UTILITY POLE
VP	VENT PIPE
W	WATER MANHOLE
WG	WATER GATE
WM	WATER METER
WSO	WATER SHUTOFF
WELL	WELL (POTABLE)
WF#	WETLAND FLAG
X-CUT	X-CUT

NOTES

1. THE TOPOGRAPHY, SITE DETAIL & SURFACE IMPROVEMENTS DEPICTED HEREON WERE OBTAINED FROM AN INSTRUMENT SURVEY CONDUCTED ON THE GROUND BY MERIDIAN ASSOCIATES, INC. BETWEEN OCTOBER 29 & NOVEMBER 2, 2020.
2. THE LOCATION OF ALL UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE AND ARE BASED UPON A PARTIAL FIELD SURVEY AND COMPILATION OF PLANS OF RECORD. MERIDIAN ASSOCIATES, INC. DOES NOT WARRANTY NOR GUARANTEE THE LOCATION OF ALL UTILITIES DEPICTED OR NOT DEPICTED. THE CONTRACTOR, PRIOR TO COMMENCEMENT OF CONSTRUCTION, SHALL VERIFY THE LOCATION OF ALL UTILITIES AND CONTACT DIG SAFE AT 811.
3. THIS PLAN DOES NOT SHOW ANY UNRECORDED OR UNWRITTEN EASEMENTS WHICH MAY EXIST. A REASONABLE AND DILIGENT ATTEMPT HAS BEEN MADE TO OBSERVE ANY APPARENT, VISIBLE USES OF THE LAND; HOWEVER, THIS DOES NOT CONSTITUTE A GUARANTEE THAT NO SUCH EASEMENTS EXIST.
4. THE ELEVATIONS DEPICTED HEREON WERE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), AS DERIVED FROM GPS OBSERVATIONS.
5. PROPERTY LINES DEPICTED HEREON ARE BASED ON COMPILED DEEDS AND PLANS OF RECORD. THIS PLAN IS NOT TO BE USED FOR THE RECONSTRUCTION OF BOUNDARY LINES OR FOR TITLE INSURANCE PURPOSES.
6. THE WETLAND LIMITS DEPICTED WERE DEMARCATED BY DEROSA ENVIRONMENTAL CONSULTANTS, INC. ON OCTOBER 17, 2020.

REFERENCES:

PLAN BOOK 145, PLAN 83
PLAN BOOK 189 PLAN 97
PLAN BOOK 307, PLAN 58
PLAN BOOK 335, PLAN 42
1953 COUNTY LAYOUT (2822) SOUTHERN AVENUE
1954 COUNTY LAYOUT (2835) SOUTHERN AVENUE

DOCUMENTS ON RECORD AT THE ESSEX DISTRICT REGISTRY OF DEEDS.

REVISIONS		
REV.	COMMENTS	DATE

PREPARED BY:
MERIDIAN ASSOCIATES
500 CUMMINGS CENTER, SUITE 5950 — BEVERLY, MASSACHUSETTS 01915 — TELEPHONE: (978) 299-0447
69 MILK STREET, SUITE 208 — WESTBOROUGH, MASSACHUSETTS 01581 — TELEPHONE: (508) 871-7030
WWW.MERIDIANASSOC.COM

SCALE: 150 FEET TO THE INCH

FILE NAME: 6268_REC_MASSDOT
FIELD BOOK. NO: 560
DRAWN BY: ER — CHECKED BY: KD
FIELD CHIEF: DW — PARS. NO: XXXXXXX

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF
APPLE STREET
IN THE CITY OF
ESSEX
AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION

DATE: NOVEMBER 18, 2020 — SHEET 1 OF 3

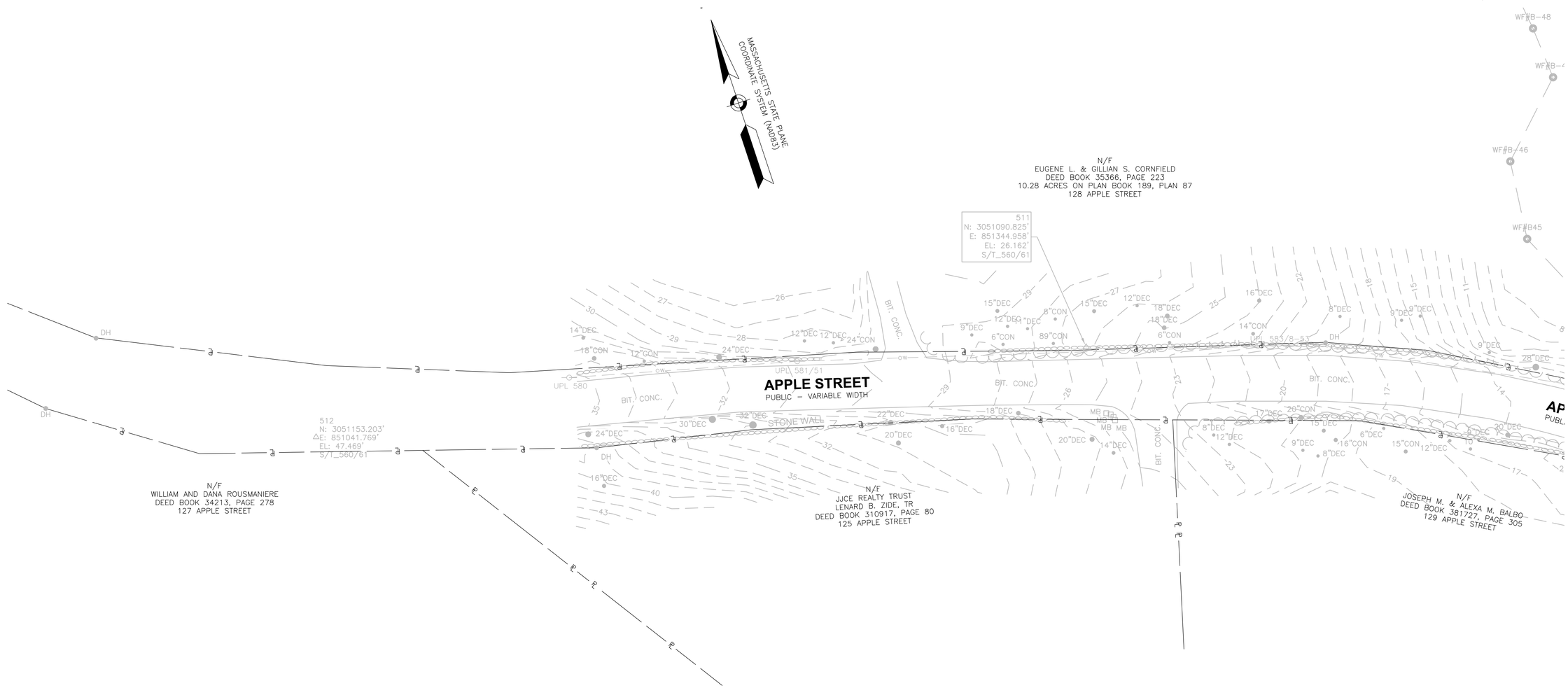
T1043_SV.DWG Plotted on 21-Jan-2021 8:40 AM

ESSEX
APPLE STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	6368	2	3
	PROJECT FILE NO. ######		

SURVEY BASEPLAN

T1043_SV.DWG Plotted on 21-Jan-2021 8:40 AM



0 20 50 100

SCALE: 1" = 20'

PREPARED BY:

MERIDIAN ASSOCIATES

500 CUMMINGS CENTER, SUITE 5950
BEVERLY, MASSACHUSETTS 01915
TELEPHONE: (978) 299-0447

69 MILK STREET, SUITE 208
WESTBOROUGH, MASSACHUSETTS 01581
TELEPHONE: (508) 871-7030

WWW.MERIDIANASSOC.COM

REVISIONS		
REV.	COMMENTS	DATE

SCALE: 20 FEET TO THE INCH

FILE NAME: 6268_REC_MASSDOT
FIELD BOOK. NO: 560
DRAWN BY: ER | CHECKED BY: KD
FIELD CHIEF: DW | PARS. NO: XXXXXXX

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF

APPLE STREET

IN THE CITY OF

ESSEX

AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF
TRANSPORTATION, HIGHWAY DIVISION

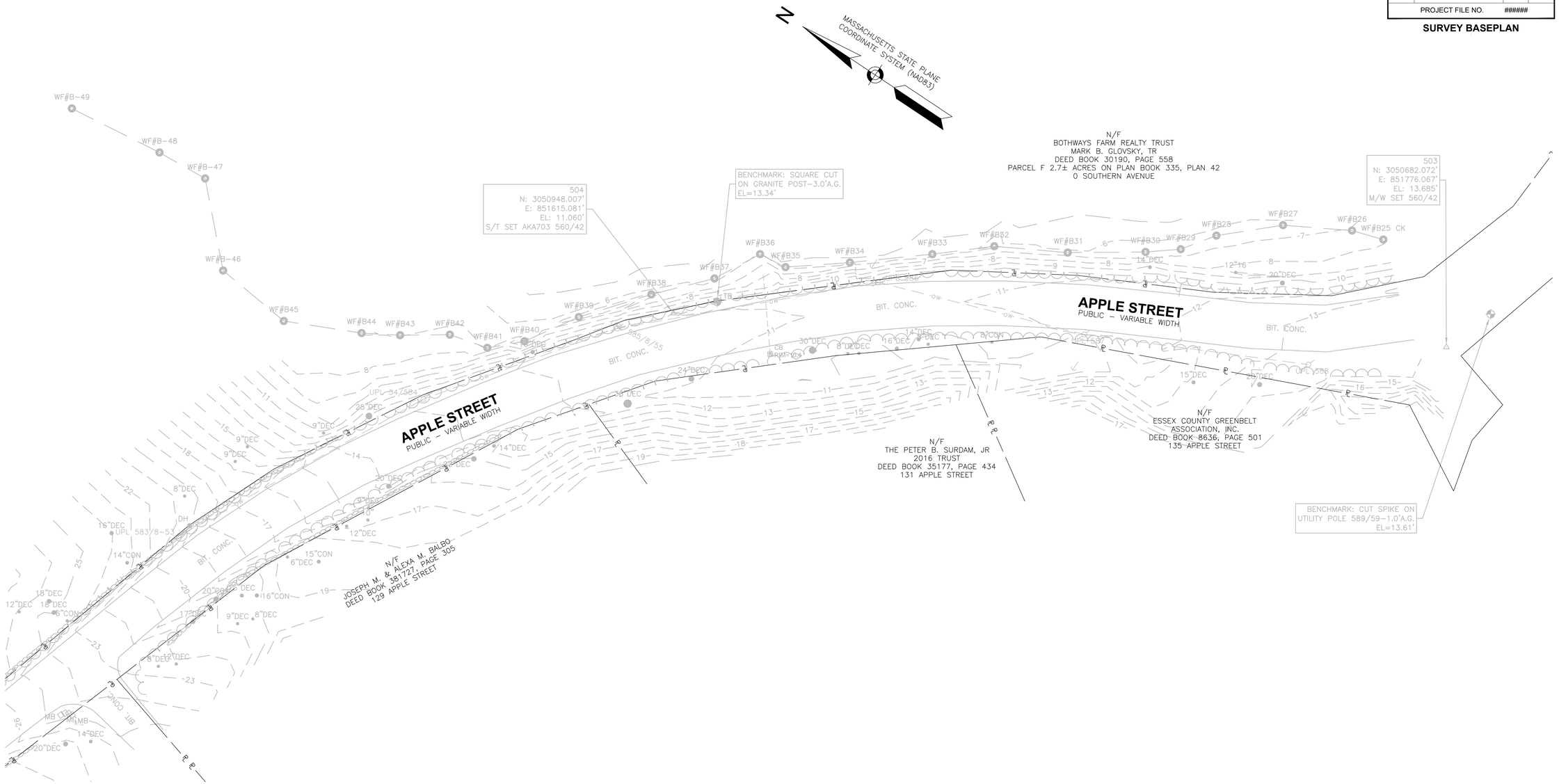
DATE: NOVEMBER 18, 2020 | SHEET 2 OF 3

ESSEX
APPLE STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	6268	3	3
PROJECT FILE NO.	######		

SURVEY BASEPLAN

T1043_SV.DWG Plotted on 21-Jan-2021 8:41 AM



PREPARED BY:

