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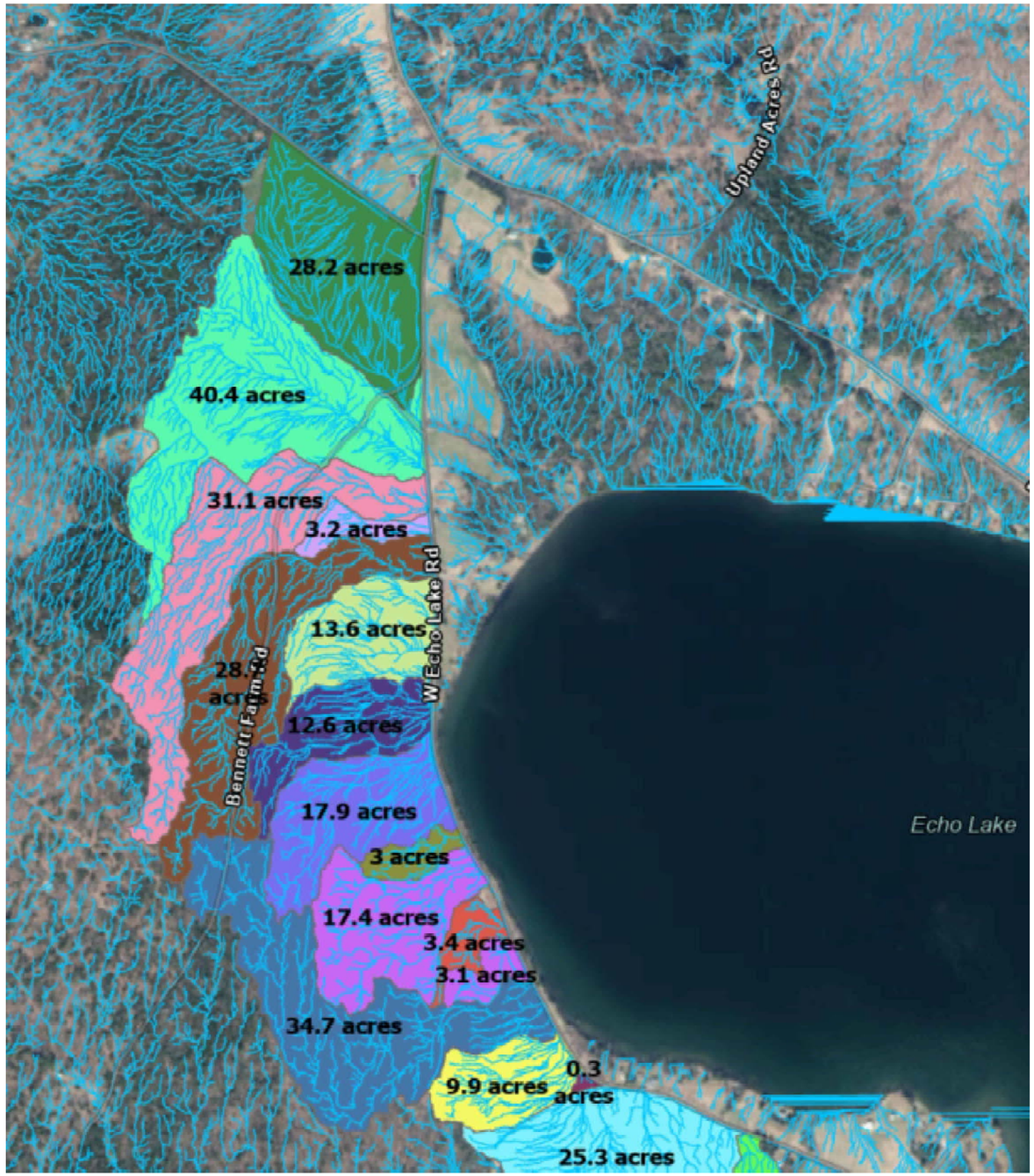
WEST ECHO LAKE ROAD
1% FLOOD DRAINAGE IMPROVEMENTS
30% DESIGNS
ECHO-SEYMOUR LAKES WATERSHED ACTION PLAN



THE FOLLOWING 30% CONCEPT DESIGNS WERE DEVELOPED BY THE MEMPHREMAGOG WATERSHED ASSOCIATION AS PART OF THE LAKE WATERSHED ACTION PLAN. THESE DESIGNS REPRESENT RECOMMENDED DRAINAGE IMPROVEMENTS AND SEDIMENT & EROSION CONTROL BEST MANAGEMENT PRACTICES FOR WEST ECHO LAKE RD. THEY ARE INTENDED TO BETTER CONVEY THE 2.5 IN/HR OR 1% ANNUAL EXCEEDANCE PROBABILITY FLOOD, MINIMIZE EROSION & PROPERTY DAMAGE, AND REDUCE SEDIMENT LOADING.