MERIDIAN ASSOCIATES

500 CUMMINGS CENTER, SUITE 5950
BEVERLY, MASSACHUSETTS 01915
TELEPHONE: (978) 299-0447

69 MILK STREET, SUITE 208
WESTBOROUGH, MASSACHUSETTS 01581
TELEPHONE: (508) 871-7030

WWW.MERIDIANASSOC.COM

REVISIONS		
REV.	COMMENTS	DATE

SCALE: 20 FEET TO THE INCH

FILE NAME: 6268_REC_MASSDOT
FIELD BOOK. NO: 560
DRAWN BY: ER | CHECKED BY: KD
FIELD CHIEF: DW | PARS. NO: XXXXXXX

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF

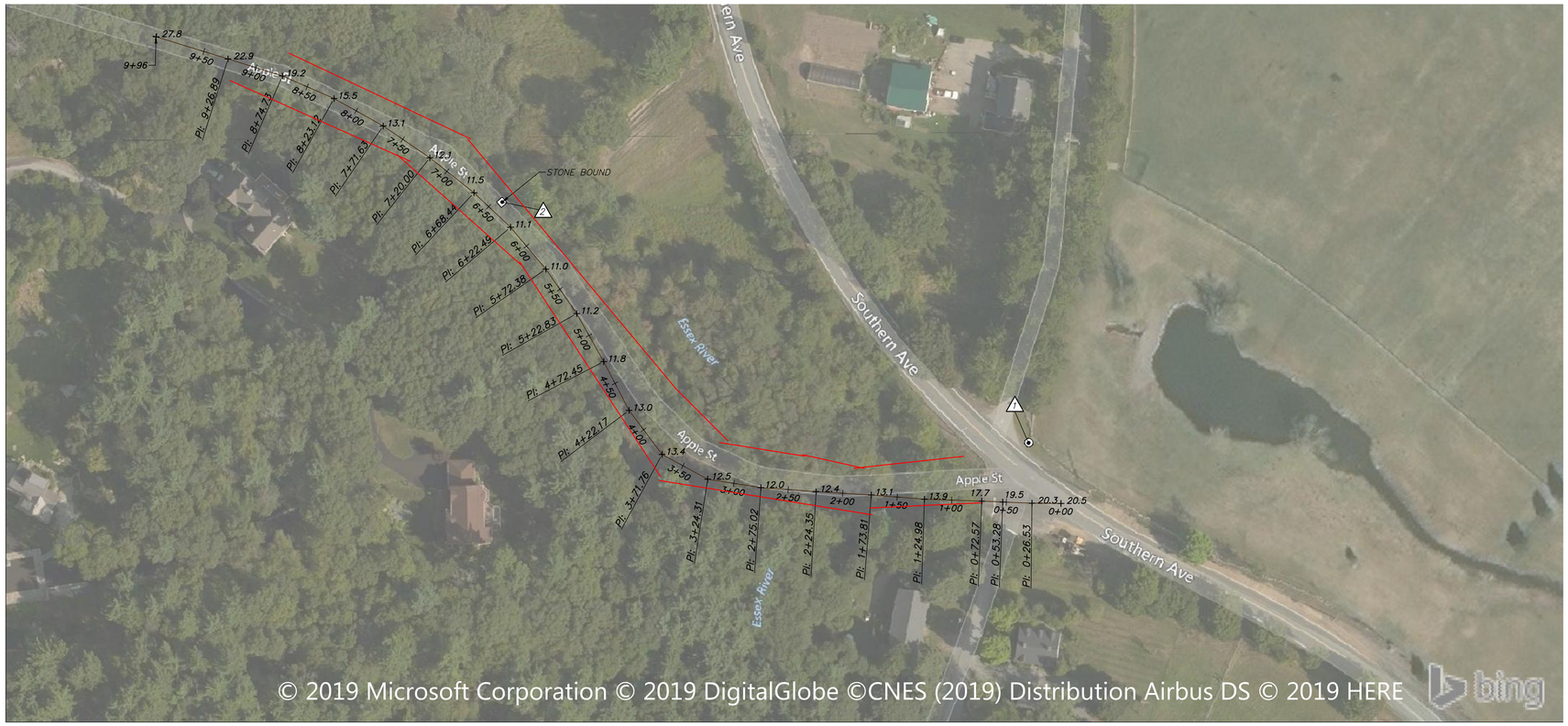
APPLE STREET

IN THE CITY OF

ESSEX

AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION

DATE: NOVEMBER 18, 2020 | SHEET 3 OF 3



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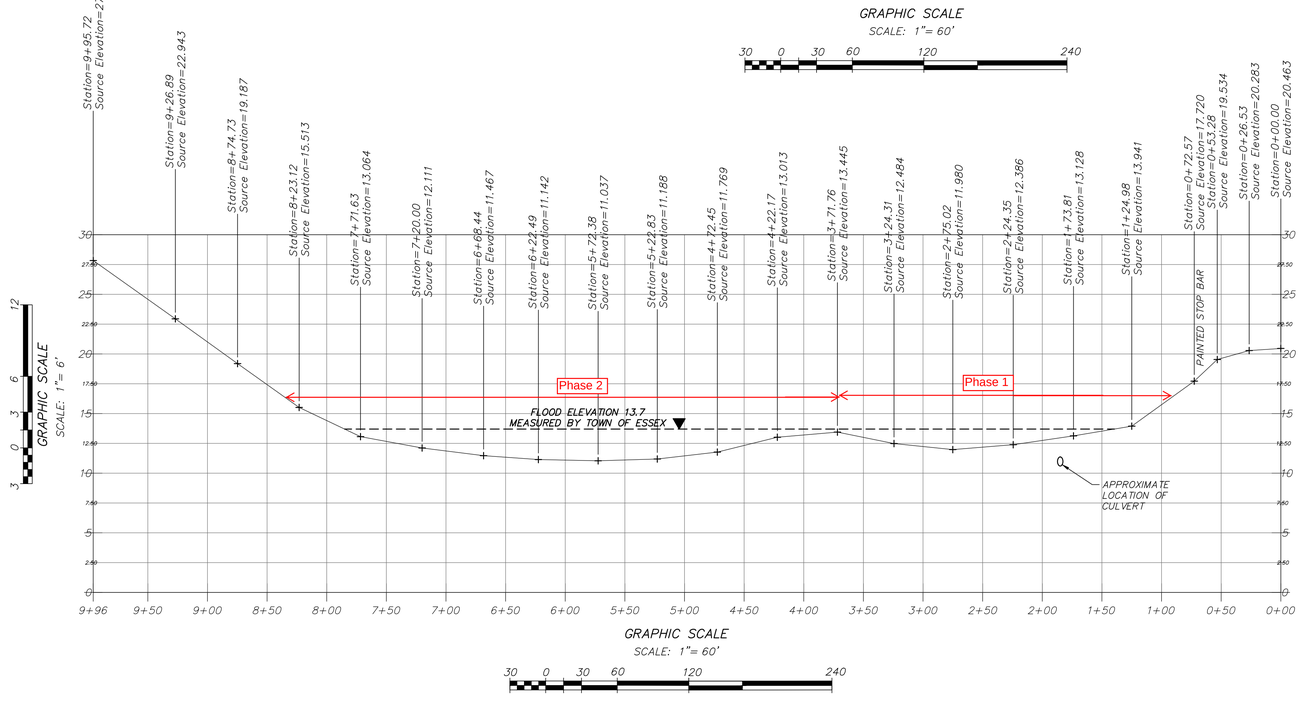

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GRAPHIC SCALE
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TEMPORARY BENCHMARK CHART:

T.B.M.#	DESCRIPTION	ELEVATION
1	X-CUT HYDRANT FRONT CAP BOLT	19.50
2	SQUARE CUT STONE BOUND	13.34

(NAVD88)

REVISIONS

DESCRIPTION	DATE	BY

APPLE STREET
PLAN AND PROFILE
LOCATED IN
ESSEX, MASSACHUSETTS
(ESSEX COUNTY)
PREPARED FOR
TOWN OF ESSEX

MERIDIAN ASSOCIATES
500 CUMMINGS CENTER, SUITE 5950
BEVERLY, MASSACHUSETTS 01915
TELEPHONE: (978) 524-4444
69 MILK STREET, SUITE 302
WESTBOROUGH, MASSACHUSETTS 01581
TELEPHONE: (508) 871-7030
WWW.MERIDIANASSOC.COM

DESIGNED BY:
CHECKED BY:

DATE:
SEPTEMBER 25, 2019

SCALE:
1"=60'

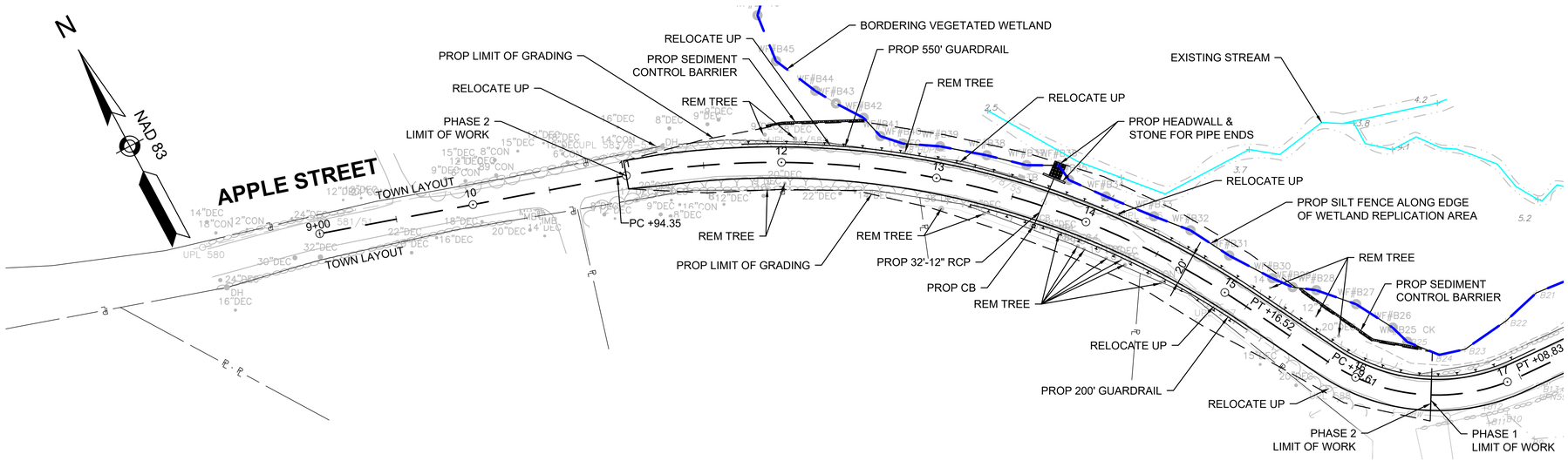
SHEET No.
1 OF 1

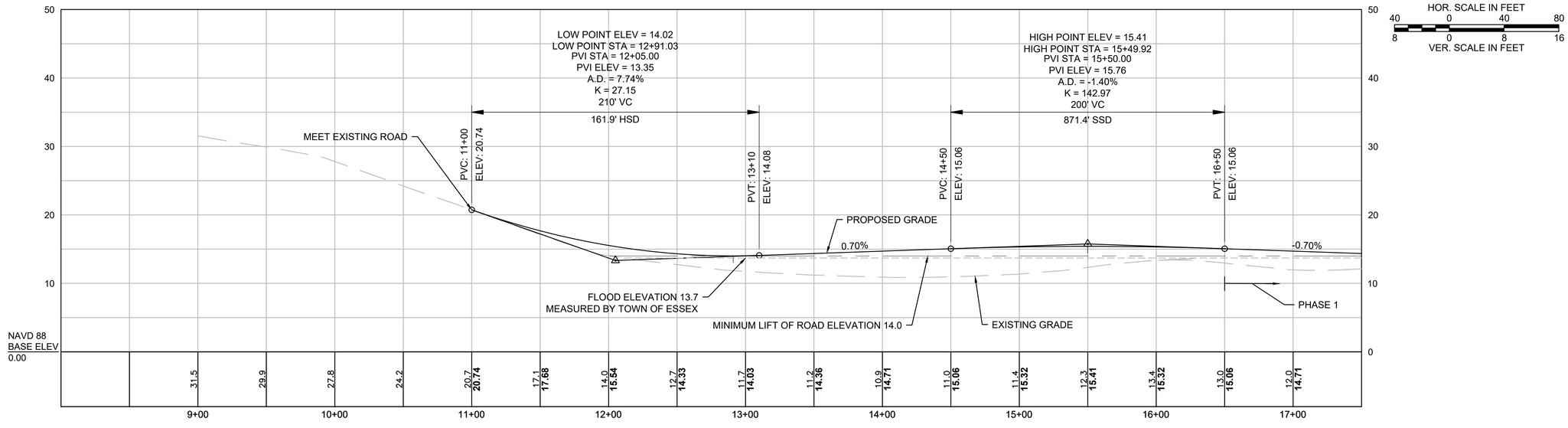
PROJECT No.
6268

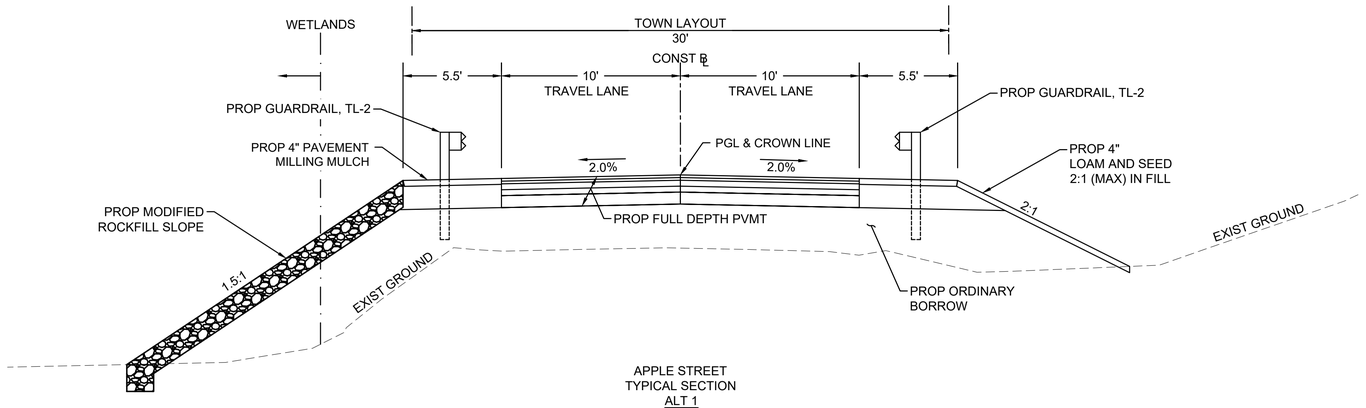
BK. #560, PG. #42
DWG. No. 6268_SURVEY.DWG

ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 1

T1043_CONCEPT.DWG Plotted on 18-Jan-2021 8:35 AM





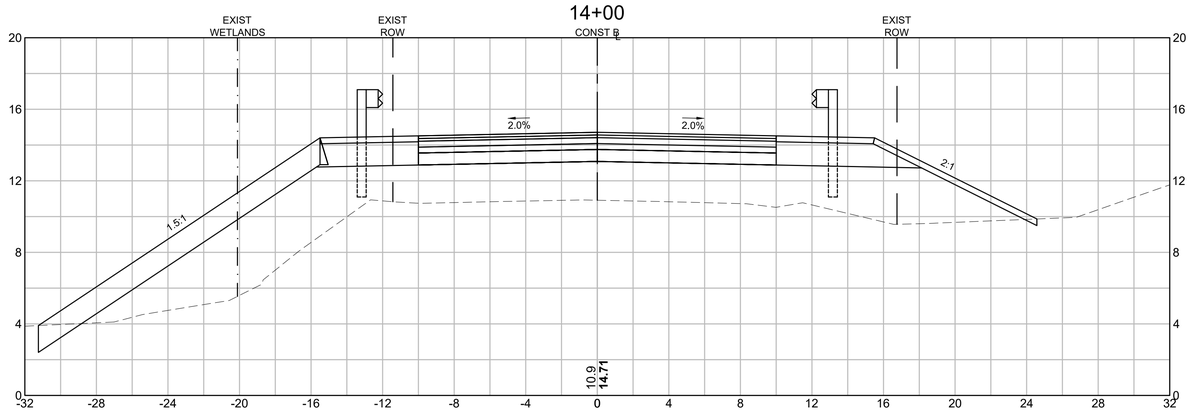


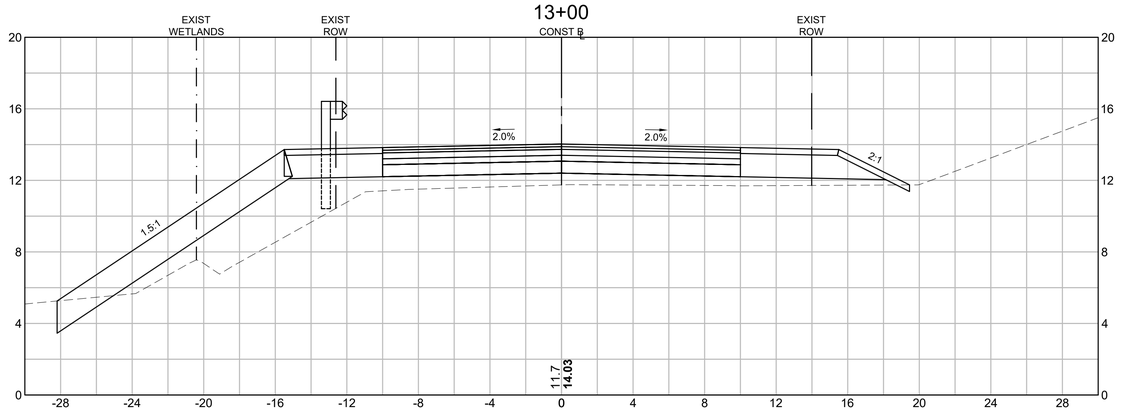
APPLE STREET
TYPICAL SECTION
ALT 1
NTS

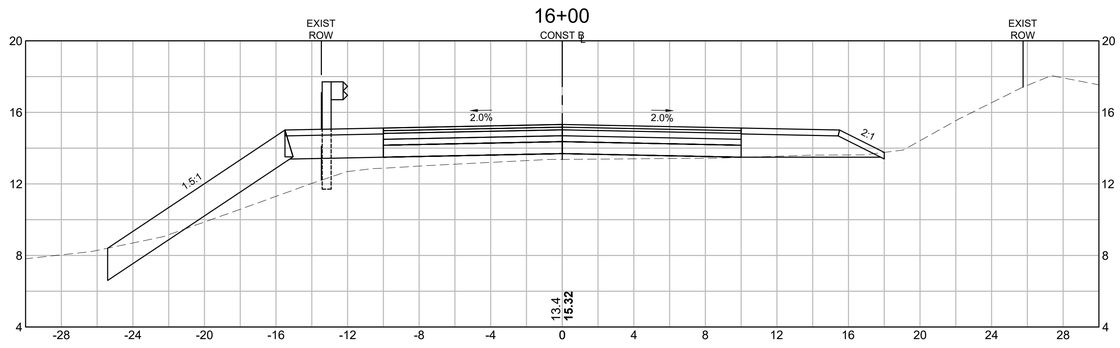
IMPACT SUMMARY		
ITEM	UNITS	QUANTITY
R&R Utility Poles	EA	6
Tree Removals	EA	17
New Guardrail	FT	750
Stone Wall Removed	FT	190
New Retaining Wall	FT	0
Temporary Easements	EA	5
Permanent Easements	EA	2
Modified Rockfill	SY	700
Wetland Impacts	SF	2200

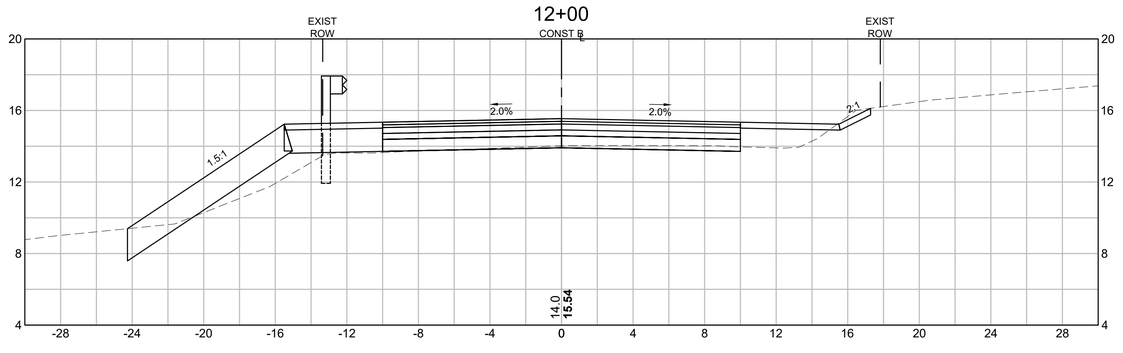
ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 1

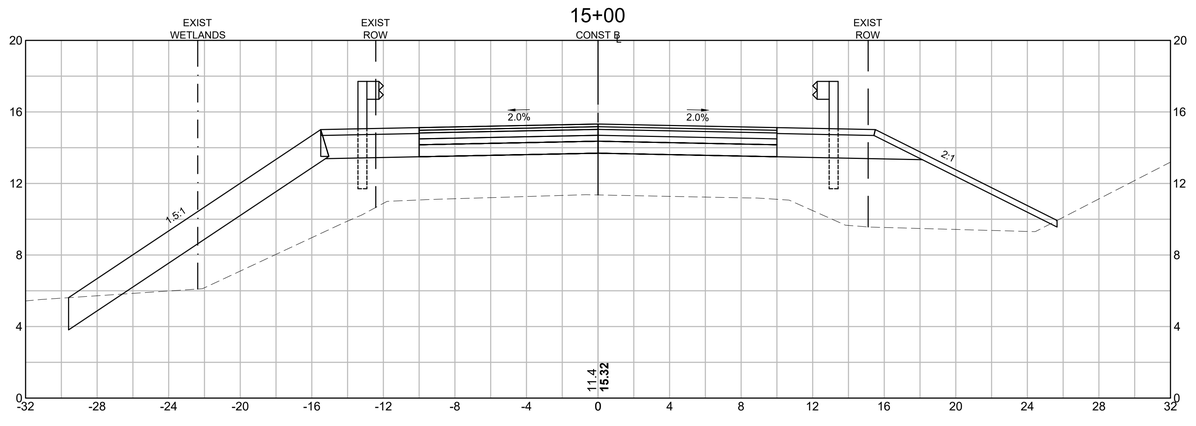
T1043_CONCEPT.DWG Plotted on 18-Jan-2021 8:35 AM







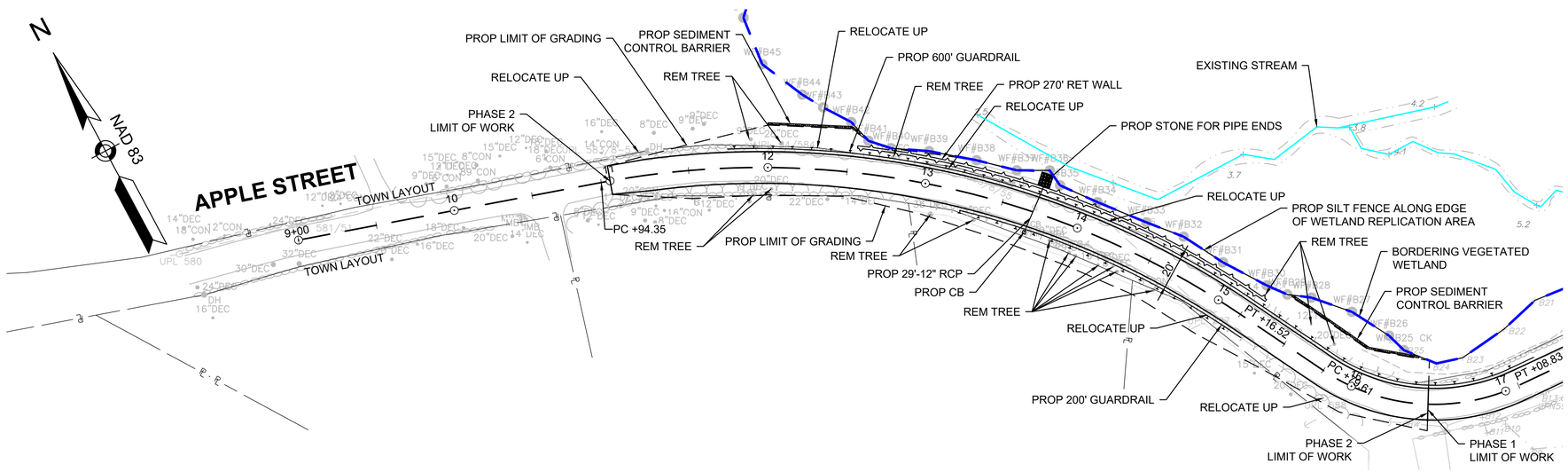


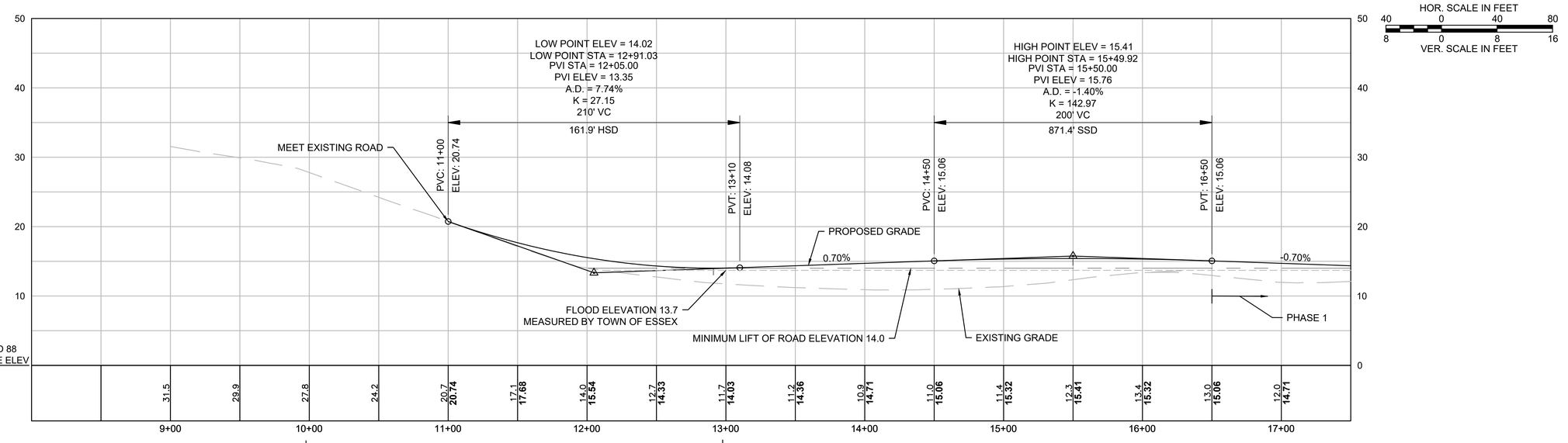


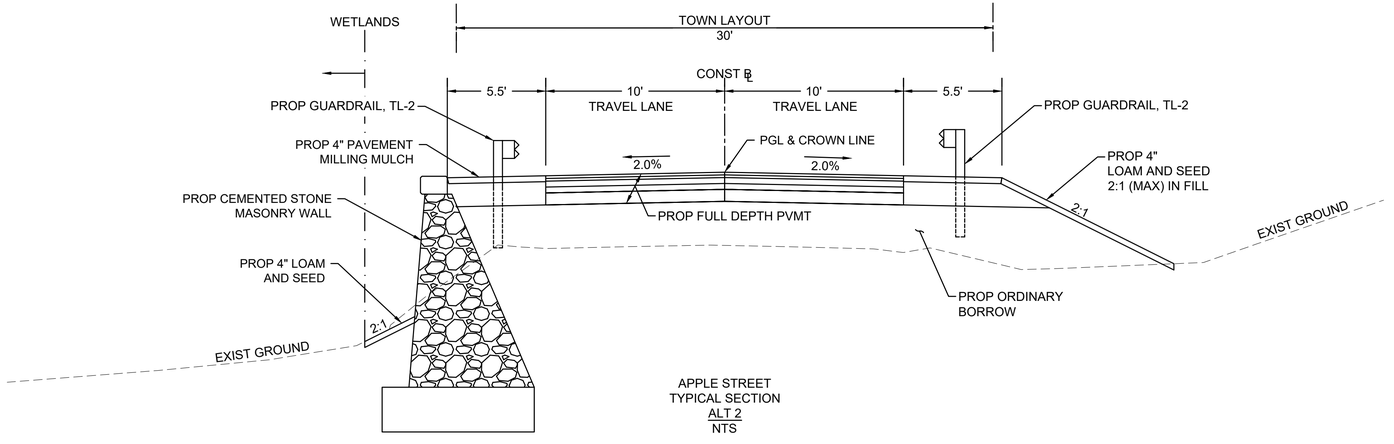
HOR. SCALE IN FEET
4 0 4 8
4 0 4 8
VER. SCALE IN FEET

ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 2

T1043_CONCEPT.DWG Plotted on 18-Jan-2021 8:35 AM





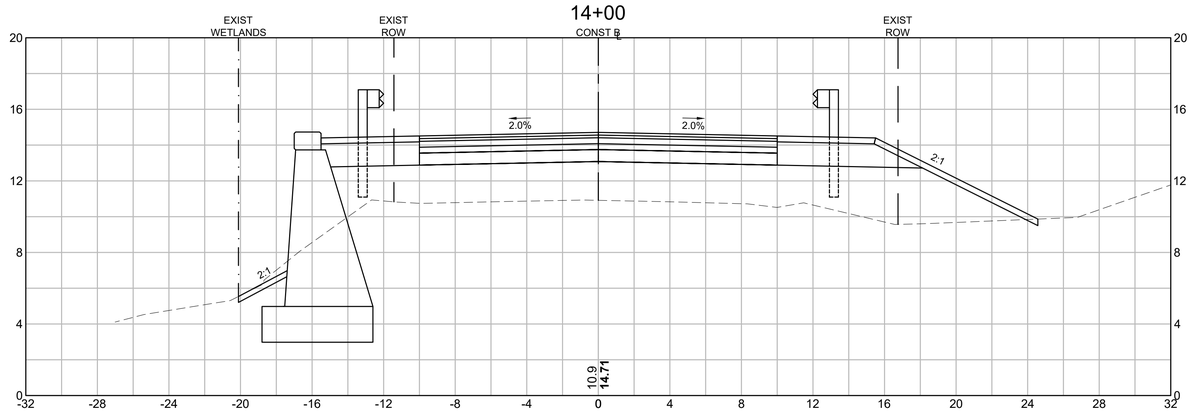


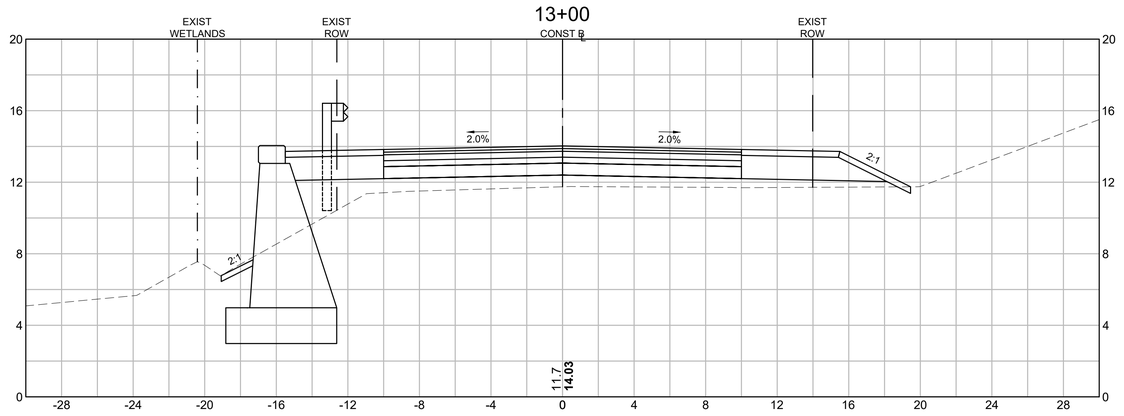
APPLE STREET
TYPICAL SECTION
ALT 2
NTS

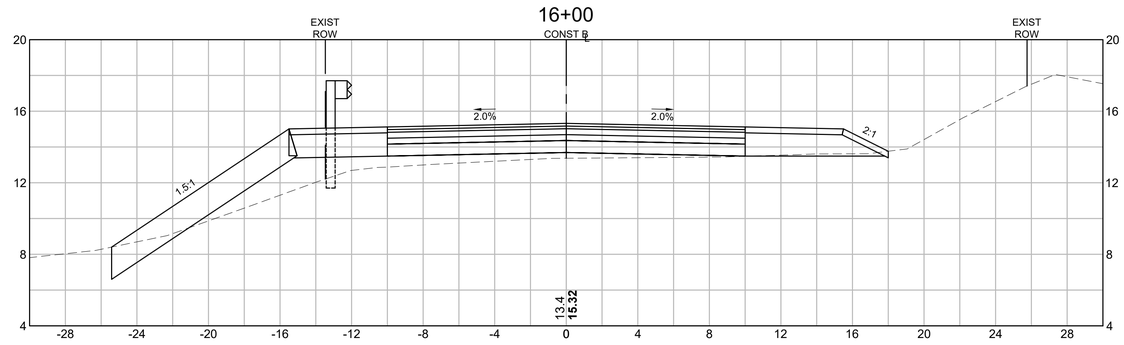
IMPACT SUMMARY		
ITEM	UNITS	QUANTITY
R&R Utility Poles	EA	6
Tree Removals	EA	17
New Guardrail	FT	600
Stone Wall Removed	FT	190
New Retaining Wall	FT	270
Temporary Easements	EA	5
Permanent Easements	EA	2
Modified Rockfill	SY	200
Wetland Impacts	SF	0

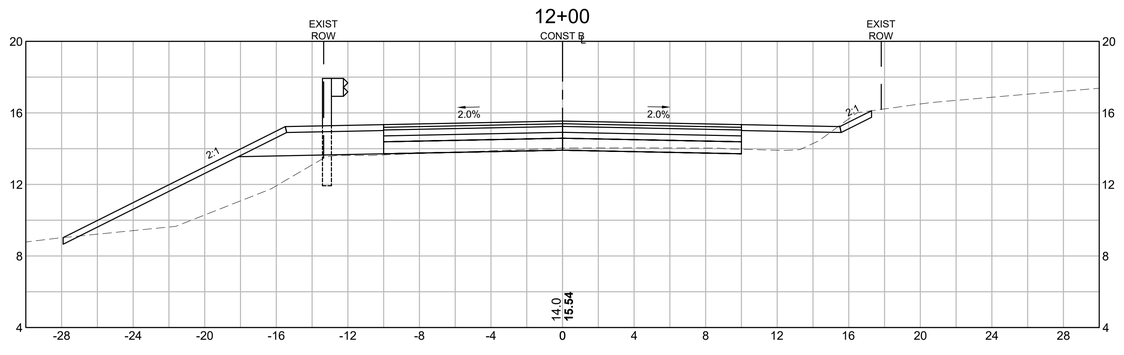
ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 2

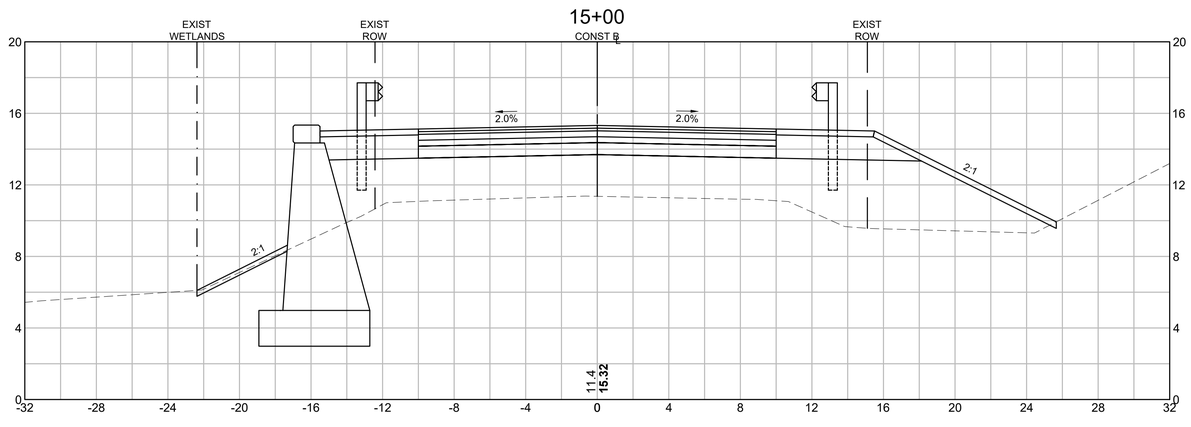
T1043_CONCEPT.DWG Plotted on 18-Jan-2021 8:36 AM

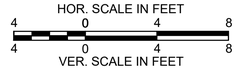












ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 3

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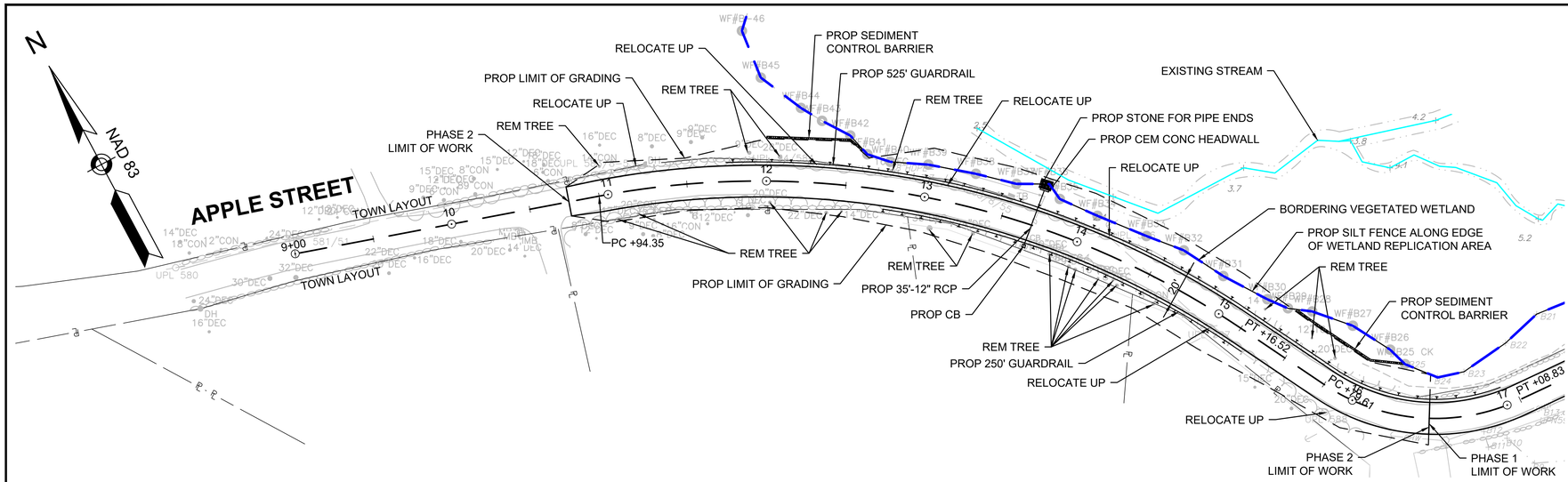