EXISITNG AND PROPOSED IMPROVEMENTS WERE LOCATED IN THE FIELD USING RTK GPS TO DETERMINE HORIZONTAL AND VERTICAL LOCATIONS. FIELD SURVEY DATA WERE USED IN CONJUNCTION WITH 2023 PRELIMINARY LIDAR DATA SOURCED FROM VT CENTER FOR GEOGRAPHIC INFORMATION. CULVERT LOCATIONS WERE USED AS LOCAL "POUR POINTS" IN A WATERSHED ANALYSIS TO DETERMINE CONTRIBUTING DRAINAGE AREAS OF EACH SUBCATCHMENT. SUBCATCHMENT DRAINAGE AREAS WERE USED TO EVALUATE RAINFALL–RUNOFF AND PEAK FLOWS THROUGH MULTIPLE METHODS SUCH AS USGS REGRESSIONS, NETC, FHWA, AND THE RATIONAL METHOD. PEAK FLOWS WERE USED TO SIZE CULVERT DIAMETERS USING TALBOTTS FORMULA, VTRANS GUIDANCE, AND OTHER RESOURCES. WHERE APPLICABLE, BANKFULL WIDTH WAS USED TO SIZE LARGER STREAM CROSSINGS.

THE WORK NECESSARY TO IMPLEMENT THESE IMPROVEMENTS MAY REQUIRE A WETLANDS PERMIT OR WAIVER, A STREAM ALTERATION PERMIT, A FLOOD HAZARD AREA & RIVER CORRIDOR PERMIT, AND CONSTRUCTION STORMWATER PERMITS DEPENDING ON LIMITS OF DISTURBANCE. PERENNIAL STREAMS AND JURISDICTIONAL STREAMS WITH DRAINAGE AREAS GREATER THAN 0.5 SQ MILES WLIL REQUIRE REVIEW BY DEC RIVERS PROGRAM.

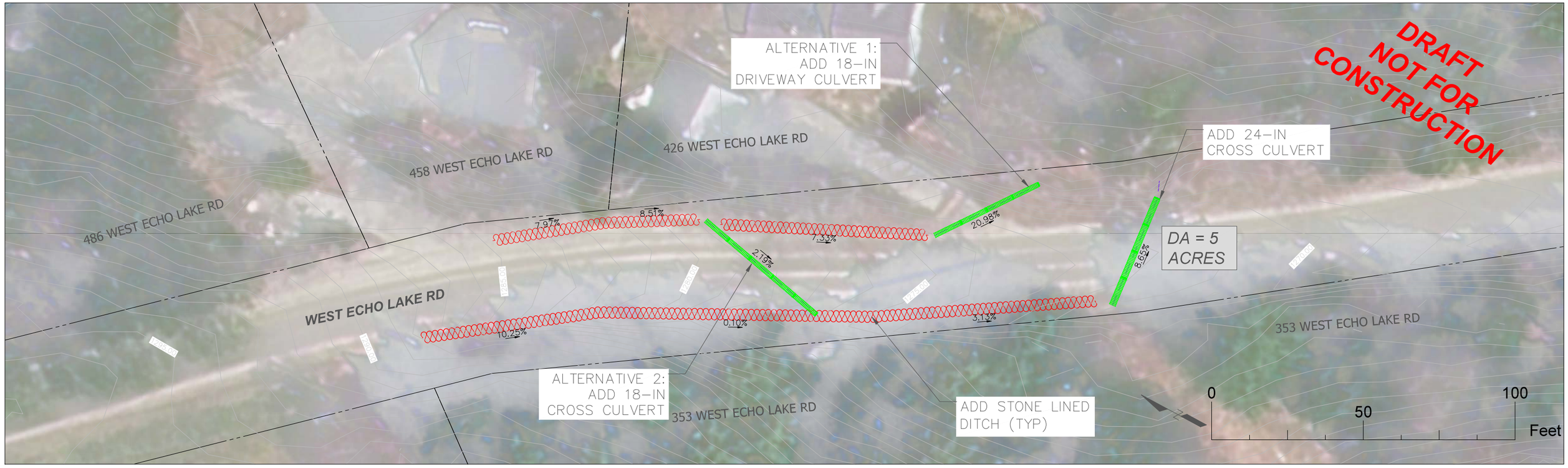
DATUM: NAD83 (2011) VT STATE PLANE US FEET & NAVD88 US FEET (HEIGHT).