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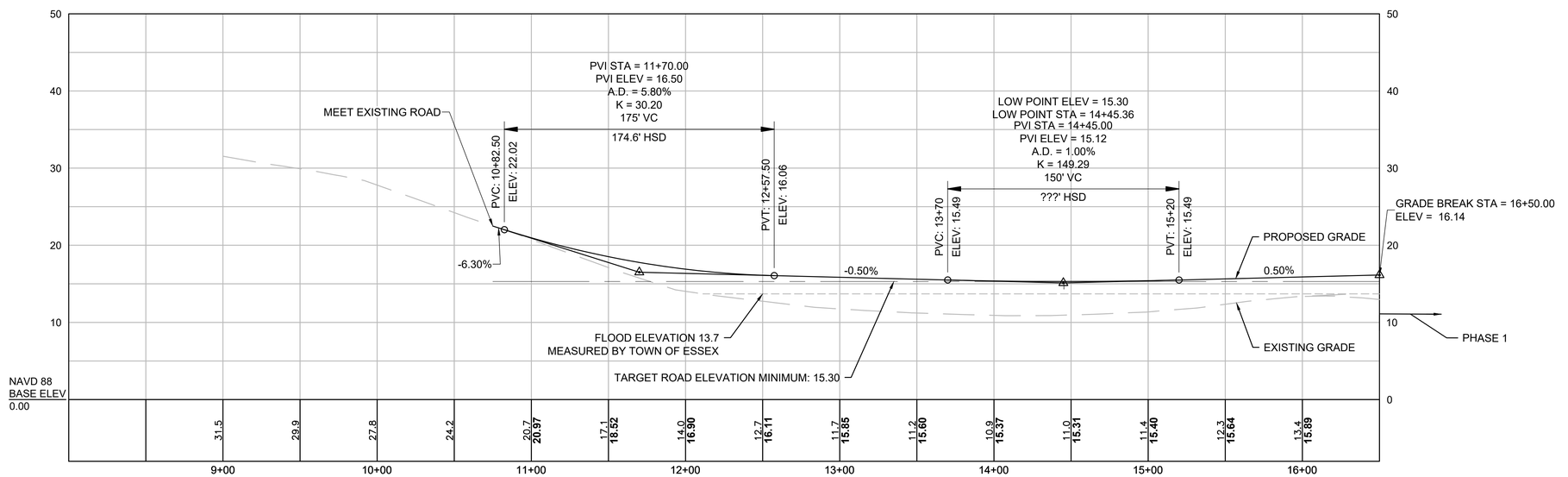
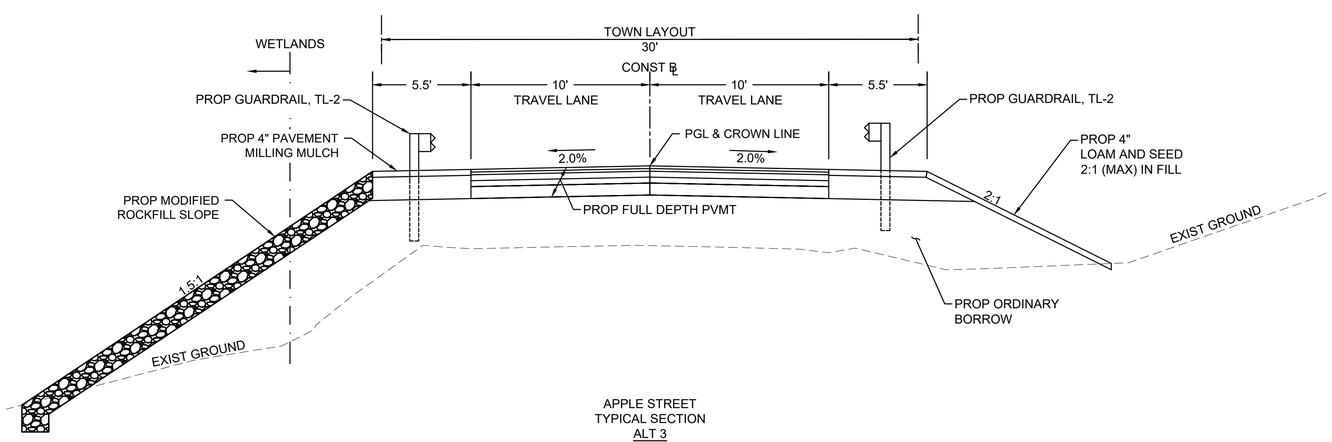
VER. SCALE IN FEET

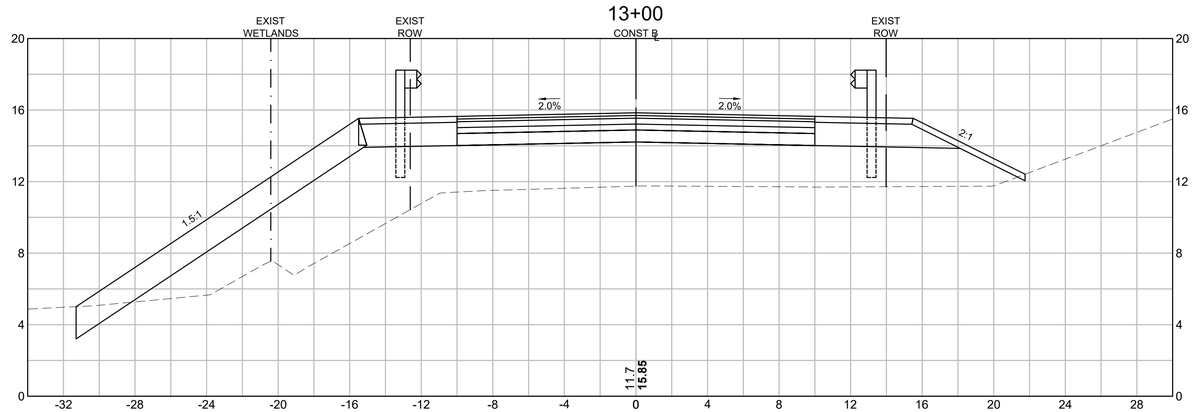


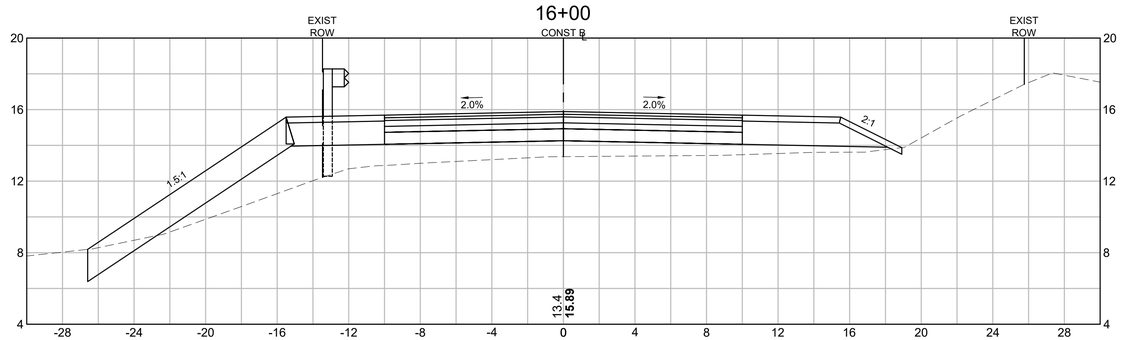


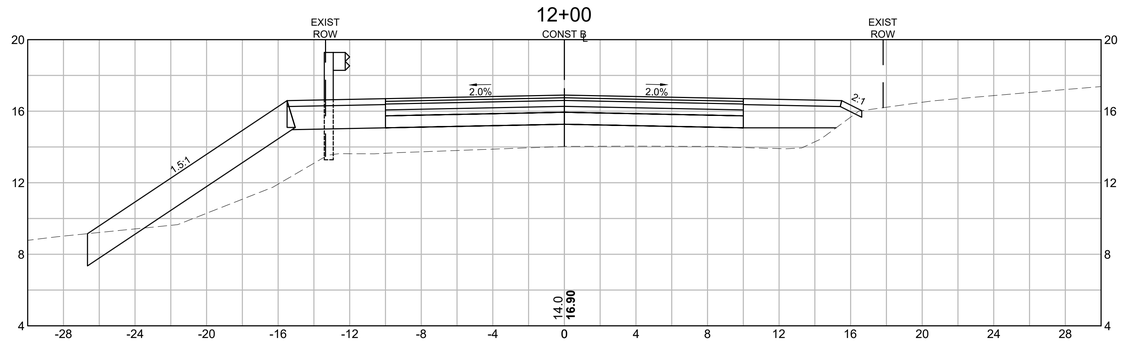
APPLE STREET
TYPICAL SECTION
ALT 3
NTS

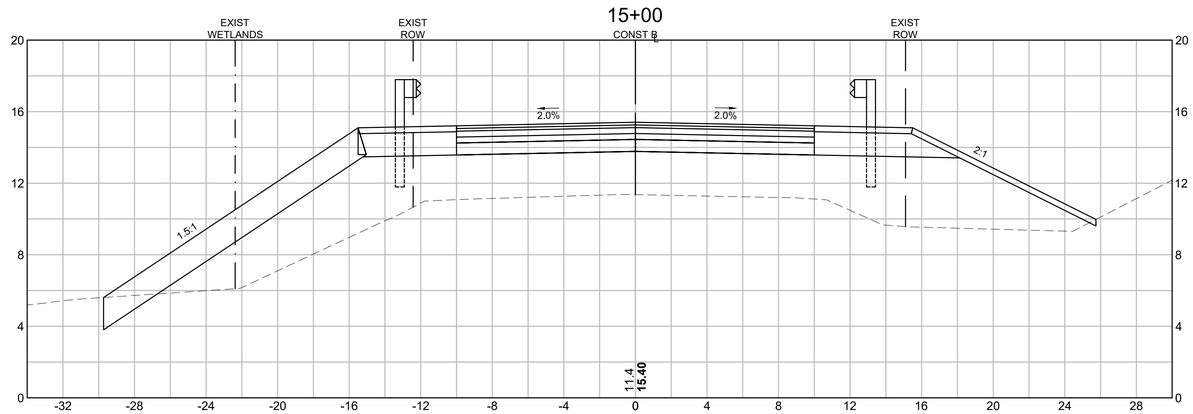
IMPACT SUMMARY		
ITEM	UNITS	QUANTITY
R&R Utility Poles	EA	6
Tree Removals	EA	21
New Guardrail	FT	775
Stone Wall Removed	FT	270
New Retaining Wall	FT	0
Temporary Easements	EA	5
Permanent Easements	EA	2
Modified Rockfill	SY	750
Wetland Impacts	SF	2350

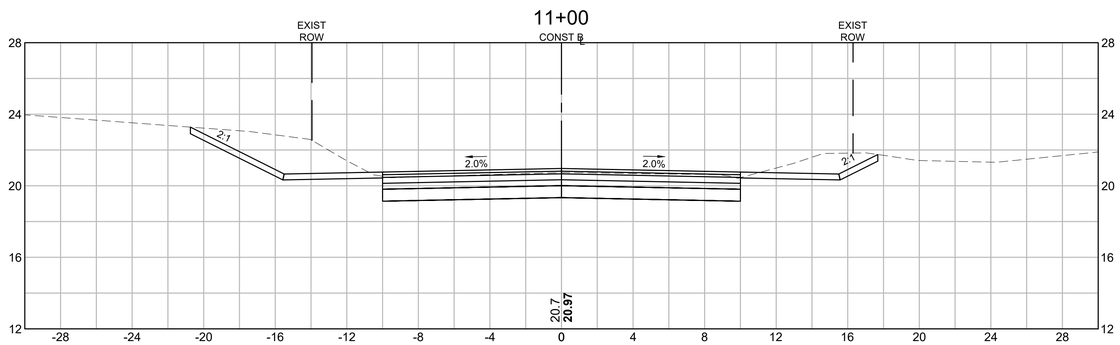
ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 3

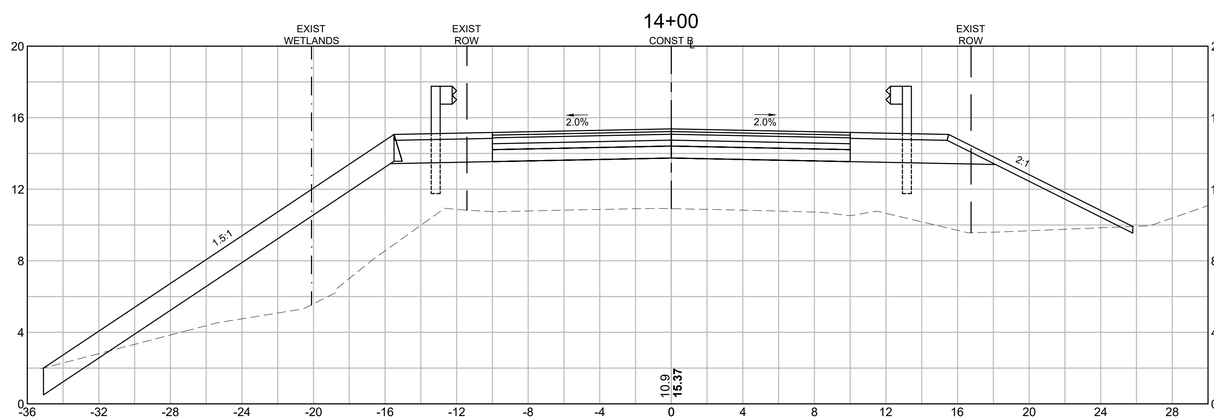












ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 4

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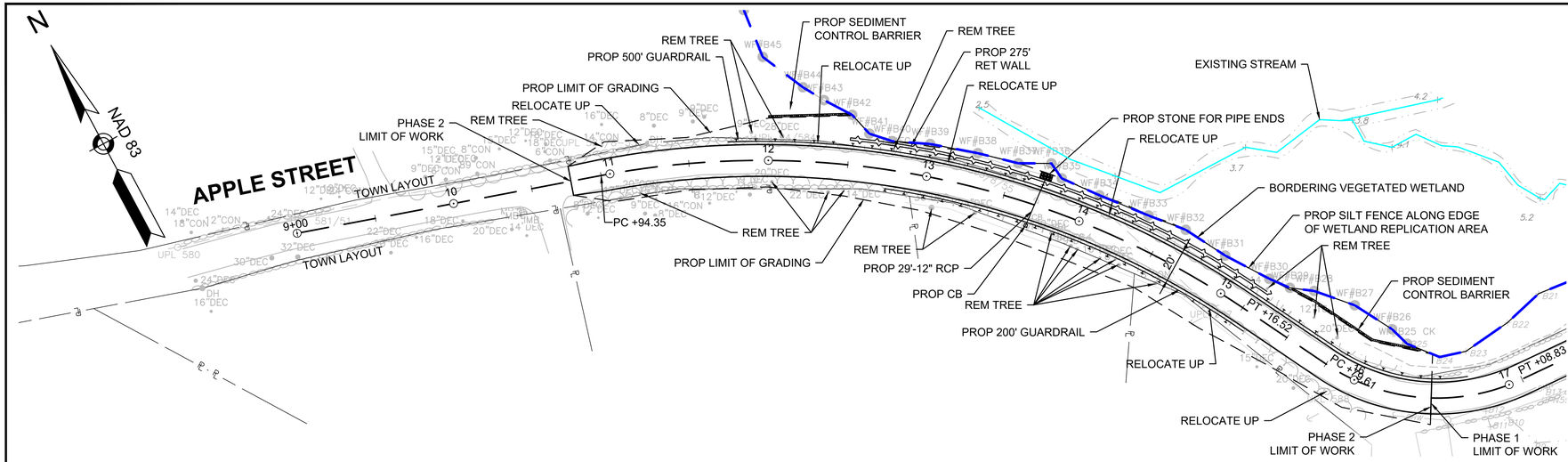

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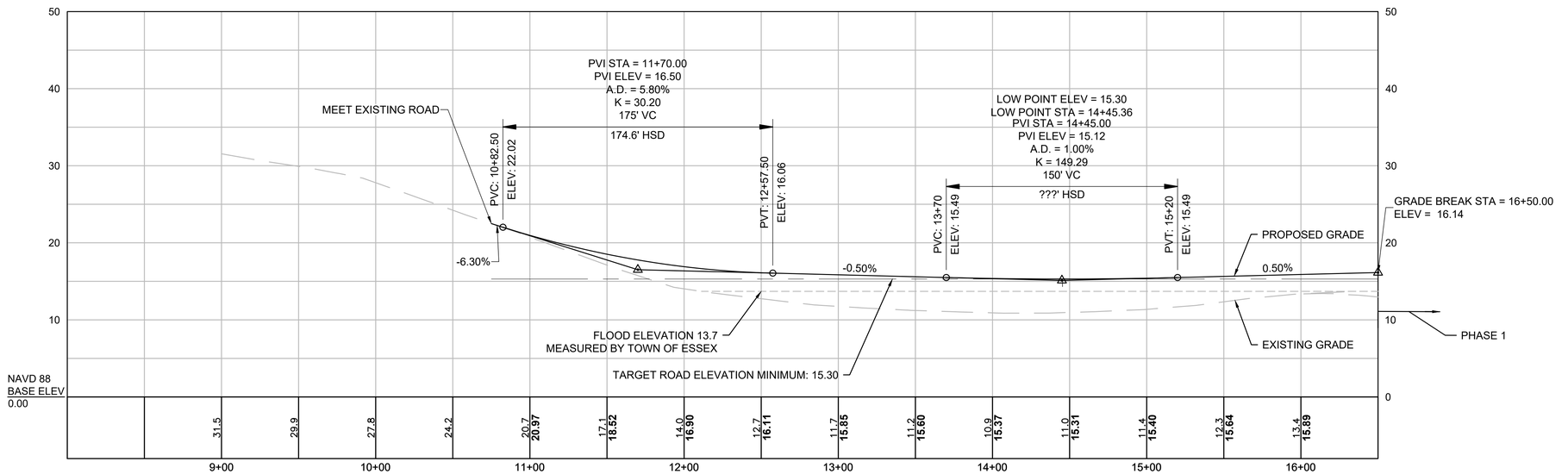
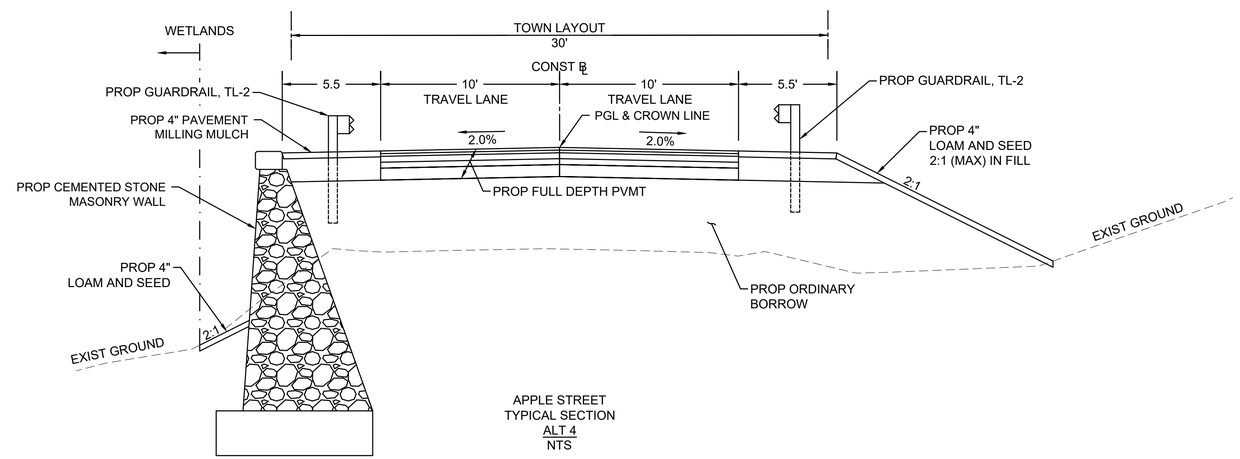
VER. SCALE IN FEET

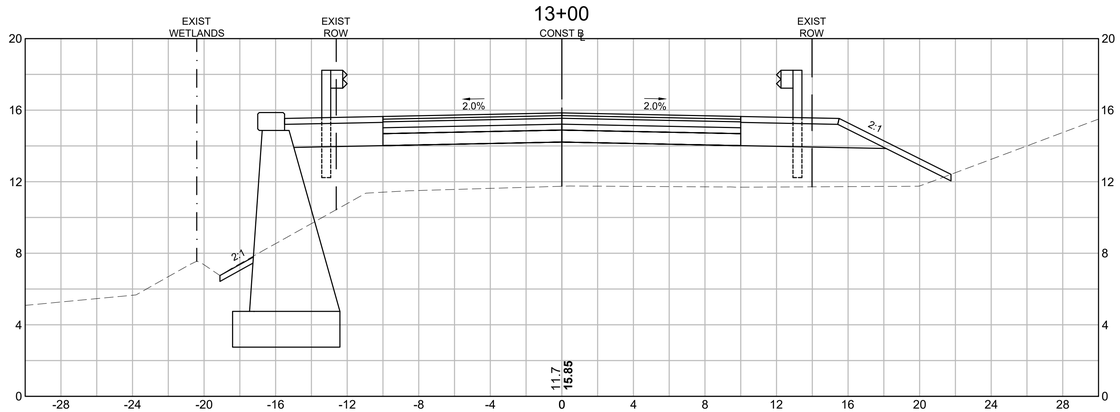


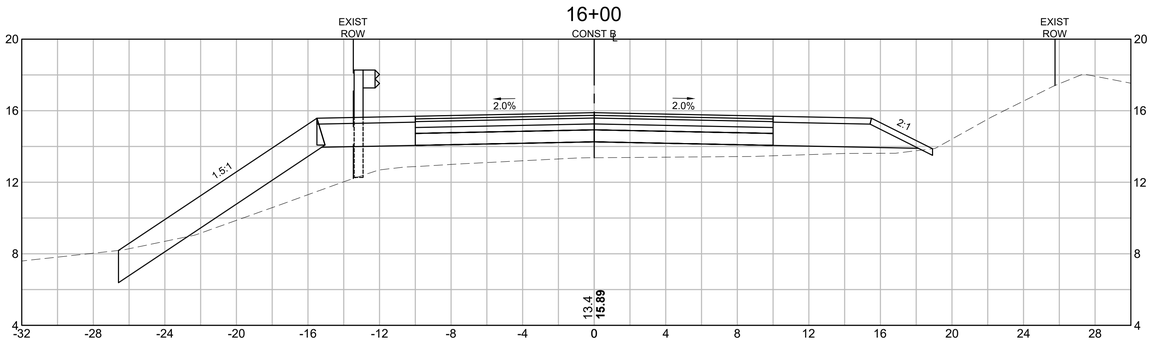


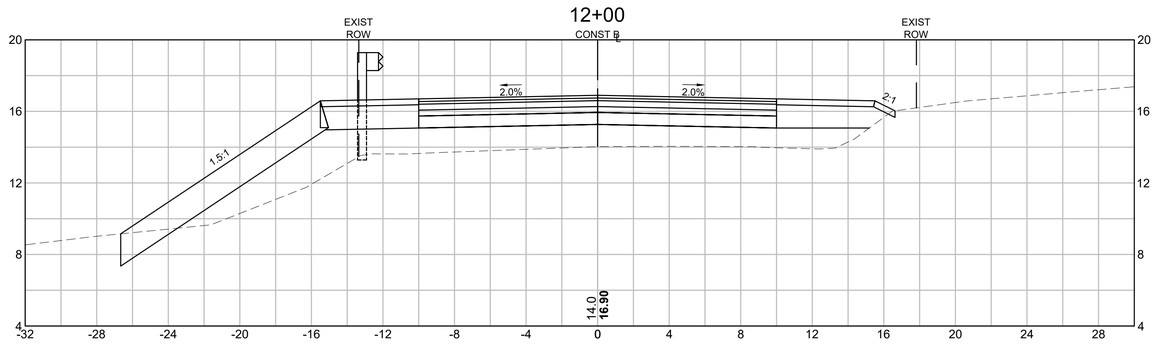
APPLE STREET
TYPICAL SECTION
ALT 4
NTS

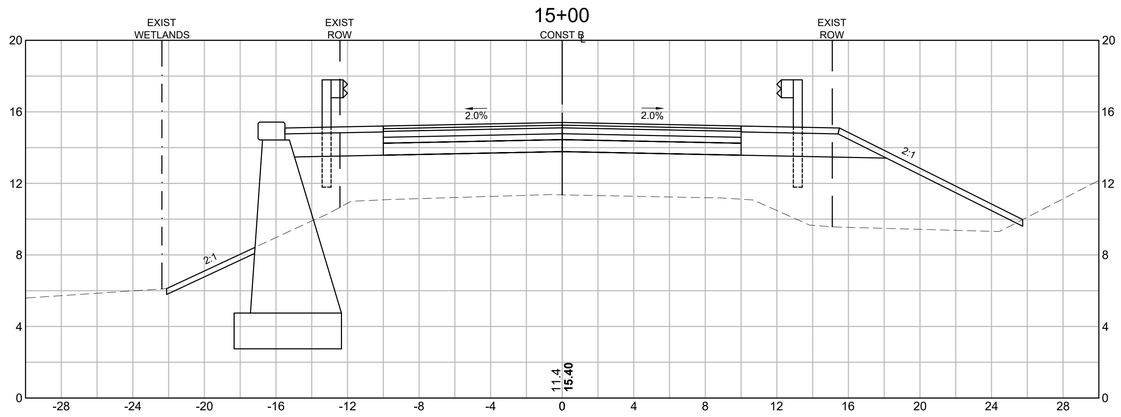
IMPACT SUMMARY		
ITEM	UNITS	QUANTITY
R&R Utility Poles	EA	6
Tree Removals	EA	21
New Guardrail	FT	750
Stone Wall Removed	FT	270
New Retaining Wall	FT	275
Temporary Easements	EA	5
Permanent Easements	EA	2
Modified Rockfill	SY	300
Wetland Impacts	SF	0