DIAMETER/WIDTH	#/CROSSINGS	LINEAR FEET	$/LF	COST
18-IN	9	450	$ 75.00	$ 33,750.00
24-IN	9	450	$ 100.00	$ 45,000.00
30-IN	5	250	$ 125.00	$ 31,250.00
36-IN	3	150	$ 150.00	$ 22,500.00

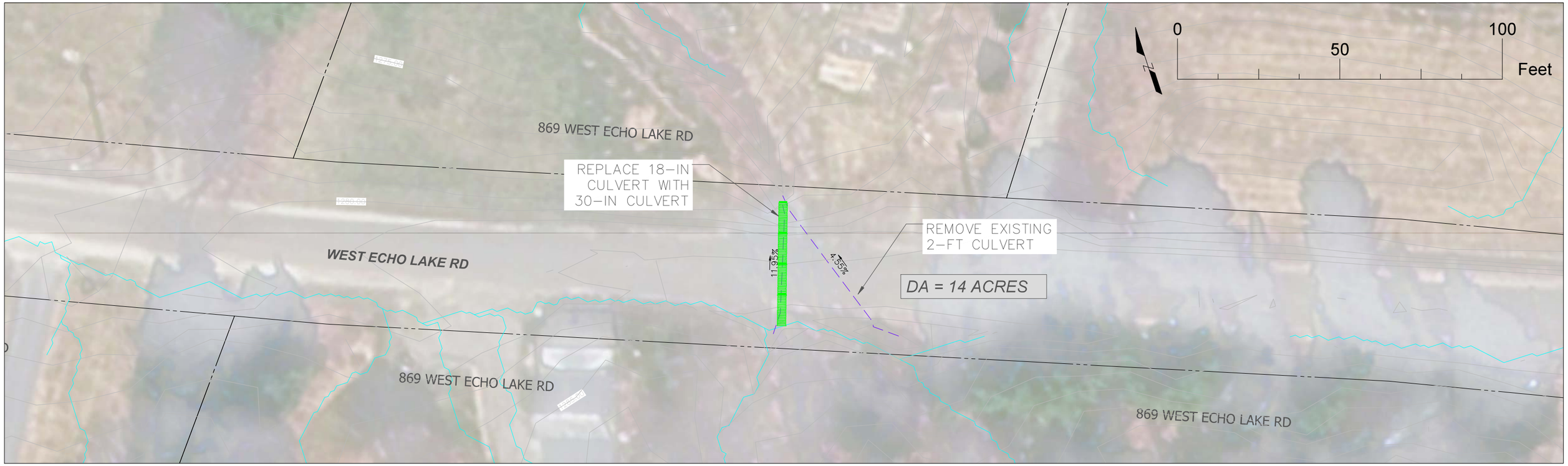
STONE LINED DITCHES - 6" RIPRAP	
4426.02	LF
26556.14	SQ FT
18589.30	CUBIC FT
688.49	CUBIC YARDS
1101.59	TONS
$ 33,047.64	$

Culverts	$132,500.00
Engineering	$ 10,000.00
Riprap & Stone	$ 40,000.00
Contractor	$ 75,000.00
TOTAL	**$257,500.00**

October 11, 2024



PROJECT AREA 1: 353-486 WEST ECHO LAKE RD



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DAYLIGHT BURIED STREAM. CREATE STABILIZED OUTFALL. RESTORE CHANNEL & BUFFER

ADD STONE LINED DITCH (TYP)

ADD 18–IN CROSS CULVERT

ADD 24–IN CROSS CULVERT

DA = 1 ACRE

DA = 25 ACRES

REPLACE WITH 30–IN CULVERT

1043 WEST ECHO LAKE RD

1008 WEST ECHO LAKE RD

994 WEST ECHO LAKE RD

974 WEST ECHO LAKE RD

952 WEST ECHO LAKE RD

WEST ECHO LAKE RD

4.21%

1.32%

3.15%

2.17%

5.05%

16.10%

0 50 100 Feet

PROJECT AREA 3: 952-1043 WEST ECHO LAKE RD

ECHO LAKE

1219 WEST ECHO LAKE RD

1199 WEST ECHO LAKE RD

1185 WEST ECHO LAKE RD

1139 WEST ECHO LAKE RD

1043 WEST ECHO LAKE RD

895 WEST ECHO LAKE RD

REPLACE WITH 24–IN CULVERT

NEW 36–IN CULVERT

REPLACE WITH 24–IN CULVERT

REPLACE WITH 18–IN DRIVEWAY CULVERT

ADD STONE LINED DITCH (TYP)

DA = 3 ACRES

DA = 35 ACRES

DA = 10 ACRES

2.39%

3.99%

4.53%

6.34%

0.90%

1.85%

4.35%

2.17%

7.62%

1.07%

1.22%

11.87%

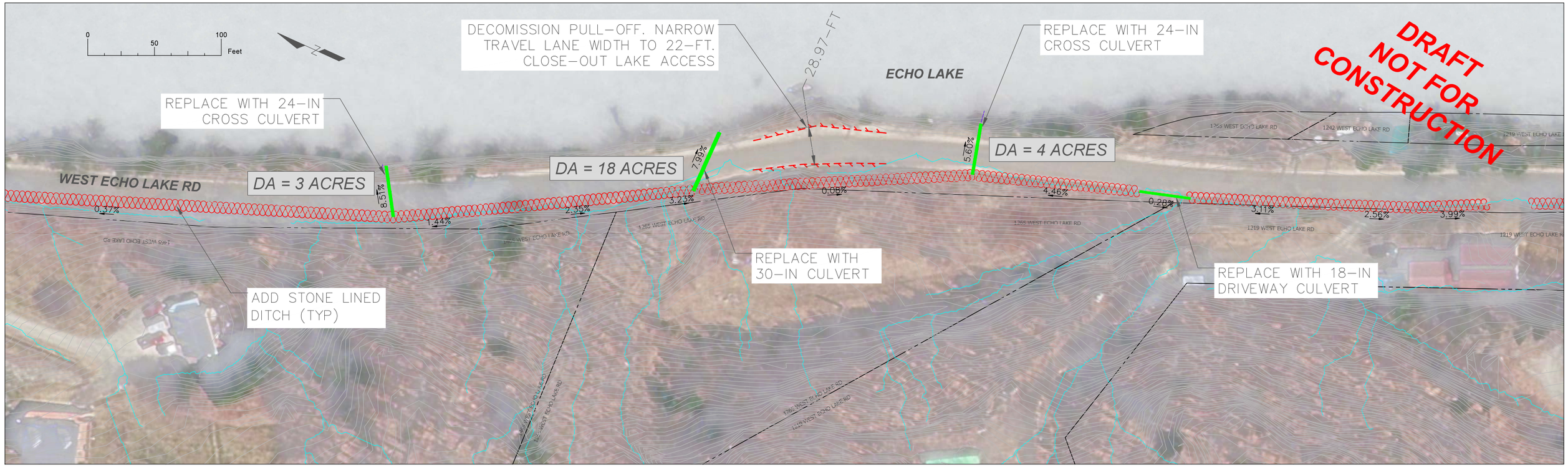
7.54%

3.48%

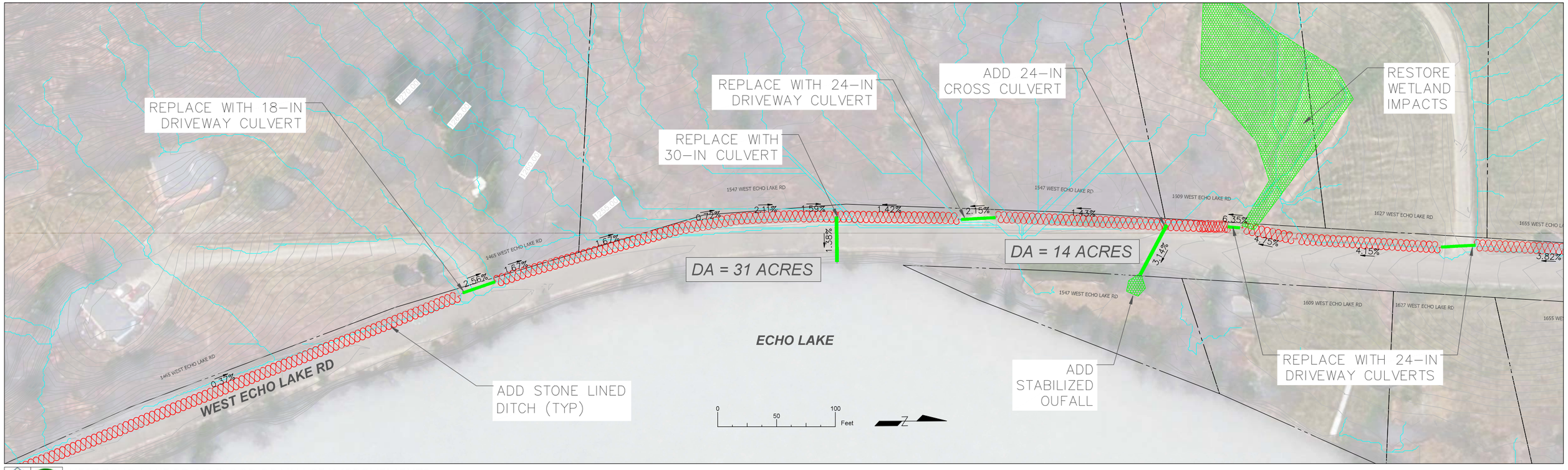
4.46%

0 50 100 Feet

PROJECT AREA 4: 1139-1199 WEST ECHO LAKE RD