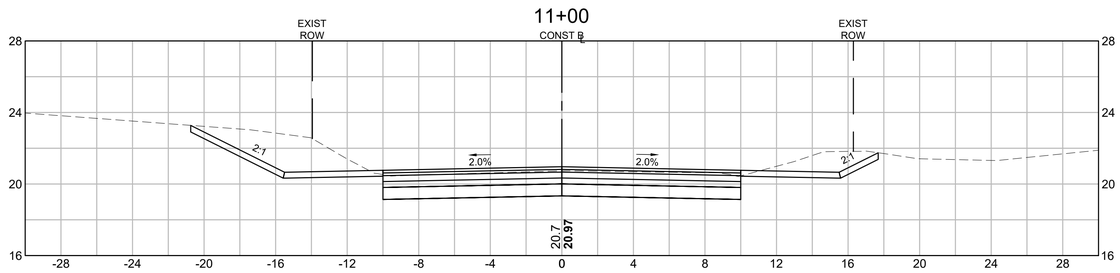
ESSEX
APPLE STREET
CONCEPT PLAN
ALTERNATIVE 4

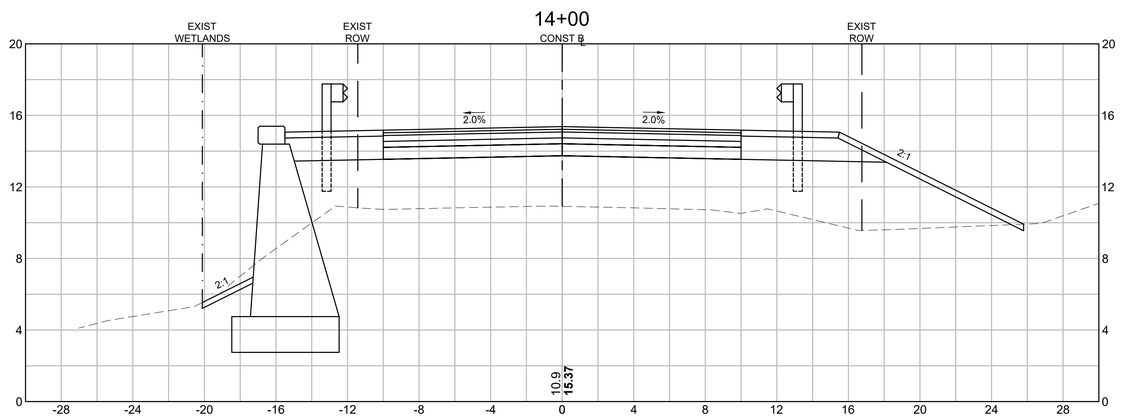












APPENDIX B – PRELIMINARY COST ESTIMATES

Preliminary Cost Estimate

Apple Street - Alternate 1

146 Dascomb Road, Andover, MA 01810
311 Main Street, 2nd Floor, Worcester MA 01608
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Apple Street Phase 2 Construction
Location:. Essex, MA
Title: Preliminary Cost Estimate - Alternate 1
Estimated By: DPS

Project No.: T1043
Date: 1/19/2021
Sheet: 1 of 1
Checked By: LSA

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	$ 20,000	$ 20,000
Earthwork	1	LS	$ 95,000	$ 95,000
Clearing & Grubbing	0.5	AC	$ 55,000	$ 27,500
Loam & Seed	1000	SY	$ 15	$ 15,000
Tree Removal	17	EA	$ 2,000	$ 34,000
Tree Protection	10	EA	$ 500	$ 5,000
Full Depth Pavement	1300	SY	$ 135	$ 175,500
Guardrail	750	FT	$ 40	$ 30,000
Drainage Modifications	1	LS	$ 45,000	$ 45,000
Traffic Signing & Markings	1	LS	$ 4,000	$ 4,000
Environmental Controls	1	LS	$ 40,000	$ 40,000
Modified Rockfill	700	SY	$ 70	$ 49,000
Subtotal				$ 540,000
10% Traffic Management				$ 54,000
Subtotal - Construction Items				$ 594,000
Contingencies				
20% Construction				$ 118,800
10% Police Detail				$ 59,400
15% Construction Engineering				$ 89,100
Contingencies Subtotal				$ 267,300
Utility Relocation				
Utility Poles Relocated	6	EA	$ 20,000	$ 120,000

Total	$ 981,300
Say	**$ 1,000,000**

Preliminary Cost Estimate

Apple Street - Alternate 2

146 Dascomb Road, Andover, MA 01810
311 Main Street, 2nd Floor, Worcester MA 01608
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Apple Street Phase 2 Construction
Location:. Essex, MA
Title: Preliminary Cost Estimate - Alternate 2
Estimated By: DPS

Project No.: T1043
Date: 1/19/2021
Sheet: 1 of 1
Checked By: LSA

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	$ 45,000	$ 45,000
Earthwork	1	LS	$ 110,000	$ 110,000
Clearing & Grubbing	0.5	AC	$ 55,000	$ 27,500
Loam & Seed	1200	SY	$ 15	$ 18,000
Tree Removal	17	EA	$ 2,000	$ 34,000
Tree Protection	10	EA	$ 500	$ 5,000
Full Depth Pavement	1300	SY	$ 135	$ 175,500
Guardrail	800	FT	$ 40	$ 32,000
Drainage Modifications	1	LS	$ 45,000	$ 45,000
Traffic Signing & Markings	1	LS	$ 4,000	$ 4,000
Environmental Controls	1	LS	$ 10,000	$ 10,000
Retaining Wall	300	FT	$ 1,800	$ 540,000
Modified Rockfill	200	SY	$ 70	$ 14,000
Subtotal				$ 1,060,000
10% Traffic Management				$ 106,000
Subtotal - Construction Items				$ 1,166,000
Contingencies				
20% Construction				$ 233,200
10% Police Detail				$ 116,600
15% Construction Engineering				$ 174,900
Contingencies Subtotal				$ 524,700
Utility Relocation				
Utility Poles Relocated	6	EA	$ 20,000	$ 120,000

Total	$ 1,810,700
Say	**$ 1,825,000**

Preliminary Cost Estimate

Apple Street - Alternate 3

The Engineering Corp
146 Dascomb Road, Andover, MA 01810
311 Main Street, 2nd Floor, Worcester MA 01608
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Apple Street Phase 2 Construction
Location:. Essex, MA
Title: Preliminary Cost Estimate - Alternate 3
Estimated By: DPS

Project No.: T1043
Date: 1/19/2021
Sheet: 1 of 1
Checked By: LSA

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	$ 20,000	$ 20,000
Earthwork	1	LS	$ 130,000	$ 130,000
Clearing & Grubbing	0.5	AC	$ 55,000	$ 27,500
Loam & Seed	1100	SY	$ 15	$ 16,500
Tree Removal	21	EA	$ 2,000	$ 42,000
Tree Protection	10	EA	$ 500	$ 5,000
Full Depth Pavement	1300	SY	$ 135	$ 175,500
Guardrail	800	FT	$ 40	$ 32,000
Drainage Modifications	1	LS	$ 45,000	$ 45,000
Traffic Signing & Markings	1	LS	$ 4,000	$ 4,000
Environmental Controls	1	LS	$ 50,000	$ 50,000
Modified Rockfill	750	SY	$ 70	$ 52,500
Subtotal				$ 600,000
10% Traffic Management				$ 60,000
Subtotal - Construction Items				$ 660,000
Contingencies				
20% Construction				$ 132,000
10% Police Detail				$ 66,000
15% Construction Engineering				$ 99,000
Contingencies Subtotal				$ 297,000
Utility Relocation				
Utility Poles Relocated	6	EA	$ 20,000	$ 120,000

Total	$ 1,077,000
Say	**$ 1,100,000**

Preliminary Cost Estimate

Apple Street - Alternate 4

The Engineering Corp
146 Dascomb Road, Andover, MA 01810
311 Main Street, 2nd Floor, Worcester MA 01608
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Apple Street Phase 2 Construction
Location:. Essex, MA
Title: Preliminary Cost Estimate - Alternate 4
Estimated By: DPS

Project No.: T1043
Date: 1/18/2021
Sheet: 1 of 1
Checked By: LSA

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	$ 50,000	$ 50,000
Earthwork	1	LS	$ 135,000	$ 135,000
Clearing & Grubbing	0.5	AC	$ 55,000	$ 27,500
Loam & Seed	1200	SY	$ 15	$ 18,000
Tree Removal	21	EA	$ 2,000	$ 42,000
Tree Protection	10	EA	$ 500	$ 5,000
Full Depth Pavement	1300	SY	$ 135	$ 175,500
Guardrail	700	FT	$ 40	$ 28,000
Drainage Modifications	1	LS	$ 45,000	$ 45,000
Traffic Signing & Markings	1	LS	$ 4,000	$ 4,000
Environmental Controls	1	LS	$ 10,000	$ 10,000
Retaining Wall	300	FT	$ 2,000	$ 600,000
Modified Rockfill	300	SY	$ 70	$ 21,000
Subtotal				$ 1,161,000
10% Traffic Management				$ 116,100
Subtotal - Construction Items				$ 1,277,100
Contingencies				
20% Construction				$ 255,420
10% Police Detail				$ 127,710
15% Construction Engineering				$ 191,565
Contingencies Subtotal				$ 574,695
Utility Relocation				
Utility Poles Relocated	6	EA	$ 20,000	$ 120,000

Total	$ 1,971,795
Say	**$ 1,975,000**

APPENDIX C – WETLAND DELINEATION REPORT

DEROSA Environmental CONSULTING, INC.

167 Main Street
P. O. Box 716
Rowley Massachusetts
USA

978.948.7717 Office

derosaenvironmental.com

November 21, 2020

BY ELECTRONIC MAIL

Mr. Charlie Wear, II, PE
Director of Engineering
Meridian Associates, Inc.
500 Cummings Center, Suite 5950
Beverly, MA 01915
P 978-299-0447 | 800-466-5505
F 978-872-1157
cwear@meridianassoc.com

RE: Wetland Delineation Report

Apple Street Culvert
Apple Street, Essex MA

Dear Mr. Wear:

We have prepared this Wetland Delineation Report to summarize the wetland resource area boundary determination at Apple Street, Essex, Massachusetts. The boundaries of the existing wetland resource areas were delineated according to methodology described in the Massachusetts Wetlands Protection Act (MGL Ch. 131 Sec. 40) and its Regulations at 310 CMR 10.00, et seq., as well as guidance documents prepared by the MADEP, including *The Guide to Inland Vegetated Wetlands in Massachusetts, dated March 1988*, as well as, Appendix G of *Delineating Bordering Vegetated Wetlands Under the MA Wetlands Protection Act, dated March 1995.*

BORDERING VEGETATED WETLAND

We delineated the boundaries of the existing bordering vegetated wetland associated with the wetland finger on February 7, 2020. The boundaries were flagged with pink surveyor's flagging consecutively numbered:

- WF-A1 to WF-A21 (Bordering Vegetated Wetland)
- WF-B1 to WF-B49 (Bordering Vegetated Wetland)
- WF-C1 to WF-C5 (Salt Marsh)

(Site Plan, attached by Meridian Associates).

Vegetation, soils, and break in slope were used to determine the boundary of the wetland resource area. The wetlands are located adjacent Apple Street and border on the Essex River. There was an abrupt boundary between upland and wetland soils and vegetation at the site.

VEGETATION

The canopy layer within the wetland resource area consisted principally of a red maple canopy. The upland areas rose steeply from the wetland boundary and included hickory, red oak, American beech and white pine.

The shrub community in the wetland areas consisted principally of highbush blueberry, winterberry and glossy buckthorn but included other species in lesser densities (Figure 2. Plant Inventory Plan).

The herbaceous plant community consisted principally of soft rush, jewelweed, and sensitive fern (dormant evidence of these plants was present during the time of the delineation).

These plants constitute a wetland plant community under the Act and the local Wetland Ordinance.

The upland plant community included several dominant non-native invasive species including multiflora rose and Asiatic bittersweet as well as glossy buckthorn in the shrub layer.

The boundary between upland and wetland plant communities was clearly determined principally by a clear break in slope at the base on the steep topographic slope associated with road alignment of Apple Street as well as the steep ledge topography to the south of the wetland area (Figure 1. USGS Topographic Map).

SOILS

Soil plots were attempted within the upland and wetland areas to aid in the delineation of the wetland boundary. The presence of stony and cobble soils did not permit either upland or wetland soil samples. The steep slope in topography between wetland and upland areas provided a clear demarcation of the wetland boundary. Accordingly, vegetation and topography were adequate to determine the boundary of this wetland resource area. The A horizon of the wetland soils were saturated at the surface and consisted of organic silt with a Munsell color of 10YR2/1 (black). The soils were very stony and a deep probe was not possible.

SUMMARY

The wetland resource areas associate with this section of Apple Street consist principally of freshwater vegetated wetland areas with red maple as the dominant canopy species and a variety of shrub and herbaceous species present (Figure 2). The boundary between upland and wetland is apparent by the clear break in slope between these two areas based on the alignment of Apple Street.

In our professional opinion, the boundary of Bordering Vegetated Wetland delineated in the field accurately represents the definition of Bordering Vegetated Wetland (BVW) under the MA Wetland Protection Act (MGL Ch. 131 Section 40.000) and its Regulations at 310 CMR 10.55(2).

Should you have any questions or comments, please call anytime.

Respectfully submitted,

DeRosa Environmental Consulting, Inc.

Michael J. DeRosa, Principal
Professional Wetland Scientist (No. 2550)

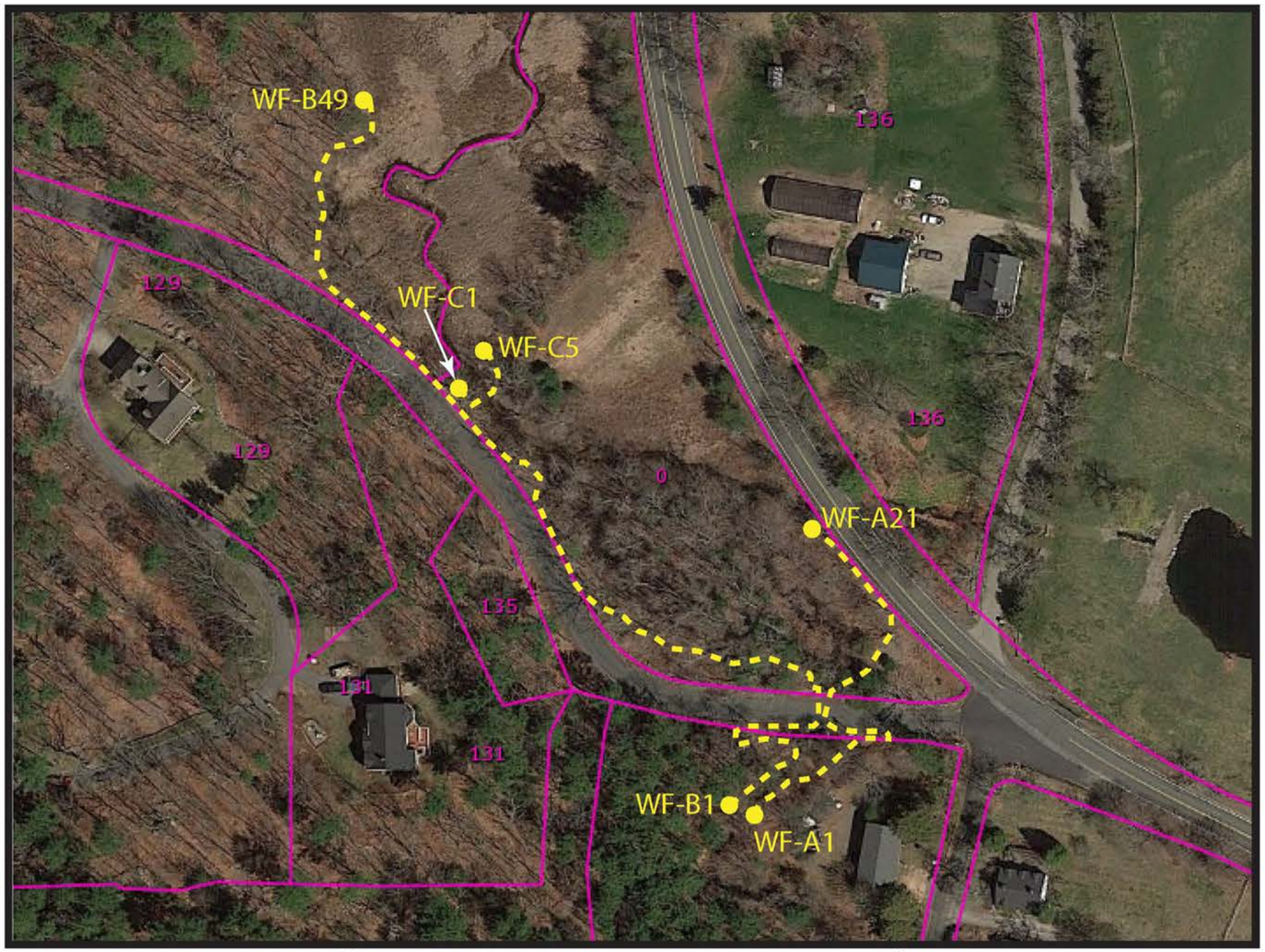
MJD/mjd

Attachments:

1. Topographic Survey of Apple Street, by Meridian Associates, Inc., dated November 18, 2020
Notes added by DeRosa Environmental Consulting Inc., November 21, 2020
2. Professional Qualifications

Delineation Sketch

Apple Street, Essex, MA.



Resource Areas Onsite:

Vegetated Wetlands: Yes

Riverfront Area: Yes, Alewife Brook

Coastal Bank: Yes

Coastal Dune: No

Salt Marsh/ACEC: Yes, salt marsh

NHESP: Yes, Natural Communities

Floodplain: Yes

Notes:

Contact: Tyler Ferrick
Cell:978-500-9053
Date: 2/7/2020, 10/20/20

Series WF-A: WF-A1 to WF-A21
Resource Area: Bordering Vegetated Wetland to Perennial Stream
Flagging: Pink

Series WF-B: WF-B1 to WF-B49
Resource Area: Bordering Vegetated Wetland to Perennial Stream
Flagging: Pink

Series WF-C: WF-C1 to WF-C5
Resource Area: Edge of Salt Marsh
Flagging: Pink

DEROSA Environmental CONSULTING, INC.
167 Main Street, PO Box 716, Rowley Massachusetts 01969 USA
978 948-7717 Office - 978 948-7718 Fax

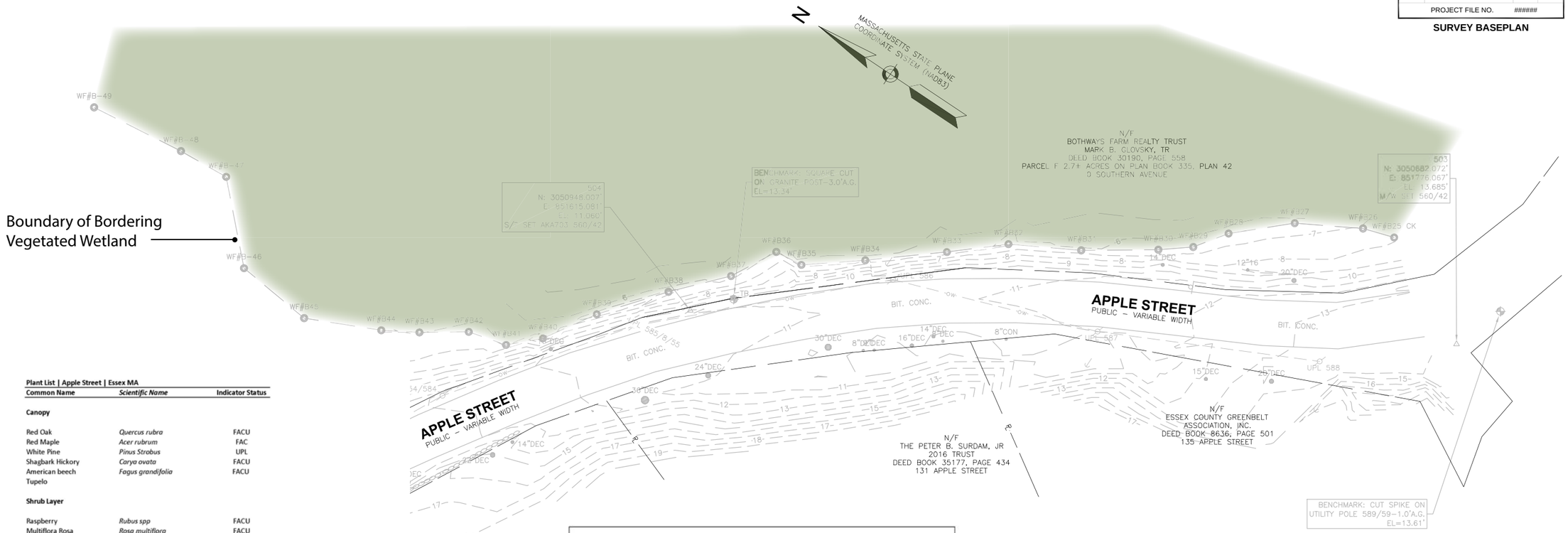
ESSEX
APPLE STREET

STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
MA	6268	2	2
PROJECT FILE NO.	######		

SURVEY BASEPLAN

Plotted on 18-Nov-2020 4:31 PM

6268_REC_MASSDOT.DWG



Plant List | Apple Street | Essex MA

Common Name	*Scientific Name*	Indicator Status
Canopy		
Red Oak	*Quercus rubra*	FACU
Red Maple	*Acer rubrum*	FAC
White Pine	*Pinus Strobus*	UPL
Shagbark Hickory	*Carya ovata*	FACU
American beech	*Fagus grandifolia*	FACU
Tupelo		
Shrub Layer		
Raspberry	*Rubus spp*	FACU
Multiflora Rosa	*Rosa multiflora*	FACU
Staghorn Sumac	*Rhus typhina*	FACU
Swamp Azalea	*Rhododendron viscosum*	FACW
Red Cedar	*Juniperus virginiana*	UPL
Glossy Buckthorn	*Frangula alnus*	FAC
Green Briar	*Smilax glauca*	FACU
Bush Honeysuckle	*Lonicera spp.*	FAC
Japanese Barberry	*Berberis thungergii*	UPL
Winterberry	*Ilex verticilatta*	FACW
High Bush Blueberry	*Vaccinium corymbosum*	FACW
Poison Ivy	*Toxicodendron radicans*	FAC
English Privet	*Ligustrum vulgare*	FAC
Steeplebush	*Spiraea tomentosa*	FAC
Maleberry	*Lyonia ligustrina*	FAC
Herbaceous Layer		
Common Reed	*Phragmites austalis*	FACW
Sensitive Fern	*Onoclea sensibilis*	FACW
Tussock Sedge	*Carex stricta*	OBL
Cattail	*Typha angustifolia*	OBL
Jewelweed	*Impatiens capensis*	FACW
Skunk Cabbage	*Symplocarpus foetidus*	OBL
New England Aster	*Symphyotrichum novae-ang*	FAC
Sphagnum Moss	*Sphagnaceae sp*	OBL

Delineation Sketch

Apple Street, Essex, MA.

Resource Areas Onsite:

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Coastal Bank: Yes

Coastal Dune: No

Salt Marsh/ACEC: Yes, salt marsh

NHESP: Yes, Natural Communities

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Flagging: Pink

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Resource Area: Bordering Vegetated Wetland to Perennial Stream
Flagging: Pink

Series WF-C: WF-C1 to WF-C5
Resource Area: Edge of Salt Marsh
Flagging: Pink

DEROSA Environmental

Figure 2. Wetland Delineation Plan

Apple Street Culvert Project
Massachusetts Department of Transportion

Michael J. DeRosa, PWS
November 21,20029

DEROSA Environmental CONSULTING, INC.
167 Main Street
P. O. Box 716
Rowley Massachusetts
USA
978.948.7717 Office
derosaenvironmental.com

massDOT
Massachusetts Department of Transportation
Highway Division

PREPARED BY:
MERIDIAN ASSOCIATES
500 CUMMINGS CENTER, SUITE 5950
BEVERLY, MASSACHUSETTS 01915
TELEPHONE: (978) 299-0447
69 MILK STREET, SUITE 208
WESTBOROUGH, MASSACHUSETTS 01581
TELEPHONE: (508) 871-7030
WWW.MERIDIANASSOC.COM

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
PLAN OF TOPOGRAPHIC SURVEY OF
APPLE STREET
IN THE CITY OF
ESSEX
AS ORDERED BY
THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION

REVISIONS		
REV.	COMMENTS	DATE

SCALE: 20 FEET TO THE INCH

FILE NAME: 6268_REC_MASSDOT
FIELD BOOK. NO: 560
DRAWN BY: ER
CHECKED BY: KD
FIELD CHIEF: DW
PARS. NO: XXXXXXX
DATE: NOVEMBER 18, 2020
SHEET 3 OF 3