PROJECT AREA 5: 1219-1465 WEST ECHO LAKE RD



PROJECT AREA 6: 1465-1627 WEST ECHO LAKE RD

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CONSTRUCTION

REPLACE WITH 24–IN CROSS CULVERT

NEW 30–IN CULVERT

ADD 24–IN CROSS CULVERT

DA = 29 ACRES

DA = 4 ACRES

DA = 32 ACRES

REPLACE WITH 36–IN CULVERT

ADD STONE LINED DITCH (TYP)

WEST ECHO LAKE RD

4.15%

3.82%

2.97%

3.46%

4.64%

3.30%

6.46%

6.07%

1270.00

1265.00

1260.00

1285.00

1280.00

1275.00

0 50 100 Feet

1627 WEST ECHO LAKE RD

1655 WEST ECHO LAKE RD

1720 WEST ECHO LAKE RD

2121 WEST ECHO LAKE RD

68 BENNETT FARM RD

1839 WEST ECHO LAKE RD

1844 WEST ECHO LAKE RD

PROJECT AREA 7: 1627-1839 WEST ECHO LAKE RD

CONVERT TO ONE–WAY. ADD STONE LINED DITCH

REPLACE WITH 36–IN CULVERT

NEW 36–IN CULVERT

REPLACE WITH 30–IN CULVERT

DA = 34 ACRES

DA = 39 ACRES

DA = 41 ACRES

ADD STONE LINED TURNOUT (TYP)

ADD STONE LINED DITCH (TYP)

BENNETT FARM RD

WEST ECHO LAKE RD

6.47%

4.50%

3.26%

3.58%

8.92%

8.51%

5.21%

0 50 100 Feet

68 BENNETT FARM RD

1839 WEST ECHO LAKE RD

1844 WEST ECHO LAKE RD

2121 WEST ECHO LAKE RD

2004 WEST ECHO LAKE RD

PROJECT AREA 8: 1839-2004 WEST ECHO LAKE RD

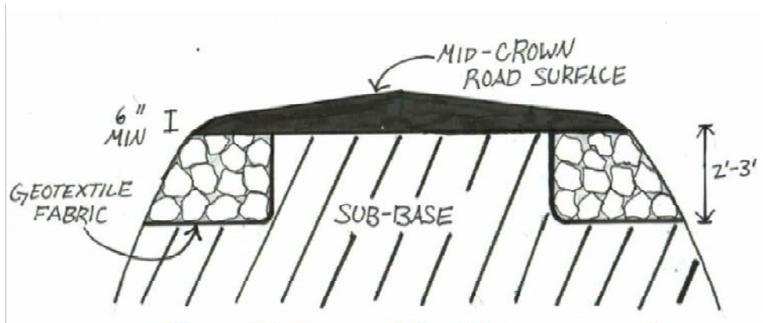

Figure 10: Armored shoulder on crowned road surface

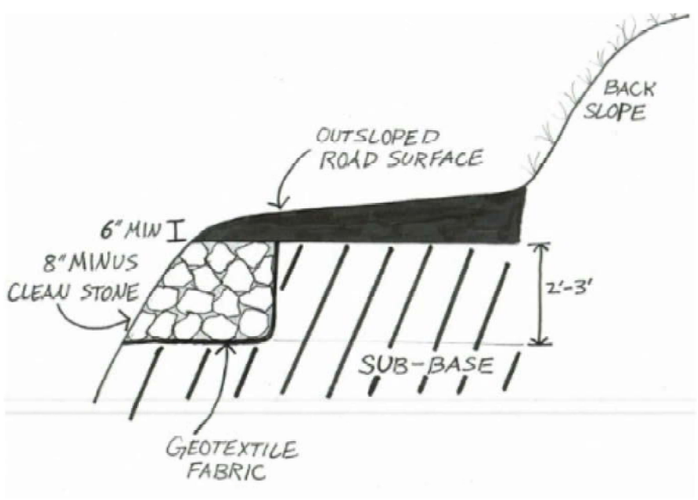

Figure 11: Armored shoulder on outsloped road surface

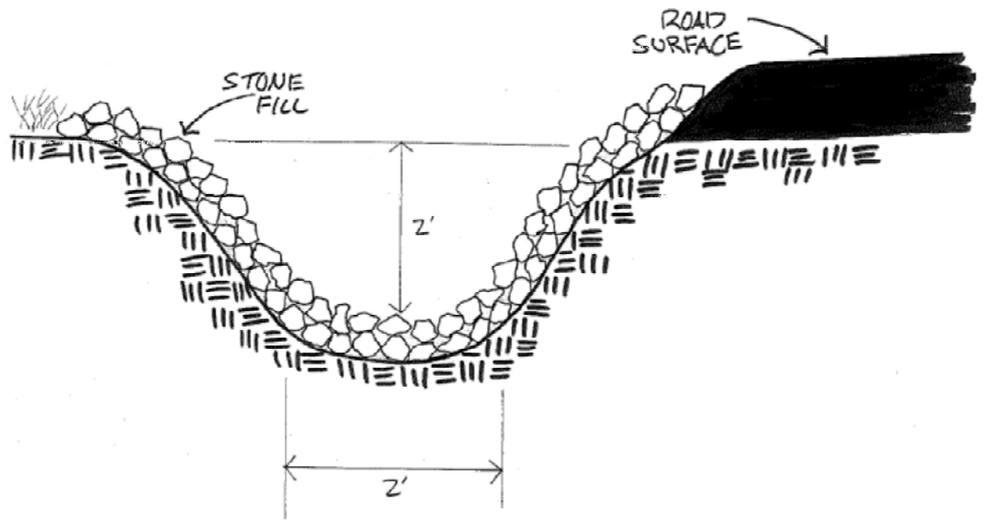

Figure 13: Stone lined ditch

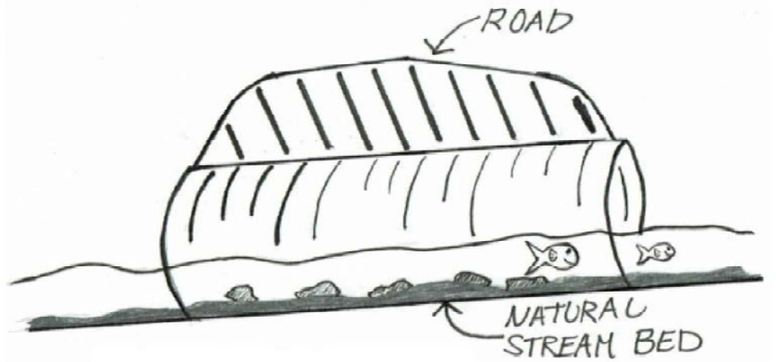

Figure 24: Proper AOP

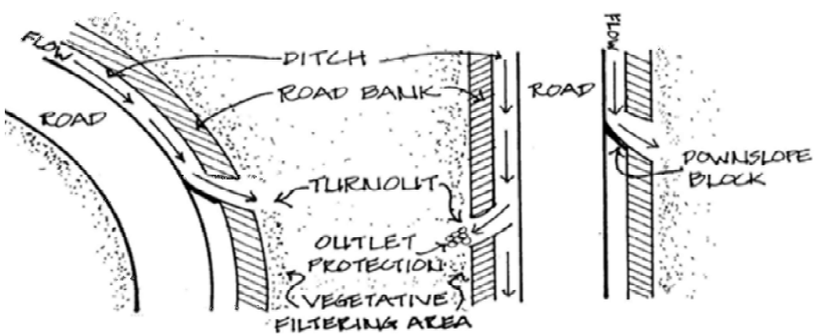

Figure 28: Turnout

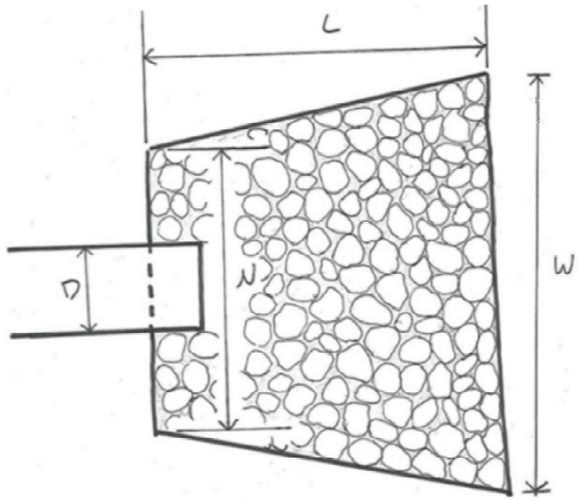

Figure 29: Rock Apron – Plan View

D = diameter of culvert
N = width of apron
W = width at downhill end of apron
L = length of apron
T = depth of stone in apron

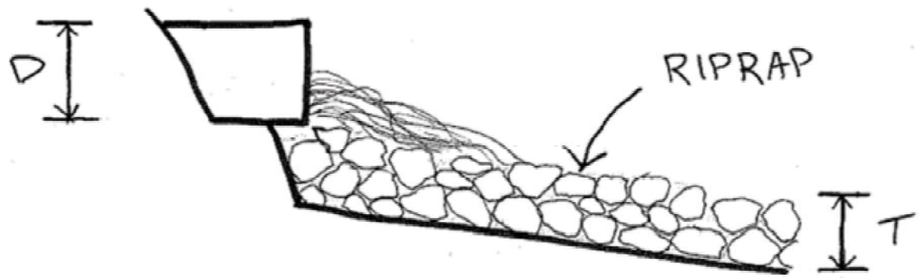

Figure 30: Rock Apron – Section View

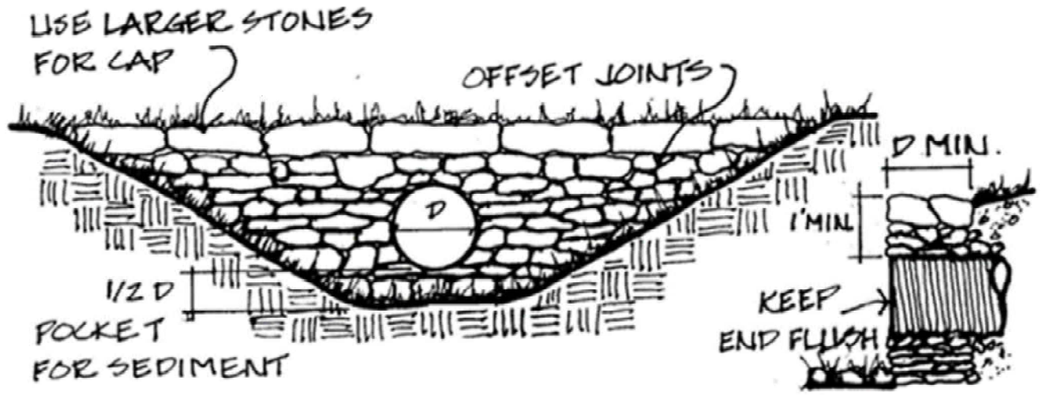

Figure 33: Culvert Header